APPENDICE DEGLI SCRIPT MATLAB UTILIZZATI PER LA TESI

“VALUTAZIONI DELLA PRESTAZIONE DI SCIATORI PARALIMPICI DI SCI DI FONDO SEDUTO IN DIFFERENTI SEZIONI DEL TRACCIATO DI GARA”

Sommario

APPENDICE A

a.0) Acquisizione dati

```
% STEP 1
clear all
close all
clc

%% Prelevo i dati dal file .xls e separo i valori numerici
%(numero dell'atleta + tempi) e quelli testuali (nome - cognome e
%nazionalità dell'atleta).

%!!!!!!!E' da modificare ogni volta per le 4 gare!!!!!!!!!!!
nome_gara='IPC04022018';

% Leggo il file excel e inserisco i valori all'interno di num, txt e total
%(num=valori numerici (sesso dell'atleta e tempi rilevati) txt=file di
%testo --> nome, cognome, nazionalità, total=file excel totale)
filepath = [cd '\' nome_gara '\STEP1'];
filename = [nome_gara '_rielaborato.xlsx'];
[num,txt,total] = xlsread([filepath '\' filename]);

% separo il numero dell'atleta (indica se Man o Woman) dai parziali
% calcolati in secondi
sesso = num(:,1);

% Calcolo i tempi rilevati di ogni atleta e li salvo in secondi
dataType = 'excel';
t = datetime(num,'ConvertFrom',dataType);
[h,m,s] = hms(t);
parziali=60*60.*h+60*m+s;

%% Vado a salvare i vettori ottenuti su file .mat separati per poterli post
% processare in un altro script.

%identifica il sesso dell'atleta in base al valore numerico
save([filepath '\gender.mat'],'sesso');
%salvo gli intertempi in secondi
save([filepath '\intertempi.mat'],'parziali');
%nome-cognome-nazionalità
save([filepath '\nome_cognome_country.mat'],'txt');
```

a.1) Biathlon sprint

```
%STEP2
clc
clear all
close all

nome_gara='IPC03022018';

filepath = [cd '\' nome_gara '\STEP1'];

load([filepath '\gender.mat'])
load([filepath '\nome_cognome_country.mat'])
load([filepath '\intertempi.mat'])
```

```
%% CREAZIONE STRUTTURA
biathlon_sprint=struct('women',[], 'men',[]);


%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta donna
C_W=[10.5 10.5 11 12 10.5 12 12 12 12 12];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

classi_W={a b c d e};
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};

numero_W= length(a)+length(b)+length(c)+length(d)+length(e);

txt_W=txt(1:numero_W,:);
tempi_W=parziali(1:numero_W,:);

for k=1:numero_W

atleta_W(k,:)=struct('first_name',txt_W(k,1),'last_name',txt_W(k,2),'countr
y',txt_W(k,3),'start_time',tempi_W(k,6),'giro1',tempi_W(k,7:17),'giro2',tem
pi_W(k,18:28),'giro3',tempi_W(k,29:39));
end

for i=1:length(nome_classi)
    if length(classi_W{i})~=0
        biathlon_sprint.women.(nome_classi{i})=atleta_W(classi_W{i},:);
    else
       biathlon_sprint.women.(nome_classi{i})=struct([]);
    end
end

%% MEN - riempimento struttura

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo
C_M=[12 12 12 12 11 11.5 12 12 12 10 12 12 12 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
classi_M={f g h l m};

M=numero_W+1;
txt_M=txt(M:end,:);
tempi_M=parziali(M:end,:);

for q=1:size(txt_M,1)
atleta_M(q,:)=struct('first_name',txt_M(q,1),'last_name',txt_M(q,2),'countr
```

```
y',txt_M(q,3),'start_time',tempi_M(q,6),'giro1',tempi_M(q,7:17),'giro2',tem
pi_M(q,18:28),'giro3',tempi_M(q,29:39));
end

for j=1:length(nome_classi)
    if length(classi_M{j})~=0
       biathlon_sprint.men.(nome_classi{j})=atleta_M(classi_M{j},:);
    else
       biathlon_sprint.men.(nome_classi{j})=struct([]);
    end
end

%% SALVATAGGIO STRUTTURA COMPLETA

filepath_save = [cd '\' nome_gara '\STEP2'];

save([filepath_save '\biathlon_sprint.mat'],'-struct','biathlon_sprint');


save([cd '\' nome_gara '\donne_sprint.mat'],'atleta_W');
save([cd '\' nome_gara '\uomini_sprint.mat'],'atleta_M');
```

a.2) Biathlon individual

```
clc
clear all
close all

nome_gara='IPC04022018';

filepath = [cd '\' nome_gara '\STEP1'];

load([filepath '\gender.mat'])
load([filepath '\nome_cognome_country.mat'])
load([filepath '\intertempi.mat'])

% Inserisco i tempi finali manualmente --> prendo i tempi finali dal file
% pdf e ci aggiungo lo start time, in modo da avere il tempo finale
% dipendente dall'orario di partenza (in questo modo non devo modificare
% gli script successivi dove vado ad eliminare questa dipendenza)

finish=[4770.4 4071.2 3798.2 3375.1 3314 3467.5 3216.2 3737.6 3746.3 3505
4158.4 3679.2 3719.6 3560.7 3445.3 3183.5 3332.4 3479.1 3252.2 3153.5];
for i=1:length(finish)
    parziali(i,61)=parziali(i,6)+finish(i);
end
%% CREAZIONE STRUTTURA
biathlon_individual=struct('women',[], 'men',[]);

%% WOMEN - riempimento struttura

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
C_W=[10.5 11 12 12 12 12 12 12]; %classi di appartenenza di ogni atleta
donna.

a=find(C_W==10);
b=find(C_W==10.5);
```

```
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

classi_W={a b c d e};
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};

numero_W= length(a)+length(b)+length(c)+length(d)+length(e);

txt_W=txt(1:numero_W,:);
parziali_W=parziali(1:numero_W,:);

for k=1:numero_W

atleta_W(k,:)=struct('first_name',txt_W(k,1),'last_name',txt_W(k,2),'countr
y',txt_W(k,3),'start_time',parziali_W(k,6),'giro1',parziali_W(k,7:17),'giro
2',parziali_W(k,18:28),'giro3',parziali_W(k,29:39),'giro4',parziali_W(k,40:
50),'giro5',parziali_W(k,51:61));
end

for i=1:length(nome_classi)
    if length(classi_W{i})~=0

biathlon_individual.women.(nome_classi{i})=atleta_W(classi_W{i},:);
    else
       biathlon_individual.women.(nome_classi{i})=struct([]);
%      biathlon_individual.women.(nome_classi{i})=[];
    end
end

%% MEN - riempimento struttura

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
C_M=[12 12 12 12 11.5 12 12 12 12 12 12 11.5]; %classi di appartenenza di
ogni atleta uomo.

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

M=numero_W+1;

txt_M=txt(M:end,:);
parziali_M=parziali(M:end,:);

nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
classi_M={f g h l m};

for q=1:size(txt_M,1)

atleta_M(q,:)=struct('first_name',txt_M(q,1),'last_name',txt_M(q,2),'countr
y',txt_M(q,3),'start_time',parziali_M(q,6),'giro1',parziali_M(q,7:17),'giro
2',parziali_M(q,18:28),'giro3',parziali_M(q,29:39),'giro4',parziali_M(q,40:
50),'giro5',parziali_M(q,51:61));
end

for j=1:length(nome_classi)
```

```
    if length(classi_M{j})~=0
       biathlon_individual.men.(nome_classi{j})=atleta_M(classi_M{j},:);
    else
       biathlon_individual.men.(nome_classi{j})=struct([]);
%      biathlon_individual.men.(nome_classi{i})=[];
    end
end

%% SALVATAGGIO STRUTTURA COMPLETA

filepath_save = [cd '\' nome_gara '\STEP2'];

save([filepath_save '\biathlon_individual.mat'],'-
struct','biathlon_individual');


save([cd '\' nome_gara '\donne_individual.mat'],'atleta_W');
save([cd '\' nome_gara '\uomini_individual.mat'],'atleta_M');
```

a.3) Cross country middle

```
%% STEP2

clc
clear all
close all

nome_gara='IPC06022018';

filepath = [cd '\' nome_gara '\STEP1'];

%Caricamento delle variabili ricavate durante lo STEP1
load([filepath '\gender.mat'])
load([filepath '\nome_cognome_country.mat'])
load([filepath '\intertempi.mat'])

%% CREAZIONE STRUTTURA
%creo la struttura vuota--> vado a separare uomini e donne; la strutura
%viene riempita nel seguito in base alla classe di appartenenza degli
%atleti.
cross_country_middle=struct('women',[], 'men',[]);

%Il procedimento per rimpire la struttura per uomini e donne è lo stesso.
%Mantengo separati i due procedimenti in modo da poter controllare
%eventuali errori.
%% WOMEN - riempimento struttura

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta donna--> le classi sono state
%ottenute dal file starlist.pdf presente all'interno della specifica gara.
%Dal file excel e dal pdf contente i risultati sono state eliminate le
%classi degli atleti assenti o di cui non si sono rilevati i parziali.
C_W=[10.5 12 10.5 12 11 10.5 10.5 12 12 12 12 12 11];

%Individuo le posizioni delle rispettive classi all'interno del vettore
%C_W. Le posizioni individuate corrispondono a quelle delle atlete nel file
%excel.
a=find(C_W==10);
```

```
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%Creo due vettori cella contenti rispettivamente il numero delle atlete
%appartenenti ad ogni classe (classi_W) e il nome delle classi
%(nome_classi)
classi_W={a b c d e};
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};

%numero totale delle donne che partecipano alla gara.
numero_W= length(a)+length(b)+length(c)+length(d)+length(e);

%prelevo nome-cognome-nazionalità solo delle atlete donne.
txt_W=txt(1:numero_W,:);
%prelevo gli intertempi solo delle atlete donne.
parziali_W=parziali(1:numero_W,:);
parziali_W1=parziali(1:numero_W,18:27);
parziali_W2=parziali(1:numero_W,39);
parziali_W_fin=[parziali_W1 parziali_W2];

%Creo una struct con inserite tutte le atlete donne utilizzando i seguenti
%campi di interesse:
% - first_name
% - last_name
% - country
% - start_time
% - giro1
% - giro2

%Per i primi 3 campi i dati sono ottenuti dal vettore cella txt_W
%selezionando le colonne opportune; i restanti campi sono ottenuti dal
%vettore tempi_W.
for k=1:numero_W

atleta_W(k,:)=struct('first_name',txt_W(k,1),'last_name',txt_W(k,2),'countr
y',txt_W(k,3),'start_time',parziali_W(k,6),'giro1',parziali_W(k,7:17),'giro
2',parziali_W_fin(k,:));
end

%Riempio la struct iniziale vuota inserendo le atlete nelle rispettive
%classi di appartenenza:
%    a) Se la classe contiene atlete queste vi sono inserite all'interno;
%    b) Se la classe non contiene atlete viene "riempita" con una struct
%       vuota;
%NB: tramite il vettore cella classi_W conosco quali classi contengono
%atlete e quali no.
for i=1:length(nome_classi)
    if length(classi_W{i})~=0

cross_country_middle.women.(nome_classi{i})=atleta_W(classi_W{i},:);
    else
       cross_country_middle.women.(nome_classi{i})=struct([]);
    end
end

%% MEN - riempimento struttura

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!
```

```
%classi di appartenenza di ogni atleta uomo--> le classi sono state
%ottenute dal file starlist.pdf presente all'interno della specifica gara.
%Dal file excel e dal pdf contente i risultati sono state eliminate le
%classi degli atleti assenti o di cui non si sono rilevati i parziali.
C_M=[12 12 12 11 11.5 12 10 12 12 12 12 11 12 11 12 12 12 12 12 10 11.5];

%Individuo le posizioni delle rispettive classi all'interno del vettore
%C_M. Le posizioni individuate corrispondono a quelle degli atleti nel file
%excel.
f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%Creo due vettori cella contenti rispettivamente il numero degli atleti
%appartenenti ad ogni classe (classi_M) e il nome delle classi
%(nome_classi).
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
classi_M={f g h l m};

%Per prelevare solo i dati relativi agli atleti uomini devo incrementare
%almeno di 1 il numero totale di donne.
M=numero_W+1;
%prelevo nome-cognome-nazionalità solo degli atleti uomini.
txt_M=txt(M:end,:);
%prelevo gli intertempi solo degli atleti uomini.
parziali_M=parziali(M:end,:);

%Creo una struct con inserite tutti gli atleti uomini utilizzando i
seguenti
%campi di interesse:
% - first_name
% - last_name
% - country
% - start_time
% - giro1
% - giro2
% - giro3

%Per i primi 3 campi i dati sono ottenuti dal vettore cella txt_M
%selezionando le colonne opportune; i restanti campi sono ottenuti dalla
%matrice tempi_M selezionando le colonne corrette (da valutare dal file
excel).
for q=1:size(txt_M,1)

atleta_M(q,:)=struct('first_name',txt_M(q,1),'last_name',txt_M(q,2),'countr
y',txt_M(q,3),'start_time',parziali_M(q,6),'giro1',parziali_M(q,7:17),'giro
2',parziali_M(q,18:28),'giro3',parziali_M(q,29:39));
end

%Riempio la struct iniziale vuota inserendo gli atleti nelle rispettive
%classi di appartenenza:
%    a) Se la classe contiene atleti questi vi sono inseriti all'interno;
%    b) Se la classe non contiene atleti viene "riempita" con una struct
%       vuota;
%NB: tramite il vettore cella classi_M conosco quali classi contengono
%atleti e quali no.
for j=1:length(nome_classi)
    if length(classi_M{j})~=0
```

```
        cross_country_middle.men.(nome_classi{j})=atleta_M(classi_M{j},:);
    else
        cross_country_middle.men.(nome_classi{j})=struct([]);
    end
end

%% SALVATAGGIO STRUTTURA COMPLETA

%Salvo la struttura appena creata nella cartella STEP2 della gara
%corrispondente.
filepath_save = [cd '\' nome_gara '\STEP2'];
save([filepath_save '\cross_country_middle.mat'],'-
struct','cross_country_middle');


save([cd '\' nome_gara '\donne_middle.mat'],'atleta_W');
save([cd '\' nome_gara '\uomini_middle.mat'],'atleta_M');
```

a.4) Cross country long

```
clc
clear all
close all

nome_gara='IPC09022018';

filepath = [cd '\' nome_gara '\STEP1'];

load([filepath '\gender.mat'])
load([filepath '\nome_cognome_country.mat'])
load([filepath '\intertempi.mat'])

%% CREAZIONE STRUTTURA
cross_country_long=struct('women',[], 'men',[]);

%% WOMEN - riempimento struttura

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
C_W=[12 12 11 10.5 10.5 12 12 12 12 11]; %classi di appartenenza di ogni
atleta donna.

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

classi_W={a b c d e};
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};

numero_W= length(a)+length(b)+length(c)+length(d)+length(e);

txt_W=txt(1:numero_W,:);
parziali_W=parziali(1:numero_W,:);

parziali_W1=parziali(1:numero_W,40:49);
parziali_W2=parziali(1:numero_W,61);
```

```
parziali_W_fin=[parziali_W1 parziali_W2];

for k=1:numero_W

atleta_W(k,:)=struct('first_name',txt_W(k,1),'last_name',txt_W(k,2),'countr
y',txt_W(k,3),'start_time',parziali_W(k,6),'giro1',parziali_W(k,7:17),'giro
2',parziali_W(k,18:28),'giro3',parziali_W(k,29:39),'giro4',parziali_W_fin(k
,:));
end

for i=1:length(nome_classi)
    if length(classi_W{i})~=0
         cross_country_long.women.(nome_classi{i})=atleta_W(classi_W{i},:);
    else
       cross_country_long.women.(nome_classi{i})=struct([]);
%      cross_country_long.women.(nome_classi{i})=[];
    end
end

%% MEN - riempimento struttura

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
C_M=[12 12 11 12 11.5 10 12 12 12 11 12 11 12 12 12 12 12 12 10 11.5];
%classi di appartenenza di ogni atleta uomo.

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

M=numero_W+1;

txt_M=txt(M:end,:);
parziali_M=parziali(M:end,:);

nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
classi_M={f g h l m};

for q=1:size(txt_M,1)

atleta_M(q,:)=struct('first_name',txt_M(q,1),'last_name',txt_M(q,2),'countr
y',txt_M(q,3),'start_time',parziali_M(q,6),'giro1',parziali_M(q,7:17),'giro
2',parziali_M(q,18:28),'giro3',parziali_M(q,29:39),'giro4',parziali_M(q,40:
50),'giro5',parziali_M(q,51:61));
end

for j=1:length(nome_classi)
    if length(classi_M{j})~=0
        cross_country_long.men.(nome_classi{j})=atleta_M(classi_M{j},:);
else
       cross_country_long.men.(nome_classi{j})=struct([]);
%      cross_country_long.men.(nome_classi{i})=[];
    end
end

%% SALVATAGGIO STRUTTURA COMPLETA

filepath_save = [cd '\' nome_gara '\STEP2'];
```

```
save([filepath_save '\cross_country_long.mat'],'-
struct','cross_country_long');

save([cd '\' nome_gara '\donne_long.mat'],'atleta_W');
save([cd '\' nome_gara '\uomini_long.mat'],'atleta_M');
```

APPENDICE B

b.1) Biathlon sprint

```
%% BIATHLON SPRINT

% (ex elab1)

%%
clc
clear all
close all

nome_gara='Biathlon_sprint';
filepath = [cd '\' nome_gara '\STEP1'];
filepath_save=[cd '\' nome_gara '\GRAFICI'];
filepath_save2=[cd '\' nome_gara];
B_sprint=load([filepath '\biathlon_sprint.mat']);

% Creazione del vettore classi
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
int_giro_W={'intertempi_giro1','intertempi_giro2','intertempi_giro3'};
int_giro_M={'intertempi_giro1','intertempi_giro2','intertempi_giro3'};
giro_W={'giro1','giro2','giro3'};
giro_M={'giro1','giro2','giro3'};

%% DONNE

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta donna.
C_W=[10.5 10.5 11 12 10.5 12 12 12 12 12];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% UOMINI

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 12 12 11 11.5 12 12 12 10 12 12 12 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];
%% DONNE Riempimento dei campi appena creati:

for i=1:length(nome_classi)
```

```
    if classi_W(i)~=0
        for j=1:classi_W(i)

B_sprint.women.(nome_classi{i})(j).finish_time=(B_sprint.women.(nome_classi
{i})(j).giro3(1,11))-(B_sprint.women.(nome_classi{i})(j).start_time);

B_sprint.women.(nome_classi{i})(j).split_time_giro1=(B_sprint.women.(nome_c
lassi{i})(j).giro1)-(B_sprint.women.(nome_classi{i})(j).start_time);

B_sprint.women.(nome_classi{i})(j).split_time_giro2=(B_sprint.women.(nome_c
lassi{i})(j).giro2)-(B_sprint.women.(nome_classi{i})(j).start_time);

B_sprint.women.(nome_classi{i})(j).split_time_giro3=(B_sprint.women.(nome_c
lassi{i})(j).giro3)-(B_sprint.women.(nome_classi{i})(j).start_time);
            for k=1:length(giro_W)
                % calcolo K2-K1 (uphill middle)

B_sprint.women.(nome_classi{i})(j).(int_giro_W{k})(1)=(B_sprint.women.(nome
_classi{i})(j).(giro_W{k})(2))-
(B_sprint.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K3-K2 (uphill steep)

B_sprint.women.(nome_classi{i})(j).(int_giro_W{k})(2)=(B_sprint.women.(nome
_classi{i})(j).(giro_W{k})(3))-
(B_sprint.women.(nome_classi{i})(j).(giro_W{k})(2));
                % calcolo K3-K1 (total uphill)

B_sprint.women.(nome_classi{i})(j).(int_giro_W{k})(3)=(B_sprint.women.(nome
_classi{i})(j).(giro_W{k})(3))-
(B_sprint.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K5-K4 (flat)

B_sprint.women.(nome_classi{i})(j).(int_giro_W{k})(4)=(B_sprint.women.(nome
_classi{i})(j).(giro_W{k})(5))-
(B_sprint.women.(nome_classi{i})(j).(giro_W{k})(4));
                % calcolo K6-K5 (curve)

B_sprint.women.(nome_classi{i})(j).(int_giro_W{k})(5)=(B_sprint.women.(nome
_classi{i})(j).(giro_W{k})(6))-
(B_sprint.women.(nome_classi{i})(j).(giro_W{k})(5));
                % calcolo K8-K7 (downhill)
%
B_sprint.women.(nome_classi{i})(j).(int_giro_W{k})(6)=(B_sprint.women.(nome
_classi{i})(j).(giro_W{k})(8))-
(B_sprint.women.(nome_classi{i})(j).(giro_W{k})(7));
            end
        end
    end
end

%% UOMINI Riempimento dei campi appena creati

for i=1:length(nome_classi)
    if classi_M(i)~=0
        for j=1:classi_M(i)

B_sprint.men.(nome_classi{i})(j).finish_time=(B_sprint.men.(nome_classi{i})
(j).giro3(1,11))-(B_sprint.men.(nome_classi{i})(j).start_time);

B_sprint.men.(nome_classi{i})(j).split_time_giro1=(B_sprint.men.(nome_class
i{i})(j).giro1)-(B_sprint.men.(nome_classi{i})(j).start_time);
```

```
B_sprint.men.(nome_classi{i})(j).split_time_giro2=(B_sprint.men.(nome_class
i{i})(j).giro2)-(B_sprint.men.(nome_classi{i})(j).start_time);

B_sprint.men.(nome_classi{i})(j).split_time_giro3=(B_sprint.men.(nome_class
i{i})(j).giro3)-(B_sprint.men.(nome_classi{i})(j).start_time);
            for k=1:length(giro_M)
                % calcolo K2-K1 (uphill middle)

B_sprint.men.(nome_classi{i})(j).(int_giro_M{k})(1)=(B_sprint.men.(nome_cla
ssi{i})(j).(giro_M{k})(2))-
(B_sprint.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K3-K2 (uphill steep)

B_sprint.men.(nome_classi{i})(j).(int_giro_M{k})(2)=(B_sprint.men.(nome_cla
ssi{i})(j).(giro_M{k})(3))-
(B_sprint.men.(nome_classi{i})(j).(giro_M{k})(2));
                % calcolo K3-K1 (total uphill)

B_sprint.men.(nome_classi{i})(j).(int_giro_M{k})(3)=(B_sprint.men.(nome_cla
ssi{i})(j).(giro_M{k})(3))-
(B_sprint.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K5-K4 (flat)

B_sprint.men.(nome_classi{i})(j).(int_giro_M{k})(4)=(B_sprint.men.(nome_cla
ssi{i})(j).(giro_M{k})(5))-
(B_sprint.men.(nome_classi{i})(j).(giro_M{k})(4));
                % calcolo K6-K5 (curve)

B_sprint.men.(nome_classi{i})(j).(int_giro_M{k})(5)=(B_sprint.men.(nome_cla
ssi{i})(j).(giro_M{k})(6))-
(B_sprint.men.(nome_classi{i})(j).(giro_M{k})(5));
                % calcolo K8-K7 (downhill)
%
B_sprint.men.(nome_classi{i})(j).(int_giro_M{k})(6)=(B_sprint.men.(nome_cla
ssi{i})(j).(giro_M{k})(8))-
(B_sprint.men.(nome_classi{i})(j).(giro_M{k})(7));
            end
        end
    end
end

%% (ex elab2)

%% DONNE: calcolo della MEDIA e della DEVIAZIONE STANDARD

tempo_finale_W=NaN(max(classi_W),length(classi_W));
split_time_giro1_W=NaN(max(classi_W),length(classi_W),length(B_sprint.women
.LW12(1).split_time_giro1));
split_time_giro2_W=NaN(max(classi_W),length(classi_W),length(B_sprint.women
.LW12(1).split_time_giro2));
split_time_giro3_W=NaN(max(classi_W),length(classi_W),length(B_sprint.women
.LW12(1).split_time_giro3));
intertempi_giro1_W=NaN(max(classi_W),length(classi_W),length(B_sprint.women
.LW12(1).intertempi_giro1));
intertempi_giro2_W=NaN(max(classi_W),length(classi_W),length(B_sprint.women
.LW12(1).intertempi_giro2));
intertempi_giro3_W=NaN(max(classi_W),length(classi_W),length(B_sprint.women
.LW12(1).intertempi_giro3));

for i=1:length(nome_classi)
```

```
    for j=1:size(B_sprint.women.(nome_classi{i}))
        if classi_W(i)~=0

tempo_finale_W(j,i)=B_sprint.women.(nome_classi{i})(j).finish_time;
            for k=1:size(split_time_giro1_W,3)

split_time_giro1_W(j,i,k)=B_sprint.women.(nome_classi{i})(j).split_time_gir
o1(k);

split_time_giro2_W(j,i,k)=B_sprint.women.(nome_classi{i})(j).split_time_gir
o2(k);

split_time_giro3_W(j,i,k)=B_sprint.women.(nome_classi{i})(j).split_time_gir
o3(k);
            end
            for m=1:size(intertempi_giro1_W,3)

intertempi_giro1_W(j,i,m)=B_sprint.women.(nome_classi{i})(j).intertempi_gir
o1(m);

intertempi_giro2_W(j,i,m)=B_sprint.women.(nome_classi{i})(j).intertempi_gir
o2(m);

intertempi_giro3_W(j,i,m)=B_sprint.women.(nome_classi{i})(j).intertempi_gir
o3(m);
            end
        end
    end
end

tempo_finale_W_MEAN=nanmean(tempo_finale_W);
tempo_finale_W_STD=nanstd(tempo_finale_W);

for k=1:size(split_time_giro1_W,3)
    split_time_giro1_W_MEAN(k,:)=nanmean(split_time_giro1_W(:,:,k));
    split_time_giro2_W_MEAN(k,:)=nanmean(split_time_giro2_W(:,:,k));
    split_time_giro3_W_MEAN(k,:)=nanmean(split_time_giro3_W(:,:,k));
    split_time_giro1_W_STD(k,:)=nanstd(split_time_giro1_W(:,:,k));
    split_time_giro2_W_STD(k,:)=nanstd(split_time_giro2_W(:,:,k));
    split_time_giro3_W_STD(k,:)=nanstd(split_time_giro3_W(:,:,k));
end

for m=1:size(intertempi_giro1_W,3)
    intertempi_giro1_W_MEAN(m,:)=nanmean(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_MEAN(m,:)=nanmean(intertempi_giro2_W(:,:,m));
    intertempi_giro3_W_MEAN(m,:)=nanmean(intertempi_giro3_W(:,:,m));
    intertempi_giro1_W_STD(m,:)=nanstd(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_STD(m,:)=nanstd(intertempi_giro2_W(:,:,m));
    intertempi_giro3_W_STD(m,:)=nanstd(intertempi_giro3_W(:,:,m));
end

%% UOMINI: calcolo della MEDIA e della DEVIAZIONE STANDARD

tempo_finale_M=NaN(max(classi_M),length(classi_M));
split_time_giro1_M=NaN(max(classi_M),length(classi_M),length(B_sprint.men.L
W12(1).split_time_giro1));
split_time_giro2_M=NaN(max(classi_M),length(classi_M),length(B_sprint.men.L
W12(1).split_time_giro2));
split_time_giro3_M=NaN(max(classi_M),length(classi_M),length(B_sprint.men.L
W12(1).split_time_giro3));
```

```
intertempi_giro1_M=NaN(max(classi_M),length(classi_M),length(B_sprint.men.L
W12(1).intertempi_giro1));
intertempi_giro2_M=NaN(max(classi_M),length(classi_M),length(B_sprint.men.L
W12(1).intertempi_giro2));
intertempi_giro3_M=NaN(max(classi_M),length(classi_M),length(B_sprint.men.L
W12(1).intertempi_giro3));

for i=1:length(nome_classi)
    for j=1:size(B_sprint.men.(nome_classi{i}))
        if classi_M(i)~=0

tempo_finale_M(j,i)=B_sprint.men.(nome_classi{i})(j).finish_time;
            for k=1:size(split_time_giro1_M,3)

split_time_giro1_M(j,i,k)=B_sprint.men.(nome_classi{i})(j).split_time_giro1
(k);

split_time_giro2_M(j,i,k)=B_sprint.men.(nome_classi{i})(j).split_time_giro2
(k);

split_time_giro3_M(j,i,k)=B_sprint.men.(nome_classi{i})(j).split_time_giro3
(k);
            end
            for m=1:size(intertempi_giro1_M,3)

intertempi_giro1_M(j,i,m)=B_sprint.men.(nome_classi{i})(j).intertempi_giro1
(m);

intertempi_giro2_M(j,i,m)=B_sprint.men.(nome_classi{i})(j).intertempi_giro2
(m);

intertempi_giro3_M(j,i,m)=B_sprint.men.(nome_classi{i})(j).intertempi_giro3
(m);
            end
        end
    end
end

tempo_finale_M_MEAN=nanmean(tempo_finale_M);
tempo_finale_M_STD=nanstd(tempo_finale_M);

for k=1:size(split_time_giro1_M,3)
    split_time_giro1_M_MEAN(k,:)=nanmean(split_time_giro1_M(:,:,k));
    split_time_giro2_M_MEAN(k,:)=nanmean(split_time_giro2_M(:,:,k));
    split_time_giro3_M_MEAN(k,:)=nanmean(split_time_giro3_M(:,:,k));
    split_time_giro1_M_STD(k,:)=nanstd(split_time_giro1_M(:,:,k));
    split_time_giro2_M_STD(k,:)=nanstd(split_time_giro2_M(:,:,k));
    split_time_giro3_M_STD(k,:)=nanstd(split_time_giro3_M(:,:,k));
end

for m=1:size(intertempi_giro1_M,3)
    intertempi_giro1_M_MEAN(m,:)=nanmean(intertempi_giro1_M(:,:,m));
    intertempi_giro2_M_MEAN(m,:)=nanmean(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_MEAN(m,:)=nanmean(intertempi_giro3_M(:,:,m));
    intertempi_giro1_M_STD(m,:)=nanstd(intertempi_giro1_M(:,:,m));
    intertempi_giro2_M_STD(m,:)=nanstd(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_STD(m,:)=nanstd(intertempi_giro3_M(:,:,m));
end

%% RIEMPIMENTO STRUTTURE
```

```
% DONNE
% MEDIA
B_sprint.women.MEAN.t_finale=tempo_finale_W_MEAN;
B_sprint.women.MEAN.split_time_giro1=split_time_giro1_W_MEAN;
B_sprint.women.MEAN.split_time_giro2=split_time_giro2_W_MEAN;
B_sprint.women.MEAN.split_time_giro3=split_time_giro3_W_MEAN;
B_sprint.women.MEAN.intertempi_giro1=intertempi_giro1_W_MEAN;
B_sprint.women.MEAN.intertempi_giro2=intertempi_giro2_W_MEAN;
B_sprint.women.MEAN.intertempi_giro3=intertempi_giro3_W_MEAN;

% DEVIAZIONE STANDARD
B_sprint.women.STD.t_finale=tempo_finale_W_STD;
B_sprint.women.STD.split_time_giro1=split_time_giro1_W_STD;
B_sprint.women.STD.split_time_giro2=split_time_giro2_W_STD;
B_sprint.women.STD.split_time_giro3=split_time_giro3_W_STD;
B_sprint.women.STD.intertempi_giro1=intertempi_giro1_W_STD;
B_sprint.women.STD.intertempi_giro2=intertempi_giro2_W_STD;
B_sprint.women.STD.intertempi_giro3=intertempi_giro3_W_STD;

% UOMINI
% MEDIA
B_sprint.men.MEAN.t_finale=tempo_finale_M_MEAN;
B_sprint.men.MEAN.split_time_giro1=split_time_giro1_M_MEAN;
B_sprint.men.MEAN.split_time_giro2=split_time_giro2_M_MEAN;
B_sprint.men.MEAN.split_time_giro3=split_time_giro3_M_MEAN;
B_sprint.men.MEAN.intertempi_giro1=intertempi_giro1_M_MEAN;
B_sprint.men.MEAN.intertempi_giro2=intertempi_giro2_M_MEAN;
B_sprint.men.MEAN.intertempi_giro3=intertempi_giro3_M_MEAN;

% DEVIAZIONE STANDARD
B_sprint.men.STD.t_finale=tempo_finale_M_STD;
B_sprint.men.STD.split_time_giro1=split_time_giro1_M_STD;
B_sprint.men.STD.split_time_giro2=split_time_giro2_M_STD;
B_sprint.men.STD.split_time_giro3=split_time_giro3_M_STD;
B_sprint.men.STD.intertempi_giro1=intertempi_giro1_M_STD;
B_sprint.men.STD.intertempi_giro2=intertempi_giro2_M_STD;
B_sprint.men.STD.intertempi_giro3=intertempi_giro3_M_STD;

%% SALVATAGGIO STRUTTURA COMPLETA

save([filepath_save2 '\B_sprint_finale.mat'],'-struct','B_sprint');

%% (ex grafici_tempo)

% Creazione dei grafici

%%

c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE'};

ngiri_W=size(giro_W,2);
ngiri_M=size(giro_M,2);
nintertempi_W=size(B_sprint.women.MEAN.intertempi_giro1,1);
nintertempi_M=size(B_sprint.men.MEAN.intertempi_giro1,1);
nsplit_time_W=size(B_sprint.women.MEAN.split_time_giro1,1);
nsplit_time_M=size(B_sprint.men.MEAN.split_time_giro1,1);
```

```
%% RAPPRESENTAZIONE GRAFICA DEI DATI
figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
ylim([0
100*(1+12.5*B_sprint.women.STD.t_finale(end)./B_sprint.women.MEAN.t_finale(
end))]);
yyaxis right
bar(c,B_sprint.women.MEAN.t_finale,'r');
hold on
errorbar(B_sprint.women.MEAN.t_finale,B_sprint.women.STD.t_finale,'.k','Lin
eWidth',1);
ylim([0
B_sprint.women.MEAN.t_finale(end)+12.5*B_sprint.women.STD.t_finale(end)]);
ylabel('tempo di gara [s]');
xlabel('classi');
title('BIATHLON SPRINT - DONNE');
hold off


figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
ylim([0
100*(1+2.5*B_sprint.men.STD.t_finale(end)./B_sprint.men.MEAN.t_finale(end))
]);
yyaxis right
b=bar(c,B_sprint.men.MEAN.t_finale,'b');
hold on
errorbar(B_sprint.men.MEAN.t_finale,B_sprint.men.STD.t_finale,'.k','LineWid
th',1);
ylim([0
B_sprint.men.MEAN.t_finale(end)+2.5*B_sprint.men.STD.t_finale(end)]);
ylabel('tempo di gara [s]');
xlabel('classi');
title('BIATHLON SPRINT - UOMINI');
hold off

%%
% SOLO DONNE
%figure(4)
k=1;
for i=1:ngiri_W:ngiri_W*nintertempi_W
    intertempi_mean_W(i,:)=B_sprint.women.MEAN.intertempi_giro1(k,:);
    intertempi_mean_W((i+1),:)=B_sprint.women.MEAN.intertempi_giro2(k,:);
    intertempi_mean_W((i+2),:)=B_sprint.women.MEAN.intertempi_giro3(k,:);
    intertempi_std_W(i,:)=B_sprint.women.STD.intertempi_giro1(k,:);
    intertempi_std_W((i+1),:)=B_sprint.women.STD.intertempi_giro2(k,:);
    intertempi_std_W((i+2),:)=B_sprint.women.STD.intertempi_giro3(k,:);
    k=k+1;
end

% SOLO DONNE
ngroups=size(intertempi_mean_W(1:ngiri_W,:)',1);
nbars=size(intertempi_mean_W(1:ngiri_W,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_W
    int_mean=intertempi_mean_W((j-1)*ngiri_W+1:j*ngiri_W,:);
```

```
    int_std=intertempi_std_W((j-1)*ngiri_W+1:j*ngiri_W,:);
    figure()
    yyaxis left
    ylim([0 100*(1+28*max(int_std(:,end)./int_mean(:,end)))]);
    ylabel('%');
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+28*int_std(:,end))]);
    ylabel('[s]');
    xlabel('classi');
    title('BIATHLON SPRINT - DONNE');
    hold off
end

%%
% SOLO UOMINI
%figure(6)
k=1;
for i=1:ngiri_M:ngiri_M*nintertempi_M
    intertempi_mean_M(i,:)=B_sprint.men.MEAN.intertempi_giro1(k,:);
    intertempi_mean_M((i+1),:)=B_sprint.men.MEAN.intertempi_giro2(k,:);
    intertempi_mean_M((i+2),:)=B_sprint.men.MEAN.intertempi_giro3(k,:);
    intertempi_std_M(i,:)=B_sprint.men.STD.intertempi_giro1(k,:);
    intertempi_std_M((i+1),:)=B_sprint.men.STD.intertempi_giro2(k,:);
    intertempi_std_M((i+2),:)=B_sprint.men.STD.intertempi_giro3(k,:);
    k=k+1;
end

% SOLO UOMINI
ngroups=size(intertempi_mean_M(1:ngiri_M,:)',1);
nbars=size(intertempi_mean_M(1:ngiri_M,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_M
    int_mean=intertempi_mean_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    int_std=intertempi_std_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    figure()
    yyaxis left
    ylim([0 100*(1+2.5*max(int_std(:,end)./int_mean(:,end)))]);
    ylabel('%');
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+2.5*int_std(:,end))]);
```

```
    ylabel('[s]');
    xlabel('classi');
    title('BIATHLON SPRINT - UOMINI');
    hold off
end


%%
%figure(8)
split_time_mean_W=[zeros(1,5); B_sprint.women.MEAN.split_time_giro1(1:6,:);
B_sprint.women.MEAN.split_time_giro2(1:6,:);
B_sprint.women.MEAN.split_time_giro3(1:3,:);
B_sprint.women.MEAN.split_time_giro3(5:6,:);
B_sprint.women.MEAN.split_time_giro3(9:11,:)];
split_time_std_W=[zeros(1,5); B_sprint.women.STD.split_time_giro1(1:6,:);
B_sprint.women.STD.split_time_giro2(1:6,:);
B_sprint.women.STD.split_time_giro3(1:3,:);
B_sprint.women.STD.split_time_giro3(5:6,:);
B_sprint.women.STD.split_time_giro3(9:11,:)];

figure()
subplot(1,2,1);
vettW=[0:size(split_time_mean_W,1)-1];

for i=1:size(split_time_mean_W,2)
    [p,S(i)]=polyfit(vettW',split_time_mean_W(:,i),1);
    [y,delta]=polyval(p,vettW,S(i));
    plot(vettW,split_time_mean_W(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettW,y,'k');
%     errorbar(vettW,y,delta,'.k');
end
title('BIATHLON SPRINT - DONNE');
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-300 3000])
hold off

subplot(1,2,2);
for i=1:size(split_time_mean_W,2)
        plot(vettW,split_time_mean_W(:,i)-min(split_time_mean_W,[],2),'-
o','LineWidth',1.5);
        hold on
end
title('BIATHLON SPRINT - DONNE');
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
hold off
saveas(gcf,[filepath_save '\split time_W.fig']);

%%
% figure(9)
split_time_mean_M=[zeros(1,5); B_sprint.men.MEAN.split_time_giro1(1:6,:);
B_sprint.men.MEAN.split_time_giro2(1:6,:);
B_sprint.men.MEAN.split_time_giro3(1:3,:);
B_sprint.men.MEAN.split_time_giro3(5:6,:);
B_sprint.men.MEAN.split_time_giro3(9:11,:)];
```

```
split_time_std_M=[zeros(1,5); B_sprint.men.STD.split_time_giro1(1:6,:);
B_sprint.men.STD.split_time_giro2(1:6,:);
B_sprint.men.STD.split_time_giro3(1:3,:);B_sprint.men.STD.split_time_giro3(
5:6,:); B_sprint.men.STD.split_time_giro3(9:11,:)];


figure()
subplot(1,2,1);
vettM=[0:size(split_time_mean_M,1)-1];
for i=1:size(split_time_mean_M,2)
    [p,S(i)]=polyfit(vettM',split_time_mean_M(:,i),1);
    [y,delta]=polyval(p,vettM,S(i));
    plot(vettM,split_time_mean_M(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettM,y,'k');
%     errorbar(vettM,y,delta,'.k');
end
title('BIATHLON SPRINT - UOMINI');
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-300 2250])
hold off

subplot(1,2,2);
for i=1:size(split_time_mean_M,2)
        plot(vettM,split_time_mean_M(:,i)-min(split_time_mean_M,[],2),'-
o','LineWidth',1.5);
        hold on
end
title('BIATHLON SPRINT - UOMINI');
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
hold off
saveas(gcf,[filepath_save '\split_time_M.fig']);
```

b.2) Biathlon individual

```
%% BIATHLON INDIVIDUAL

% (ex elab1)
%%
clc
clear all
close all

nome_gara='Biathlon_individual';
filepath= [cd '\' nome_gara '\STEP1'];
filepath_save=[cd '\' nome_gara '\GRAFICI'];
filepath_save2=[cd '\' nome_gara];
B_individual=load([filepath '\biathlon_individual.mat']);

% Creazione del vettore classi
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
int_giro_W={'intertempi_giro1','intertempi_giro2','intertempi_giro3','inter
tempi_giro4','intertempi_giro5'};
int_giro_M={'intertempi_giro1','intertempi_giro2','intertempi_giro3','inter
tempi_giro4','intertempi_giro5'};
```

```
giro_W={'giro1','giro2','giro3','giro4','giro5'};
giro_M={'giro1','giro2','giro3','giro4','giro5'};
%% DONNE

%classi di appartenenza di ogni atleta donna.
C_W=[10.5 11 12 12 12 12 12 12];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% UOMINI

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 12 12 11.5 12 12 12 12 12 12 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];

%% DONNE Riempimento dei campi appena creati

for i=1:length(nome_classi)
    if classi_W(i)~=0
        for j=1:classi_W(i)

B_individual.women.(nome_classi{i})(j).finish_time=(B_individual.women.(nom
e_classi{i})(j).giro5(1,11))-
(B_individual.women.(nome_classi{i})(j).start_time);

B_individual.women.(nome_classi{i})(j).split_time_giro1=(B_individual.women
.(nome_classi{i})(j).giro1)-
(B_individual.women.(nome_classi{i})(j).start_time);

B_individual.women.(nome_classi{i})(j).split_time_giro2=(B_individual.women
.(nome_classi{i})(j).giro2)-
(B_individual.women.(nome_classi{i})(j).start_time);

B_individual.women.(nome_classi{i})(j).split_time_giro3=(B_individual.women
.(nome_classi{i})(j).giro3)-
(B_individual.women.(nome_classi{i})(j).start_time);

B_individual.women.(nome_classi{i})(j).split_time_giro4=(B_individual.women
.(nome_classi{i})(j).giro4)-
(B_individual.women.(nome_classi{i})(j).start_time);

B_individual.women.(nome_classi{i})(j).split_time_giro5=(B_individual.women
.(nome_classi{i})(j).giro5)-
(B_individual.women.(nome_classi{i})(j).start_time);
```

```
            for k=1:length(giro_W)
                % calcolo K2-K1 (uphill middle)

B_individual.women.(nome_classi{i})(j).(int_giro_W{k})(1)=(B_individual.wom
en.(nome_classi{i})(j).(giro_W{k})(2))-
(B_individual.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K3-K2 (uphill steep)

B_individual.women.(nome_classi{i})(j).(int_giro_W{k})(2)=(B_individual.wom
en.(nome_classi{i})(j).(giro_W{k})(3))-
(B_individual.women.(nome_classi{i})(j).(giro_W{k})(2));
                % calcolo K3-K1 (total uphill)

B_individual.women.(nome_classi{i})(j).(int_giro_W{k})(3)=(B_individual.wom
en.(nome_classi{i})(j).(giro_W{k})(3))-
(B_individual.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K5-K4 (flat)

B_individual.women.(nome_classi{i})(j).(int_giro_W{k})(4)=(B_individual.wom
en.(nome_classi{i})(j).(giro_W{k})(5))-
(B_individual.women.(nome_classi{i})(j).(giro_W{k})(4));
                % calcolo K6-K5 (curve)

B_individual.women.(nome_classi{i})(j).(int_giro_W{k})(5)=(B_individual.wom
en.(nome_classi{i})(j).(giro_W{k})(6))-
(B_individual.women.(nome_classi{i})(j).(giro_W{k})(5));
                % calcolo K8-K7 (downhill)

B_individual.women.(nome_classi{i})(j).(int_giro_W{k})(6)=(B_individual.wom
en.(nome_classi{i})(j).(giro_W{k})(8))-
(B_individual.women.(nome_classi{i})(j).(giro_W{k})(7));
            end
        end
    end
end

%% UOMINI Riempimento dei campi appena creati

for i=1:length(nome_classi)
    if classi_M(i)~=0
        for j=1:classi_M(i)

B_individual.men.(nome_classi{i})(j).finish_time=(B_individual.men.(nome_cl
assi{i})(j).giro5(1,11))-(B_individual.men.(nome_classi{i})(j).start_time);

B_individual.men.(nome_classi{i})(j).split_time_giro1=(B_individual.men.(no
me_classi{i})(j).giro1)-(B_individual.men.(nome_classi{i})(j).start_time);

B_individual.men.(nome_classi{i})(j).split_time_giro2=(B_individual.men.(no
me_classi{i})(j).giro2)-(B_individual.men.(nome_classi{i})(j).start_time);

B_individual.men.(nome_classi{i})(j).split_time_giro3=(B_individual.men.(no
me_classi{i})(j).giro3)-(B_individual.men.(nome_classi{i})(j).start_time);

B_individual.men.(nome_classi{i})(j).split_time_giro4=(B_individual.men.(no
me_classi{i})(j).giro4)-(B_individual.men.(nome_classi{i})(j).start_time);

B_individual.men.(nome_classi{i})(j).split_time_giro5=(B_individual.men.(no
me_classi{i})(j).giro5)-(B_individual.men.(nome_classi{i})(j).start_time);
            for k=1:length(giro_M)
                % calcolo K2-K1 (uphill middle)
```

```
B_individual.men.(nome_classi{i})(j).(int_giro_M{k})(1)=(B_individual.men.(
nome_classi{i})(j).(giro_M{k})(2))-
(B_individual.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K3-K2 (uphill steep)

B_individual.men.(nome_classi{i})(j).(int_giro_M{k})(2)=(B_individual.men.(
nome_classi{i})(j).(giro_M{k})(3))-
(B_individual.men.(nome_classi{i})(j).(giro_M{k})(2));
                % calcolo K3-K1 (total uphill)

B_individual.men.(nome_classi{i})(j).(int_giro_M{k})(3)=(B_individual.men.(
nome_classi{i})(j).(giro_M{k})(3))-
(B_individual.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K5-K4 (flat)

B_individual.men.(nome_classi{i})(j).(int_giro_M{k})(4)=(B_individual.men.(
nome_classi{i})(j).(giro_M{k})(5))-
(B_individual.men.(nome_classi{i})(j).(giro_M{k})(4));
                % calcolo K6-K5 (curve)

B_individual.men.(nome_classi{i})(j).(int_giro_M{k})(5)=(B_individual.men.(
nome_classi{i})(j).(giro_M{k})(6))-
(B_individual.men.(nome_classi{i})(j).(giro_M{k})(5));
                % calcolo K8-K7 (downhill)

B_individual.men.(nome_classi{i})(j).(int_giro_M{k})(6)=(B_individual.men.(
nome_classi{i})(j).(giro_M{k})(8))-
(B_individual.men.(nome_classi{i})(j).(giro_M{k})(7));
            end
        end
    end
end

%% (ex elab2)

% Calcolo di media e deviazione standard per ogni classe

%% DONNE: calcolo della MEDIA e della DEVIAZIONE STANDARD

tempo_finale_W=NaN(max(classi_W),length(classi_W));
split_time_giro1_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).split_time_giro1));
split_time_giro2_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).split_time_giro2));
split_time_giro3_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).split_time_giro3));
split_time_giro4_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).split_time_giro4));
split_time_giro5_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).split_time_giro5));
intertempi_giro1_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).intertempi_giro1));
intertempi_giro2_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).intertempi_giro2));
intertempi_giro3_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).intertempi_giro3));
intertempi_giro4_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).intertempi_giro4));
intertempi_giro5_W=NaN(max(classi_W),length(classi_W),length(B_individual.w
omen.LW12(1).intertempi_giro5));
```

```
for i=1:length(nome_classi)
    for j=1:size(B_individual.women.(nome_classi{i}))
        if classi_W(i)~=0

tempo_finale_W(j,i)=B_individual.women.(nome_classi{i})(j).finish_time;
            for k=1:size(split_time_giro1_W,3)

split_time_giro1_W(j,i,k)=B_individual.women.(nome_classi{i})(j).split_time
_giro1(k);

split_time_giro2_W(j,i,k)=B_individual.women.(nome_classi{i})(j).split_time
_giro2(k);

split_time_giro3_W(j,i,k)=B_individual.women.(nome_classi{i})(j).split_time
_giro3(k);

split_time_giro4_W(j,i,k)=B_individual.women.(nome_classi{i})(j).split_time
_giro4(k);

split_time_giro5_W(j,i,k)=B_individual.women.(nome_classi{i})(j).split_time
_giro5(k);
            end
            for m=1:size(intertempi_giro1_W,3)

intertempi_giro1_W(j,i,m)=B_individual.women.(nome_classi{i})(j).intertempi
_giro1(m);

intertempi_giro2_W(j,i,m)=B_individual.women.(nome_classi{i})(j).intertempi
_giro2(m);

intertempi_giro3_W(j,i,m)=B_individual.women.(nome_classi{i})(j).intertempi
_giro3(m);

intertempi_giro4_W(j,i,m)=B_individual.women.(nome_classi{i})(j).intertempi
_giro4(m);

intertempi_giro5_W(j,i,m)=B_individual.women.(nome_classi{i})(j).intertempi
_giro5(m);
            end
        end
    end
end

tempo_finale_W_MEAN=nanmean(tempo_finale_W);
tempo_finale_W_STD=nanstd(tempo_finale_W);

for k=1:size(split_time_giro1_W,3)
    split_time_giro1_W_MEAN(k,:)=nanmean(split_time_giro1_W(:,:,k));
    split_time_giro2_W_MEAN(k,:)=nanmean(split_time_giro2_W(:,:,k));
    split_time_giro3_W_MEAN(k,:)=nanmean(split_time_giro3_W(:,:,k));
    split_time_giro4_W_MEAN(k,:)=nanmean(split_time_giro4_W(:,:,k));
    split_time_giro5_W_MEAN(k,:)=nanmean(split_time_giro5_W(:,:,k));
    split_time_giro1_W_STD(k,:)=nanstd(split_time_giro1_W(:,:,k));
    split_time_giro2_W_STD(k,:)=nanstd(split_time_giro2_W(:,:,k));
    split_time_giro3_W_STD(k,:)=nanstd(split_time_giro3_W(:,:,k));
    split_time_giro4_W_STD(k,:)=nanstd(split_time_giro4_W(:,:,k));
    split_time_giro5_W_STD(k,:)=nanstd(split_time_giro5_W(:,:,k));
end

for m=1:size(intertempi_giro1_W,3)
```

```
    intertempi_giro1_W_MEAN(m,:)=nanmean(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_MEAN(m,:)=nanmean(intertempi_giro2_W(:,:,m));
    intertempi_giro3_W_MEAN(m,:)=nanmean(intertempi_giro3_W(:,:,m));
    intertempi_giro4_W_MEAN(m,:)=nanmean(intertempi_giro4_W(:,:,m));
    intertempi_giro5_W_MEAN(m,:)=nanmean(intertempi_giro5_W(:,:,m));
    intertempi_giro1_W_STD(m,:)=nanstd(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_STD(m,:)=nanstd(intertempi_giro2_W(:,:,m));
    intertempi_giro3_W_STD(m,:)=nanstd(intertempi_giro3_W(:,:,m));
    intertempi_giro4_W_STD(m,:)=nanstd(intertempi_giro4_W(:,:,m));
    intertempi_giro5_W_STD(m,:)=nanstd(intertempi_giro5_W(:,:,m));
end

%% UOMINI: calcolo della MEDIA e della DEVIAZIONE STANDARD

tempo_finale_M=NaN(max(classi_M),length(classi_M));
split_time_giro1_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).split_time_giro1));
split_time_giro2_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).split_time_giro2));
split_time_giro3_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).split_time_giro3));
split_time_giro4_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).split_time_giro4));
split_time_giro5_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).split_time_giro5));
intertempi_giro1_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).intertempi_giro1));
intertempi_giro2_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).intertempi_giro2));
intertempi_giro3_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).intertempi_giro3));
intertempi_giro4_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).intertempi_giro4));
intertempi_giro5_M=NaN(max(classi_M),length(classi_M),length(B_individual.m
en.LW12(1).intertempi_giro5));

for i=1:length(nome_classi)
    for j=1:size(B_individual.men.(nome_classi{i}))
        if classi_M(i)~=0

tempo_finale_M(j,i)=B_individual.men.(nome_classi{i})(j).finish_time;
            for k=1:size(split_time_giro1_M,3)

split_time_giro1_M(j,i,k)=B_individual.men.(nome_classi{i})(j).split_time_g
iro1(k);

split_time_giro2_M(j,i,k)=B_individual.men.(nome_classi{i})(j).split_time_g
iro2(k);

split_time_giro3_M(j,i,k)=B_individual.men.(nome_classi{i})(j).split_time_g
iro3(k);

split_time_giro4_M(j,i,k)=B_individual.men.(nome_classi{i})(j).split_time_g
iro4(k);

split_time_giro5_M(j,i,k)=B_individual.men.(nome_classi{i})(j).split_time_g
iro5(k);
            end
            for m=1:size(intertempi_giro1_M,3)
```

```
intertempi_giro1_M(j,i,m)=B_individual.men.(nome_classi{i})(j).intertempi_g
iro1(m);

intertempi_giro2_M(j,i,m)=B_individual.men.(nome_classi{i})(j).intertempi_g
iro2(m);

intertempi_giro3_M(j,i,m)=B_individual.men.(nome_classi{i})(j).intertempi_g
iro3(m);

intertempi_giro4_M(j,i,m)=B_individual.men.(nome_classi{i})(j).intertempi_g
iro4(m);

intertempi_giro5_M(j,i,m)=B_individual.men.(nome_classi{i})(j).intertempi_g
iro5(m);
            end
        end
    end
end

tempo_finale_M_MEAN=nanmean(tempo_finale_M);
tempo_finale_M_STD=nanstd(tempo_finale_M);

for k=1:size(split_time_giro1_M,3)
    split_time_giro1_M_MEAN(k,:)=nanmean(split_time_giro1_M(:,:,k));
    split_time_giro2_M_MEAN(k,:)=nanmean(split_time_giro2_M(:,:,k));
    split_time_giro3_M_MEAN(k,:)=nanmean(split_time_giro3_M(:,:,k));
    split_time_giro4_M_MEAN(k,:)=nanmean(split_time_giro4_M(:,:,k));
    split_time_giro5_M_MEAN(k,:)=nanmean(split_time_giro5_M(:,:,k));
    split_time_giro1_M_STD(k,:)=nanstd(split_time_giro1_M(:,:,k));
    split_time_giro2_M_STD(k,:)=nanstd(split_time_giro2_M(:,:,k));
    split_time_giro3_M_STD(k,:)=nanstd(split_time_giro3_M(:,:,k));
    split_time_giro4_M_STD(k,:)=nanstd(split_time_giro4_M(:,:,k));
    split_time_giro5_M_STD(k,:)=nanstd(split_time_giro5_M(:,:,k));
end

for m=1:size(intertempi_giro1_M,3)
    intertempi_giro1_M_MEAN(m,:)=nanmean(intertempi_giro1_M(:,:,m));
    intertempi_giro2_M_MEAN(m,:)=nanmean(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_MEAN(m,:)=nanmean(intertempi_giro3_M(:,:,m));
    intertempi_giro4_M_MEAN(m,:)=nanmean(intertempi_giro4_M(:,:,m));
    intertempi_giro5_M_MEAN(m,:)=nanmean(intertempi_giro5_M(:,:,m));
    intertempi_giro1_M_STD(m,:)=nanstd(intertempi_giro1_M(:,:,m));
    intertempi_giro2_M_STD(m,:)=nanstd(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_STD(m,:)=nanstd(intertempi_giro3_M(:,:,m));
    intertempi_giro4_M_STD(m,:)=nanstd(intertempi_giro4_M(:,:,m));
    intertempi_giro5_M_STD(m,:)=nanstd(intertempi_giro5_M(:,:,m));
end

%% RIEMPIMENTO STRUTTURE

% DONNE
% MEDIA
B_individual.women.MEAN.t_finale=tempo_finale_W_MEAN;
B_individual.women.MEAN.split_time_giro1=split_time_giro1_W_MEAN;
B_individual.women.MEAN.split_time_giro2=split_time_giro2_W_MEAN;
B_individual.women.MEAN.split_time_giro3=split_time_giro3_W_MEAN;
B_individual.women.MEAN.split_time_giro4=split_time_giro4_W_MEAN;
B_individual.women.MEAN.split_time_giro5=split_time_giro5_W_MEAN;
B_individual.women.MEAN.intertempi_giro1=intertempi_giro1_W_MEAN;
```

```
B_individual.women.MEAN.intertempi_giro2=intertempi_giro2_W_MEAN;
B_individual.women.MEAN.intertempi_giro3=intertempi_giro3_W_MEAN;
B_individual.women.MEAN.intertempi_giro4=intertempi_giro4_W_MEAN;
B_individual.women.MEAN.intertempi_giro5=intertempi_giro5_W_MEAN;

% DEVIAZIONE STANDARD
B_individual.women.STD.t_finale=tempo_finale_W_STD;
B_individual.women.STD.split_time_giro1=split_time_giro1_W_STD;
B_individual.women.STD.split_time_giro2=split_time_giro2_W_STD;
B_individual.women.STD.split_time_giro3=split_time_giro3_W_STD;
B_individual.women.STD.split_time_giro4=split_time_giro4_W_STD;
B_individual.women.STD.split_time_giro5=split_time_giro5_W_STD;
B_individual.women.STD.intertempi_giro1=intertempi_giro1_W_STD;
B_individual.women.STD.intertempi_giro2=intertempi_giro2_W_STD;
B_individual.women.STD.intertempi_giro3=intertempi_giro3_W_STD;
B_individual.women.STD.intertempi_giro4=intertempi_giro4_W_STD;
B_individual.women.STD.intertempi_giro5=intertempi_giro5_W_STD;

% UOMINI
% MEDIA
B_individual.men.MEAN.t_finale=tempo_finale_M_MEAN;
B_individual.men.MEAN.split_time_giro1=split_time_giro1_M_MEAN;
B_individual.men.MEAN.split_time_giro2=split_time_giro2_M_MEAN;
B_individual.men.MEAN.split_time_giro3=split_time_giro3_M_MEAN;
B_individual.men.MEAN.split_time_giro4=split_time_giro4_M_MEAN;
B_individual.men.MEAN.split_time_giro5=split_time_giro5_M_MEAN;
B_individual.men.MEAN.intertempi_giro1=intertempi_giro1_M_MEAN;
B_individual.men.MEAN.intertempi_giro2=intertempi_giro2_M_MEAN;
B_individual.men.MEAN.intertempi_giro3=intertempi_giro3_M_MEAN;
B_individual.men.MEAN.intertempi_giro4=intertempi_giro4_M_MEAN;
B_individual.men.MEAN.intertempi_giro5=intertempi_giro5_M_MEAN;

% DEVIAZIONE STANDARD
B_individual.men.STD.t_finale=tempo_finale_M_STD;
B_individual.men.STD.split_time_giro1=split_time_giro1_M_STD;
B_individual.men.STD.split_time_giro2=split_time_giro2_M_STD;
B_individual.men.STD.split_time_giro3=split_time_giro3_M_STD;
B_individual.men.STD.split_time_giro4=split_time_giro4_M_STD;
B_individual.men.STD.split_time_giro5=split_time_giro5_M_STD;
B_individual.men.STD.intertempi_giro1=intertempi_giro1_M_STD;
B_individual.men.STD.intertempi_giro2=intertempi_giro2_M_STD;
B_individual.men.STD.intertempi_giro3=intertempi_giro3_M_STD;
B_individual.men.STD.intertempi_giro4=intertempi_giro4_M_STD;
B_individual.men.STD.intertempi_giro5=intertempi_giro5_M_STD;

%% SALVATAGGIO STRUTTURA COMPLETA

save([filepath_save2 '\B_individual_finale.mat'],'-struct','B_individual');

%% (ex grafici_tempo)

% Creazione dei grafici

%%

c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};
```

```
ngiri_W=size(giro_W,2);
ngiri_M=size(giro_M,2);
nintertempi_W=size(B_individual.women.MEAN.intertempi_giro1,1);
nintertempi_M=size(B_individual.men.MEAN.intertempi_giro1,1);
nsplit_time_W=size(B_individual.women.MEAN.split_time_giro1,1);
nsplit_time_M=size(B_individual.men.MEAN.split_time_giro1,1);

%% RAPPRESENTAZIONE GRAFICA DEI DATI
figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
ylim([0
100*(1+6*B_individual.women.STD.t_finale(end)./B_individual.women.MEAN.t_fi
nale(end))]);
yyaxis right
bar(c,B_individual.women.MEAN.t_finale,'r');
hold on
errorbar(B_individual.women.MEAN.t_finale,B_individual.women.STD.t_finale,'
.k','LineWidth',1);
ylim([0
B_individual.women.MEAN.t_finale(end)+6*B_individual.women.STD.t_finale(end
)]);
ylabel('tempo di gara [s]');
xlabel('classi');
title('BIATHLON INDIVIDUAL - DONNE');
hold off

figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
ylim([0
100*(1+2.5*B_individual.men.STD.t_finale(end)./B_individual.men.MEAN.t_fina
le(end))]);
yyaxis right
bar(c,B_individual.men.MEAN.t_finale,'b');
hold on
errorbar(B_individual.men.MEAN.t_finale,B_individual.men.STD.t_finale,'.k',
'LineWidth',1);
ylim([0
B_individual.men.MEAN.t_finale(end)+2.5*B_individual.men.STD.t_finale(end)]
);
ylabel('tempo di gara [s]');
xlabel('classi');
title('BIATHLON INDIVIDUAL - UOMINI');
hold off

%%
% SOLO DONNE
k=1;
for i=1:ngiri_W:ngiri_W*nintertempi_W
    intertempi_mean_W(i,:)=B_individual.women.MEAN.intertempi_giro1(k,:);

intertempi_mean_W((i+1),:)=B_individual.women.MEAN.intertempi_giro2(k,:);

intertempi_mean_W((i+2),:)=B_individual.women.MEAN.intertempi_giro3(k,:);

intertempi_mean_W((i+3),:)=B_individual.women.MEAN.intertempi_giro4(k,:);

intertempi_mean_W((i+4),:)=B_individual.women.MEAN.intertempi_giro5(k,:);
    intertempi_std_W(i,:)=B_individual.women.STD.intertempi_giro1(k,:);
    intertempi_std_W((i+1),:)=B_individual.women.STD.intertempi_giro2(k,:);
```

```
    intertempi_std_W((i+2),:)=B_individual.women.STD.intertempi_giro3(k,:);
    intertempi_std_W((i+3),:)=B_individual.women.STD.intertempi_giro4(k,:);
    intertempi_std_W((i+4),:)=B_individual.women.STD.intertempi_giro5(k,:);
    k=k+1;
end

% SOLO DONNE
ngroups=size(intertempi_mean_W(1:ngiri_W,:)',1);
nbars=size(intertempi_mean_W(1:ngiri_W,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_W
figure()
int_mean=intertempi_mean_W((j-1)*ngiri_W+1:j*ngiri_W,:);
    int_std=intertempi_std_W((j-1)*ngiri_W+1:j*ngiri_W,:);
    yyaxis left
    ylim([0 100*(1+9*max(int_std(:,end)./int_mean(:,end)))]);
    ylabel('%');
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+9*int_std(:,end))]);
    ylabel('[s]');
    xlabel('classi');
    title('BIATHLON INDIVIDUAL - DONNE');
    hold off
end

%%
% SOLO UOMINI
k=1;
for i=1:ngiri_M:ngiri_M*nintertempi_M
    intertempi_mean_M(i,:)=B_individual.men.MEAN.intertempi_giro1(k,:);
    intertempi_mean_M((i+1),:)=B_individual.men.MEAN.intertempi_giro2(k,:);
    intertempi_mean_M((i+2),:)=B_individual.men.MEAN.intertempi_giro3(k,:);
    intertempi_mean_M((i+3),:)=B_individual.men.MEAN.intertempi_giro4(k,:);
    intertempi_mean_M((i+4),:)=B_individual.men.MEAN.intertempi_giro5(k,:);
    intertempi_std_M(i,:)=B_individual.men.STD.intertempi_giro1(k,:);
    intertempi_std_M((i+1),:)=B_individual.men.STD.intertempi_giro2(k,:);
    intertempi_std_M((i+2),:)=B_individual.men.STD.intertempi_giro3(k,:);
    intertempi_std_M((i+3),:)=B_individual.men.STD.intertempi_giro4(k,:);
    intertempi_std_M((i+4),:)=B_individual.men.STD.intertempi_giro5(k,:);
    k=k+1;
end

% SOLO UOMINI
ngroups=size(intertempi_mean_M(1:ngiri_M,:)',1);
nbars=size(intertempi_mean_M(1:ngiri_M,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_M
figure()
```

```
int_mean=intertempi_mean_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    int_std=intertempi_std_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    yyaxis left
    ylim([0 100*(1+3*max(int_std(:,end)./int_mean(:,end)))]);
    ylabel('%');
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+3*int_std(:,end))]);
    ylabel('[s]');
    xlabel('classi');
    title('BIATHLON INDIVIDUAL - UOMINI');
    hold off
end

%%
% figure(8)

split_time_mean_W=[zeros(1,5);
B_individual.women.MEAN.split_time_giro1(1:8,:);
B_individual.women.MEAN.split_time_giro2(1:8,:);
B_individual.women.MEAN.split_time_giro3(1:8,:);
B_individual.women.MEAN.split_time_giro4(1:8,:);
B_individual.women.MEAN.split_time_giro5(1:8,:);
B_individual.women.MEAN.split_time_giro5(11,:)];
split_time_std_W=[zeros(1,5);
B_individual.women.STD.split_time_giro1(1:8,:);
B_individual.women.STD.split_time_giro2(1:8,:);
B_individual.women.STD.split_time_giro3(1:8,:);
B_individual.women.STD.split_time_giro4(1:8,:);
B_individual.women.STD.split_time_giro5(1:8,:);
B_individual.women.STD.split_time_giro5(11,:)];

figure(8)
subplot(1,2,1);
vettW=[0:size(split_time_mean_W,1)-1];

for i=1:size(split_time_mean_W,2)
    [p,S(i)]=polyfit(vettW',split_time_mean_W(:,i),1);
    [y,delta]=polyval(p,vettW,S(i));
    plot(vettW,split_time_mean_W(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettW,y,'k');
%     errorbar(vettW,y,delta,'.k');
end
title('BIATHLON INDIVIDUAL - DONNE')
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-500 5000])
hold off

subplot(1,2,2);
```

```
for i=1:size(split_time_mean_W,2)
        plot(vettW,split_time_mean_W(:,i)-min(split_time_mean_W,[],2),'-
o','LineWidth',1.5);
        hold on
end
title('BIATHLON INDIVIDUAL - DONNE')
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
hold off
saveas(gcf,[filepath_save '\split_time_W.fig']);

%%
% figure(9)

split_time_mean_M=[zeros(1,5);
B_individual.men.MEAN.split_time_giro1(1:8,:);
B_individual.men.MEAN.split_time_giro2(1:8,:);
B_individual.men.MEAN.split_time_giro3(1:8,:);
B_individual.men.MEAN.split_time_giro4(1:8,:);
B_individual.men.MEAN.split_time_giro5(1:8,:);
B_individual.men.MEAN.split_time_giro5(11,:)];
split_time_std_M=[zeros(1,5); B_individual.men.STD.split_time_giro1(1:8,:);
B_individual.men.STD.split_time_giro2(1:8,:);
B_individual.men.STD.split_time_giro3(1:8,:);
B_individual.men.STD.split_time_giro4(1:8,:);
B_individual.men.STD.split_time_giro5(1:8,:);
B_individual.men.STD.split_time_giro5(11,:)];

figure(9)
subplot(1,2,1);
vettM=[0:size(split_time_mean_M,1)-1];

for i=1:size(split_time_mean_M,2)
    [p,S(i)]=polyfit(vettM',split_time_mean_M(:,i),1);
    [y,delta]=polyval(p,vettM,S(i));
    plot(vettM,split_time_mean_M(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettM,y,'k');
%     errorbar(vettM,y,delta,'.k');
end
title('BIATHLON INDIVIDUAL - UOMINI')
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-250 3800])
hold off

subplot(1,2,2);
for i=1:size(split_time_mean_M,2)
        plot(vettM,split_time_mean_M(:,i)-min(split_time_mean_M,[],2),'-
o','LineWidth',1.5);
        hold on
end
title('BIATHLON INDIVIDUAL - UOMINI')
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
hold off
```

```
saveas(gcf,[filepath_save '\split_time_M.fig']);
```

b.3) Cross country middle

```
%% CROSS COUNTRY MIDDLE DISTANCE

% (ex elab1) Inserimento dei nuovi campi usati poi per la rappresentazione
% grafica. I campi creati diventano inidipendenti dal tempo di partenza del
% singolo atleta, permettendo quindi il confronto dei tempi tra loro.
%%
clc
clear all
close all

% Caricamento della struttura ottenuta dall'inizializzazione dei dati (la
% struttura ottenuta è stata copiata all'interno della nuova cartella per
% tenere separate le fasi di inizializzazione ed elaborazione dei dati).

nome_gara='Cross_country_middle';
filepath = [cd '\' nome_gara '\STEP1'];
filepath_save=[cd '\' nome_gara '\GRAFICI'];
filepath_save2=[cd '\' nome_gara];
XC_middle=load([filepath '\cross_country_middle.mat']);

% Creazione del vettore classi
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
int_giro_W={'intertempi_giro1','intertempi_giro2'};
int_giro_M={'intertempi_giro1','intertempi_giro2','intertempi_giro3'};
giro_W={'giro1','giro2'};
giro_M={'giro1','giro2','giro3'};

%% DONNE

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!
%classi di appartenenza di ogni atleta donna.
C_W=[10.5 12 10.5 12 11 10.5 10.5 12 12 12 12 12 11];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% UOMINI

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 12 11 11.5 12 10 12 12 12 12 11 12 11 12 12 12 12 12 10 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);
```

```
%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];

%% DONNE Riempimento dei campi appena creati:

%Si vuole ottenere l'indipendenza dei tempi e degli intertempi dall'orario
%di partenza di ogni atleta. In questo modo è poi possibile fare un
%confronto inter e intra classi.
%  - finish_time: differenza tra il tempo finale dell'ultimo giro (giro 2
%                   per le donne e giro 3 per gli uomini) e lo start_time.
%        - tempo_giro1
%        - tempo_giro2
%        - split_time_giro1: ottengo il tempo intercorso tra la partenza e
%                            ogni sensore del giro 1; stessa cosa è valida
%                            anche per il giro 2.
%        - split_time_giro2
%        - intertempi_giro1: valuto i parziali tra i vari sensori, in modo
%                            da poter poi confrontare le differenze di tempo
%                            causate dai diversi impedimenti per le varie
%                            classi nei tratti di pianura, salita, discesa e
%                            tratti rettilinei e curvi.
%        - intertempi_giro2

for i=1:length(nome_classi)
    if classi_W(i)~=0
        for j=1:classi_W(i)

XC_middle.women.(nome_classi{i})(j).finish_time=(XC_middle.women.(nome_clas
si{i})(j).giro2(1,11))-(XC_middle.women.(nome_classi{i})(j).start_time);

XC_middle.women.(nome_classi{i})(j).split_time_giro1=(XC_middle.women.(nome
_classi{i})(j).giro1)-(XC_middle.women.(nome_classi{i})(j).start_time);

XC_middle.women.(nome_classi{i})(j).split_time_giro2=(XC_middle.women.(nome
_classi{i})(j).giro2)-(XC_middle.women.(nome_classi{i})(j).start_time);
            for k=1:length(giro_W)
                % calcolo K2-K1 (uphill middle)

XC_middle.women.(nome_classi{i})(j).(int_giro_W{k})(1)=(XC_middle.women.(no
me_classi{i})(j).(giro_W{k})(2))-
(XC_middle.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K3-K2 (uphill steep)

XC_middle.women.(nome_classi{i})(j).(int_giro_W{k})(2)=(XC_middle.women.(no
me_classi{i})(j).(giro_W{k})(3))-
(XC_middle.women.(nome_classi{i})(j).(giro_W{k})(2));
                % calcolo K3-K1 (total uphill)

XC_middle.women.(nome_classi{i})(j).(int_giro_W{k})(3)=(XC_middle.women.(no
me_classi{i})(j).(giro_W{k})(3))-
(XC_middle.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K5-K4 (flat)

XC_middle.women.(nome_classi{i})(j).(int_giro_W{k})(4)=(XC_middle.women.(no
me_classi{i})(j).(giro_W{k})(5))-
(XC_middle.women.(nome_classi{i})(j).(giro_W{k})(4));
                % calcolo K6-K5 (curve)

XC_middle.women.(nome_classi{i})(j).(int_giro_W{k})(5)=(XC_middle.women.(no
me_classi{i})(j).(giro_W{k})(6))-
(XC_middle.women.(nome_classi{i})(j).(giro_W{k})(5));
```

```
                % calcolo K8-K7 (downhill)

XC_middle.women.(nome_classi{i})(j).(int_giro_W{k})(6)=(XC_middle.women.(no
me_classi{i})(j).(giro_W{k})(8))-
(XC_middle.women.(nome_classi{i})(j).(giro_W{k})(7));
            end
        end
    end
end

%% UOMINI Riempimento dei campi appena creati

for i=1:length(nome_classi)
    if classi_M(i)~=0
        for j=1:classi_M(i)

XC_middle.men.(nome_classi{i})(j).finish_time=(XC_middle.men.(nome_classi{i
})(j).giro3(1,11))-(XC_middle.men.(nome_classi{i})(j).start_time);

XC_middle.men.(nome_classi{i})(j).split_time_giro1=(XC_middle.men.(nome_cla
ssi{i})(j).giro1)-(XC_middle.men.(nome_classi{i})(j).start_time);

XC_middle.men.(nome_classi{i})(j).split_time_giro2=(XC_middle.men.(nome_cla
ssi{i})(j).giro2)-(XC_middle.men.(nome_classi{i})(j).start_time);

XC_middle.men.(nome_classi{i})(j).split_time_giro3=(XC_middle.men.(nome_cla
ssi{i})(j).giro3)-(XC_middle.men.(nome_classi{i})(j).start_time);
            for k=1:length(giro_M)
                % calcolo K2-K1 (uphill middle)

XC_middle.men.(nome_classi{i})(j).(int_giro_M{k})(1)=(XC_middle.men.(nome_c
lassi{i})(j).(giro_M{k})(2))-
(XC_middle.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K3-K2 (uphill steep)

XC_middle.men.(nome_classi{i})(j).(int_giro_M{k})(2)=(XC_middle.men.(nome_c
lassi{i})(j).(giro_M{k})(3))-
(XC_middle.men.(nome_classi{i})(j).(giro_M{k})(2));
                % calcolo K3-K1 (total uphill)

XC_middle.men.(nome_classi{i})(j).(int_giro_M{k})(3)=(XC_middle.men.(nome_c
lassi{i})(j).(giro_M{k})(3))-
(XC_middle.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K5-K4 (flat)

XC_middle.men.(nome_classi{i})(j).(int_giro_M{k})(4)=(XC_middle.men.(nome_c
lassi{i})(j).(giro_M{k})(5))-
(XC_middle.men.(nome_classi{i})(j).(giro_M{k})(4));
                % calcolo K6-K5 (curve)

XC_middle.men.(nome_classi{i})(j).(int_giro_M{k})(5)=(XC_middle.men.(nome_c
lassi{i})(j).(giro_M{k})(6))-
(XC_middle.men.(nome_classi{i})(j).(giro_M{k})(5));
                % calcolo K8-K7 (downhill)

XC_middle.men.(nome_classi{i})(j).(int_giro_M{k})(6)=(XC_middle.men.(nome_c
lassi{i})(j).(giro_M{k})(8))-
(XC_middle.men.(nome_classi{i})(j).(giro_M{k})(7));
            end
        end
    end
```

```
end

%% (ex elab2)

% Calcolo di media e deviazione standard per ogni classe

%% DONNE: calcolo della MEDIA e della DEVIAZIONE STANDARD

% Creo delle matrici (dimxdim) in cui le colonne corrispondono alle 5
classi LW,
% mentre il numero di righe è dato dal numero massimo di atlete all'interno
% di una delle 5 classi; per le classi con un numero inferiore di atlete la
% matrice è completata dagli NaN che non verranno poi considerati durante
% il calcolo della std --> valido per tempo_finale_W e tempo_giroj-esimo_W.
% Per gli split_time e gli intertempi creo delle matrici (dimxdimxdim) dove
% le prime 2 dimensioni sono le stesse dette prima, mentre la 3 è uguale
% rispettivamente al numero di split_time e di intertempi calcolati in ogni
% giro (quindi 11 e 10); in questo modo ottengo 11 (e 10) matrici di
% dimensioni uguali a tempo_finale_W(ho scelto di utilizzare la clsse LW12
% per il calcolo della lunghezza dei vettori split_time e intertempi in
% modo arbitrario perché avevo controllato essere una classe con almeno un
% atleta all'interno.
% In ogni matrice corrisponde un valore corrisponde allo split_time
% (intertempo) dell'atleta j-esimo (riga) appartenente alla classe i-esima
% (colonna).
tempo_finale_W=NaN(max(classi_W),length(classi_W));
split_time_giro1_W=NaN(max(classi_W),length(classi_W),length(XC_middle.wome
n.LW12(1).split_time_giro1));
split_time_giro2_W=NaN(max(classi_W),length(classi_W),length(XC_middle.wome
n.LW12(1).split_time_giro2));
intertempi_giro1_W=NaN(max(classi_W),length(classi_W),length(XC_middle.wome
n.LW12(1).intertempi_giro1));
intertempi_giro2_W=NaN(max(classi_W),length(classi_W),length(XC_middle.wome
n.LW12(1).intertempi_giro2));

for i=1:length(nome_classi)
    for j=1:size(XC_middle.women.(nome_classi{i}))
        if classi_W(i)~=0

tempo_finale_W(j,i)=XC_middle.women.(nome_classi{i})(j).finish_time;
            for k=1:size(split_time_giro1_W,3)

split_time_giro1_W(j,i,k)=XC_middle.women.(nome_classi{i})(j).split_time_gi
ro1(k);

split_time_giro2_W(j,i,k)=XC_middle.women.(nome_classi{i})(j).split_time_gi
ro2(k);
            end
            for m=1:size(intertempi_giro1_W,3)

intertempi_giro1_W(j,i,m)=XC_middle.women.(nome_classi{i})(j).intertempi_gi
ro1(m);

intertempi_giro2_W(j,i,m)=XC_middle.women.(nome_classi{i})(j).intertempi_gi
ro2(m);
            end
        end
    end
end
```

```
tempo_finale_W_MEAN=nanmean(tempo_finale_W);
tempo_finale_W_STD=nanstd(tempo_finale_W);

% Calcolo la media dei valori per ogni matrice (medio i valori lungo le
% colonne) --> ottengo un vettore (1x5) per ogni matrice, contenente i
% valori medi dello split_time k-esimo per ogni classe. Stesso procedimento
% è applicato col calcolo della deviazione standard.
% --> Otterrò delle matrici ...._MEAN e ..._STD di dimensioni (11x5), dove
% le colonne corrispondono alle classi, mentre ogni riga corrisponde al
% relativo split_time.

for k=1:size(split_time_giro1_W,3)
    split_time_giro1_W_MEAN(k,:)=nanmean(split_time_giro1_W(:,:,k));
    split_time_giro2_W_MEAN(k,:)=nanmean(split_time_giro2_W(:,:,k));
    split_time_giro1_W_STD(k,:)=nanstd(split_time_giro1_W(:,:,k));
    split_time_giro2_W_STD(k,:)=nanstd(split_time_giro2_W(:,:,k));
end

% Vale lo stesso ragionamento fatto con gli split_time, ma in questo caso
% le matrici avranno dimensione (10x5).

for m=1:size(intertempi_giro1_W,3)
    intertempi_giro1_W_MEAN(m,:)=nanmean(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_MEAN(m,:)=nanmean(intertempi_giro2_W(:,:,m));
    intertempi_giro1_W_STD(m,:)=nanstd(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_STD(m,:)=nanstd(intertempi_giro2_W(:,:,m));
end

%% UOMINI: calcolo della MEDIA e della DEVIAZIONE STANDARD

tempo_finale_M=NaN(max(classi_M),length(classi_M));
split_time_giro1_M=NaN(max(classi_M),length(classi_M),length(XC_middle.men.
LW12(1).split_time_giro1));
split_time_giro2_M=NaN(max(classi_M),length(classi_M),length(XC_middle.men.
LW12(1).split_time_giro2));
split_time_giro3_M=NaN(max(classi_M),length(classi_M),length(XC_middle.men.
LW12(1).split_time_giro3));
intertempi_giro1_M=NaN(max(classi_M),length(classi_M),length(XC_middle.men.
LW12(1).intertempi_giro1));
intertempi_giro2_M=NaN(max(classi_M),length(classi_M),length(XC_middle.men.
LW12(1).intertempi_giro2));
intertempi_giro3_M=NaN(max(classi_M),length(classi_M),length(XC_middle.men.
LW12(1).intertempi_giro3));

for i=1:length(nome_classi)
    for j=1:size(XC_middle.men.(nome_classi{i}))
        if classi_M(i)~=0

tempo_finale_M(j,i)=XC_middle.men.(nome_classi{i})(j).finish_time;
            for k=1:size(split_time_giro1_M,3)

split_time_giro1_M(j,i,k)=XC_middle.men.(nome_classi{i})(j).split_time_giro
1(k);

split_time_giro2_M(j,i,k)=XC_middle.men.(nome_classi{i})(j).split_time_giro
2(k);

split_time_giro3_M(j,i,k)=XC_middle.men.(nome_classi{i})(j).split_time_giro
3(k);
            end
```

```
            for m=1:size(intertempi_giro1_M,3)
intertempi_giro1_M(j,i,m)=XC_middle.men.(nome_classi{i})(j).intertempi_giro
1(m);
intertempi_giro2_M(j,i,m)=XC_middle.men.(nome_classi{i})(j).intertempi_giro
2(m);
intertempi_giro3_M(j,i,m)=XC_middle.men.(nome_classi{i})(j).intertempi_giro
3(m);
            end
        end
    end
end

tempo_finale_M_MEAN=nanmean(tempo_finale_M);
tempo_finale_M_STD=nanstd(tempo_finale_M);

for k=1:size(split_time_giro1_M,3)
    split_time_giro1_M_MEAN(k,:)=nanmean(split_time_giro1_M(:,:,k));
    split_time_giro2_M_MEAN(k,:)=nanmean(split_time_giro2_M(:,:,k));
    split_time_giro3_M_MEAN(k,:)=nanmean(split_time_giro3_M(:,:,k));
    split_time_giro1_M_STD(k,:)=nanstd(split_time_giro1_M(:,:,k));
    split_time_giro2_M_STD(k,:)=nanstd(split_time_giro2_M(:,:,k));
    split_time_giro3_M_STD(k,:)=nanstd(split_time_giro3_M(:,:,k));
end

for m=1:size(intertempi_giro1_M,3)
    intertempi_giro1_M_MEAN(m,:)=nanmean(intertempi_giro1_M(:,:,m));
    intertempi_giro2_M_MEAN(m,:)=nanmean(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_MEAN(m,:)=nanmean(intertempi_giro3_M(:,:,m));
    intertempi_giro1_M_STD(m,:)=nanstd(intertempi_giro1_M(:,:,m));
    intertempi_giro2_M_STD(m,:)=nanstd(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_STD(m,:)=nanstd(intertempi_giro3_M(:,:,m));
end

%% RIEMPIMENTO STRUTTURE

% DONNE
% MEDIA
XC_middle.women.MEAN.t_finale=tempo_finale_W_MEAN;
XC_middle.women.MEAN.split_time_giro1=split_time_giro1_W_MEAN;
XC_middle.women.MEAN.split_time_giro2=split_time_giro2_W_MEAN;
XC_middle.women.MEAN.intertempi_giro1=intertempi_giro1_W_MEAN;
XC_middle.women.MEAN.intertempi_giro2=intertempi_giro2_W_MEAN;

% DEVIAZIONE STANDARD
XC_middle.women.STD.t_finale=tempo_finale_W_STD;
XC_middle.women.STD.split_time_giro1=split_time_giro1_W_STD;
XC_middle.women.STD.split_time_giro2=split_time_giro2_W_STD;
XC_middle.women.STD.intertempi_giro1=intertempi_giro1_W_STD;
XC_middle.women.STD.intertempi_giro2=intertempi_giro2_W_STD;

% UOMINI
% MEDIA
XC_middle.men.MEAN.t_finale=tempo_finale_M_MEAN;
XC_middle.men.MEAN.split_time_giro1=split_time_giro1_M_MEAN;
XC_middle.men.MEAN.split_time_giro2=split_time_giro2_M_MEAN;
XC_middle.men.MEAN.split_time_giro3=split_time_giro3_M_MEAN;
XC_middle.men.MEAN.intertempi_giro1=intertempi_giro1_M_MEAN;
```

```
XC_middle.men.MEAN.intertempi_giro2=intertempi_giro2_M_MEAN;
XC_middle.men.MEAN.intertempi_giro3=intertempi_giro3_M_MEAN;

%DEVIAZIONE STANDARD
XC_middle.men.STD.t_finale=tempo_finale_M_STD;
XC_middle.men.STD.split_time_giro1=split_time_giro1_M_STD;
XC_middle.men.STD.split_time_giro2=split_time_giro2_M_STD;
XC_middle.men.STD.split_time_giro3=split_time_giro3_M_STD;
XC_middle.men.STD.intertempi_giro1=intertempi_giro1_M_STD;
XC_middle.men.STD.intertempi_giro2=intertempi_giro2_M_STD;
XC_middle.men.STD.intertempi_giro3=intertempi_giro3_M_STD;

%% SALVATAGGIO STRUTTURA COMPLETA

save([filepath_save2 '\XC_middle_finale.mat'],'-struct','XC_middle');

%% (ex grafici_tempo)

% Creazione dei grafici

%%

c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};

ngiri_W=size(giro_W,2);
ngiri_M=size(giro_M,2);
nintertempi_W=size(XC_middle.women.MEAN.intertempi_giro1,1);
nintertempi_M=size(XC_middle.men.MEAN.intertempi_giro1,1);
nsplit_time_W=size(XC_middle.women.MEAN.split_time_giro1,1);
nsplit_time_M=size(XC_middle.men.MEAN.split_time_giro1,1);

%% RAPPRESENTAZIONE GRAFICA DEI DATI
figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
ylim([0
100*(1+7.5*XC_middle.women.STD.t_finale(end)./XC_middle.women.MEAN.t_finale
(end))]);
yyaxis right
bar(c,XC_middle.women.MEAN.t_finale,'r');
hold on
% La funzione errorbar permette di aggiungere all'istogramma la deviazione
% standard corrispondente ad ogni barra (aggiungo 1 std positiva e 1 std
% negativa --> in totale ho una barra d'errore corrispondente a 2*std).
errorbar(XC_middle.women.MEAN.t_finale,XC_middle.women.STD.t_finale,'.k','L
ineWidth',1);
ylim([0
XC_middle.women.MEAN.t_finale(end)+7.5*XC_middle.women.STD.t_finale(end)]);
ylabel('tempo di gara [s]');
xlabel('classi');
title('CROSS COUNTRY MIDDLE - DONNE');
hold off

figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
```

```
ylim([0
100*(1+7.5*XC_middle.men.STD.t_finale(end)./XC_middle.men.MEAN.t_finale(end
))]);
yyaxis right
b=bar(c,XC_middle.men.MEAN.t_finale,'b');
hold on
errorbar(XC_middle.men.MEAN.t_finale,XC_middle.men.STD.t_finale,'.k','LineW
idth',1);
ylim([0
XC_middle.men.MEAN.t_finale(end)+7.5*XC_middle.men.STD.t_finale(end)]);
ylabel('tempo di gara [s]');
xlabel('classi');
title('CROSS COUNTRY MIDDLE - UOMINI');
hold off

%%
% SOLO DONNE
% (figure(4)) Rappresentazione degli intertempi in funzione dei giri
% effettuati. In questo modo ottengo 10 grafici (lavoro separatamente per
% ogni intertempo) dove vado a confrontare il tempo dello stesso intertempo
% tra le varie classi.
k=1;
for i=1:ngiri_W:ngiri_W*nintertempi_W
    intertempi_mean_W(i,:)=XC_middle.women.MEAN.intertempi_giro1(k,:);
    intertempi_mean_W((i+1),:)=XC_middle.women.MEAN.intertempi_giro2(k,:);
    intertempi_std_W(i,:)=XC_middle.women.STD.intertempi_giro1(k,:);
    intertempi_std_W((i+1),:)=XC_middle.women.STD.intertempi_giro2(k,:);
    k=k+1;
end

% ngroups=size(intertempi_mean_W(1:ngiri_W,:),1);
% nbars=size(intertempi_mean_W(1:ngiri_W,:),2);
% groupwidth=min(0.8, nbars/(nbars+1.5));
%
% for j=1:nintertempi_W
%     figure()
%     int_mean=intertempi_mean_W((j-1)*ngiri_W+1:j*ngiri_W,:);
%     int_std=intertempi_std_W((j-1)*ngiri_W+1:j*ngiri_W,:);
%     yyaxis left
%     ylabel('%');
%     ylim([0 100*(1+10*max(int_std(:,end)./int_mean(:,end)))]);
%     yyaxis right
%     b=bar(int_mean,'FaceColor','flat');
%     for k = 1:size(int_mean,2)
%         b(k).CData = k;
%     end
%     set(gca,'XTickLabel',{'giro 1','giro 2'});
%     hold on
%     for i=1:nbars
%         vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
%         errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
%     end
%     ylim([0 max(int_mean(:,end)+10*int_std(:,end))]);
%     ylabel('[s]');
%     xlabel('n° giro');
%     title('CROSS COUNTRY MIDDLE - DONNE');
%     hold off
% end


% SOLO DONNE
```

```matlab
% (figure(5)) Rappresentazione degli intertempi in relazione alla classe di
% appartenenza. I 10 intertempi sono stati plottati in 10 differenti
% grafici, in modo da avere un confronto visivo tra 1 e 2 giro.

ngroups=size(intertempi_mean_W(1:ngiri_W,:)',1);
nbars=size(intertempi_mean_W(1:ngiri_W,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_W
    figure()
    int_mean=intertempi_mean_W((j-1)*ngiri_W+1:j*ngiri_W,:);
    int_std=intertempi_std_W((j-1)*ngiri_W+1:j*ngiri_W,:);
    yyaxis left
    ylabel('%');
    ylim([0 100*(1+10*max(int_std(:,end)./int_mean(:,end)))]);
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+10*int_std(:,end))]);
    ylabel('[s]');
    xlabel('classi');
    title('CROSS COUNTRY MIDDLE - DONNE');
    hold off
end
%%
% SOLO UOMINI
% (figure(6)) Rappresentazione degli intertempi in funzione dei giri
% effettuati. In questo modo ottengo 10 grafici (lavoro separatamente per
% ogni intertempo) dove vado a confrontare il tempo dello stesso intertempo
% tra le varie classi.
k=1;
for i=1:ngiri_M:ngiri_M*nintertempi_M
    intertempi_mean_M(i,:)=XC_middle.men.MEAN.intertempi_giro1(k,:);
    intertempi_mean_M((i+1),:)=XC_middle.men.MEAN.intertempi_giro2(k,:);
    intertempi_mean_M((i+2),:)=XC_middle.men.MEAN.intertempi_giro3(k,:);
    intertempi_std_M(i,:)=XC_middle.men.STD.intertempi_giro1(k,:);
    intertempi_std_M((i+1),:)=XC_middle.men.STD.intertempi_giro2(k,:);
    intertempi_std_M((i+2),:)=XC_middle.men.STD.intertempi_giro3(k,:);
    k=k+1;
end

% ngroups=size(intertempi_mean_M(1:ngiri_M,:),1);
% nbars=size(intertempi_mean_M(1:ngiri_M,:),2);
% groupwidth=min(0.8, nbars/(nbars+1.5));
%
% for j=1:nintertempi_M
%     figure()
%     int_mean=intertempi_mean_M((j-1)*ngiri_M+1:j*ngiri_M,:);
%     int_std=intertempi_std_M((j-1)*ngiri_M+1:j*ngiri_M,:);
%     yyaxis left
%     ylim([0 100*(1+5*max(int_std(:,end)./int_mean(:,end)))]);
%     ylabel('%');
%     yyaxis right
```

```
%     b=bar(int_mean,'FaceColor','flat');
%     for k = 1:size(int_mean,2)
%         b(k).CData = k;
%     end
%     set(gca,'XTickLabel',{'giro 1','giro 2','giro 3'});
%     hold on
%     for i=1:nbars
%         vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
%         errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
%     end
%     ylim([0 max(int_mean(:,end)+5*int_std(:,end))]);
%     ylabel('[s]');
%     xlabel('n° giro');
%     title('CROSS COUNTRY MIDDLE - UOMINI');
%     hold off
% end

% SOLO UOMINI
% (figure(7)) Rappresentazione degli intertempi in relazione alla classe di
% appartenenza. I 10 intertempi sono stati plottati in 10 differenti
% grafici, in modo da avere un confronto visivo tra 1 e 2 giro.

ngroups=size(intertempi_mean_M(1:ngiri_M,:)',1);
nbars=size(intertempi_mean_M(1:ngiri_M,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_M
    figure()
    int_mean=intertempi_mean_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    int_std=intertempi_std_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    yyaxis left
    ylim([0 100*(1+5*max(int_std(:,end)./int_mean(:,end)))]);
    ylabel('%');
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+5*int_std(:,end))]);
    ylabel('[s]');
    xlabel('classi');
    title('CROSS COUNTRY MIDDLE - UOMINI');
    hold off
end
%%
% (figure(8)/figure(9)) Rappresentazione grafica dell'andamento medio del
tempo di
% gara tra uno split time e l'altro: la differenza in secondi dello stesso
% split_time per LW diverse varia all'aumentare del tempo.

split_time_mean_W=[zeros(1,5);
XC_middle.women.MEAN.split_time_giro1(1:8,:);
XC_middle.women.MEAN.split_time_giro2(1:8,:);
XC_middle.women.MEAN.split_time_giro2(11,:)];
```

```
split_time_std_W=[zeros(1,5); XC_middle.women.STD.split_time_giro1(1:8,:);
XC_middle.women.STD.split_time_giro2(1:8,:);
XC_middle.women.STD.split_time_giro2(11,:)];

figure()
subplot(1,2,1);
vettW=0:size(split_time_mean_W,1)-1;

for i=1:size(split_time_mean_W,2)
    % Faccio anche la regressione lineare dei dati
    [p,S(i)]=polyfit(vettW',split_time_mean_W(:,i),1);
    [y,delta]=polyval(p,vettW,S(i));
    plot(vettW,split_time_mean_W(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettW,y,'k');
%     errorbar(vettW,y,delta,'.k');
end
title('CROSS COUNTRY MIDDLE - DONNE');
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-100 2000])
hold off

subplot(1,2,2);
for i=1:size(split_time_mean_W,2)
        plot(vettW,split_time_mean_W(:,i)-min(split_time_mean_W,[],2),'-
o','LineWidth',1.5);
        hold on
end
title('CROSS COUNTRY MIDDLE - DONNE');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
hold off
saveas(gcf,[filepath_save '\split time_W.fig']);

%%

% figure(9)
split_time_mean_M=[zeros(1,5); XC_middle.men.MEAN.split_time_giro1(1:8,:);
XC_middle.men.MEAN.split_time_giro2(1:8,:);
XC_middle.men.MEAN.split_time_giro3(1:8,:);
XC_middle.men.MEAN.split_time_giro3(11,:)];
split_time_std_M=[zeros(1,5); XC_middle.men.STD.split_time_giro1(1:8,:);
XC_middle.men.STD.split_time_giro2(1:8,:);
XC_middle.men.STD.split_time_giro3(1:8,:);
XC_middle.men.STD.split_time_giro3(11,:)];

% Se inserisco anche la deviazione standard nei grafici non si capisce
% nulla perché le std si sovrappongono tra di loro.

figure()
subplot(1,2,1);
vettM=0:size(split_time_mean_M,1)-1;

for i=1:size(split_time_mean_M,2)
    % Faccio anche la regressione lineare dei dati
    [p,S(i)]=polyfit(vettM',split_time_mean_M(:,i),1);
    [y,delta]=polyval(p,vettM,S(i));
```

```
    plot(vettM,split_time_mean_M(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettM,y,'k');
%     errorbar(vettM,y,delta,'.k');
end
title('CROSS COUNTRY MIDDLE - UOMINI');
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-250 2250])
hold off

subplot(1,2,2);
for i=1:size(split_time_mean_M,2)
    plot(vettM,split_time_mean_M(:,i)-min(split_time_mean_M,[],2),'-
o','LineWidth',1.5);
    hold on
end
title('CROSS COUNTRY MIDDLE - UOMINI');
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
hold off
saveas(gcf,[filepath_save '\split_time_M.fig']);
```

b.4) Cross country long

```
%% CROSS COUNTRY LONG DISTANCE

clc
clear all
close all

nome_gara='Cross_country_long';
filepath = [cd '\' nome_gara '\STEP1'];
filepath_save=[cd '\' nome_gara '\GRAFICI'];
filepath_save2=[cd '\' nome_gara];
XC_long=load([filepath '\cross_country_long.mat']);

% Creazione del vettore classi
nome_classi={'LW10','LW10_5','LW11','LW11_5','LW12'};
int_giro_W={'intertempi_giro1','intertempi_giro2','intertempi_giro3','inter
tempi_giro4'};
int_giro_M={'intertempi_giro1','intertempi_giro2','intertempi_giro3','inter
tempi_giro4','intertempi_giro5'};
giro_W={'giro1','giro2','giro3','giro4'};
giro_M={'giro1','giro2','giro3','giro4','giro5'};
%% DONNE

%classi di appartenenza di ogni atleta donna.
C_W=[12 12 11 10.5 10.5 12 12 12 12 11];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
```

```
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% UOMINI

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 11 12 11.5 10 12 12 12 11 12 11 12 12 12 12 12 12 10 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];

%% DONNE Riempimento dei campi appena creati

for i=1:length(nome_classi)
    if classi_W(i)~=0
        for j=1:classi_W(i)

XC_long.women.(nome_classi{i})(j).finish_time=(XC_long.women.(nome_classi{i
})(j).giro4(1,11))-(XC_long.women.(nome_classi{i})(j).start_time);

XC_long.women.(nome_classi{i})(j).split_time_giro1=(XC_long.women.(nome_cla
ssi{i})(j).giro1)-(XC_long.women.(nome_classi{i})(j).start_time);

XC_long.women.(nome_classi{i})(j).split_time_giro2=(XC_long.women.(nome_cla
ssi{i})(j).giro2)-(XC_long.women.(nome_classi{i})(j).start_time);

XC_long.women.(nome_classi{i})(j).split_time_giro3=(XC_long.women.(nome_cla
ssi{i})(j).giro3)-(XC_long.women.(nome_classi{i})(j).start_time);

XC_long.women.(nome_classi{i})(j).split_time_giro4=(XC_long.women.(nome_cla
ssi{i})(j).giro4)-(XC_long.women.(nome_classi{i})(j).start_time);
            for k=1:length(giro_W)
                % calcolo K2-K1 (uphill long)

XC_long.women.(nome_classi{i})(j).(int_giro_W{k})(1)=(XC_long.women.(nome_c
lassi{i})(j).(giro_W{k})(2))-
(XC_long.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K3-K2 (uphill steep)

XC_long.women.(nome_classi{i})(j).(int_giro_W{k})(2)=(XC_long.women.(nome_c
lassi{i})(j).(giro_W{k})(3))-
(XC_long.women.(nome_classi{i})(j).(giro_W{k})(2));
                % calcolo K3-K1 (total uphill)

XC_long.women.(nome_classi{i})(j).(int_giro_W{k})(3)=(XC_long.women.(nome_c
lassi{i})(j).(giro_W{k})(3))-
(XC_long.women.(nome_classi{i})(j).(giro_W{k})(1));
                % calcolo K5-K4 (flat)

XC_long.women.(nome_classi{i})(j).(int_giro_W{k})(4)=(XC_long.women.(nome_c
lassi{i})(j).(giro_W{k})(5))-
(XC_long.women.(nome_classi{i})(j).(giro_W{k})(4));
                % calcolo K6-K5 (curve)
```

```
XC_long.women.(nome_classi{i})(j).(int_giro_W{k})(5)=(XC_long.women.(nome_c
lassi{i})(j).(giro_W{k})(6))-
(XC_long.women.(nome_classi{i})(j).(giro_W{k})(5));
                % calcolo K8-K7 (downhill)

XC_long.women.(nome_classi{i})(j).(int_giro_W{k})(6)=(XC_long.women.(nome_c
lassi{i})(j).(giro_W{k})(8))-
(XC_long.women.(nome_classi{i})(j).(giro_W{k})(7));
            end
        end
    end
end

%% UOMINI Riempimento dei campi appena creati

for i=1:length(nome_classi)
    if classi_M(i)~=0
        for j=1:classi_M(i)

XC_long.men.(nome_classi{i})(j).tempo_finale=(XC_long.men.(nome_classi{i})(
j).giro5(1,11))-(XC_long.men.(nome_classi{i})(j).start_time);

XC_long.men.(nome_classi{i})(j).split_time_giro1=(XC_long.men.(nome_classi{
i})(j).giro1)-(XC_long.men.(nome_classi{i})(j).start_time);

XC_long.men.(nome_classi{i})(j).split_time_giro2=(XC_long.men.(nome_classi{
i})(j).giro2)-(XC_long.men.(nome_classi{i})(j).start_time);

XC_long.men.(nome_classi{i})(j).split_time_giro3=(XC_long.men.(nome_classi{
i})(j).giro3)-(XC_long.men.(nome_classi{i})(j).start_time);

XC_long.men.(nome_classi{i})(j).split_time_giro4=(XC_long.men.(nome_classi{
i})(j).giro4)-(XC_long.men.(nome_classi{i})(j).start_time);

XC_long.men.(nome_classi{i})(j).split_time_giro5=(XC_long.men.(nome_classi{
i})(j).giro5)-(XC_long.men.(nome_classi{i})(j).start_time);
            for k=1:length(giro_M)
                % calcolo K2-K1 (uphill long)

XC_long.men.(nome_classi{i})(j).(int_giro_M{k})(1)=(XC_long.men.(nome_class
i{i})(j).(giro_M{k})(2))-(XC_long.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K3-K2 (uphill steep)

XC_long.men.(nome_classi{i})(j).(int_giro_M{k})(2)=(XC_long.men.(nome_class
i{i})(j).(giro_M{k})(3))-(XC_long.men.(nome_classi{i})(j).(giro_M{k})(2));
                % calcolo K3-K1 (total uphill)

XC_long.men.(nome_classi{i})(j).(int_giro_M{k})(3)=(XC_long.men.(nome_class
i{i})(j).(giro_M{k})(3))-(XC_long.men.(nome_classi{i})(j).(giro_M{k})(1));
                % calcolo K5-K4 (flat)

XC_long.men.(nome_classi{i})(j).(int_giro_M{k})(4)=(XC_long.men.(nome_class
i{i})(j).(giro_M{k})(5))-(XC_long.men.(nome_classi{i})(j).(giro_M{k})(4));
                % calcolo K6-K5 (curve)

XC_long.men.(nome_classi{i})(j).(int_giro_M{k})(5)=(XC_long.men.(nome_class
i{i})(j).(giro_M{k})(6))-(XC_long.men.(nome_classi{i})(j).(giro_M{k})(5));
                % calcolo K8-K7 (downhill)
```

```
XC_long.men.(nome_classi{i})(j).(int_giro_M{k})(6)=(XC_long.men.(nome_class
i{i})(j).(giro_M{k})(8))-(XC_long.men.(nome_classi{i})(j).(giro_M{k})(7));
            end
        end
    end
end


%% (ex elab2)

% Calcolo di media e deviazione standard per ogni classe

%% DONNE: calcolo della MEDIA e della DEVIAZIONE STANDARD

tempo_finale_W=NaN(max(classi_W),length(classi_W));
split_time_giro1_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).split_time_giro1));
split_time_giro2_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).split_time_giro2));
split_time_giro3_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).split_time_giro3));
split_time_giro4_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).split_time_giro4));
intertempi_giro1_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).intertempi_giro1));
intertempi_giro2_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).intertempi_giro2));
intertempi_giro3_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).intertempi_giro3));
intertempi_giro4_W=NaN(max(classi_W),length(classi_W),length(XC_long.women.
LW12(1).intertempi_giro4));

for i=1:length(nome_classi)
    for j=1:size(XC_long.women.(nome_classi{i}))
        if classi_W(i)~=0

tempo_finale_W(j,i)=XC_long.women.(nome_classi{i})(j).finish_time;
            for k=1:size(split_time_giro1_W,3)

split_time_giro1_W(j,i,k)=XC_long.women.(nome_classi{i})(j).split_time_giro
1(k);

split_time_giro2_W(j,i,k)=XC_long.women.(nome_classi{i})(j).split_time_giro
2(k);

split_time_giro3_W(j,i,k)=XC_long.women.(nome_classi{i})(j).split_time_giro
3(k);

split_time_giro4_W(j,i,k)=XC_long.women.(nome_classi{i})(j).split_time_giro
4(k);
            end
            for m=1:size(intertempi_giro1_W,3)

intertempi_giro1_W(j,i,m)=XC_long.women.(nome_classi{i})(j).intertempi_giro
1(m);

intertempi_giro2_W(j,i,m)=XC_long.women.(nome_classi{i})(j).intertempi_giro
2(m);
```

```
intertempi_giro3_W(j,i,m)=XC_long.women.(nome_classi{i})(j).intertempi_giro
3(m);

intertempi_giro4_W(j,i,m)=XC_long.women.(nome_classi{i})(j).intertempi_giro
4(m);
            end
        end
    end
end

tempo_finale_W_MEAN=nanmean(tempo_finale_W);
tempo_finale_W_STD=nanstd(tempo_finale_W);

for k=1:size(split_time_giro1_W,3)
    split_time_giro1_W_MEAN(k,:)=nanmean(split_time_giro1_W(:,:,k));
    split_time_giro2_W_MEAN(k,:)=nanmean(split_time_giro2_W(:,:,k));
    split_time_giro3_W_MEAN(k,:)=nanmean(split_time_giro3_W(:,:,k));
    split_time_giro4_W_MEAN(k,:)=nanmean(split_time_giro4_W(:,:,k));
    split_time_giro1_W_STD(k,:)=nanstd(split_time_giro1_W(:,:,k));
    split_time_giro2_W_STD(k,:)=nanstd(split_time_giro2_W(:,:,k));
    split_time_giro3_W_STD(k,:)=nanstd(split_time_giro3_W(:,:,k));
    split_time_giro4_W_STD(k,:)=nanstd(split_time_giro4_W(:,:,k));
end

for m=1:size(intertempi_giro1_W,3)
    intertempi_giro1_W_MEAN(m,:)=nanmean(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_MEAN(m,:)=nanmean(intertempi_giro2_W(:,:,m));
    intertempi_giro3_W_MEAN(m,:)=nanmean(intertempi_giro3_W(:,:,m));
    intertempi_giro4_W_MEAN(m,:)=nanmean(intertempi_giro4_W(:,:,m));
    intertempi_giro1_W_STD(m,:)=nanstd(intertempi_giro1_W(:,:,m));
    intertempi_giro2_W_STD(m,:)=nanstd(intertempi_giro2_W(:,:,m));
    intertempi_giro3_W_STD(m,:)=nanstd(intertempi_giro3_W(:,:,m));
    intertempi_giro4_W_STD(m,:)=nanstd(intertempi_giro4_W(:,:,m));
end

%% UOMINI: calcolo della MEDIA e della DEVIAZIONE STANDARD

tempo_finale_M=NaN(max(classi_M),length(classi_M));
split_time_giro1_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).split_time_giro1));
split_time_giro2_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).split_time_giro2));
split_time_giro3_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).split_time_giro3));
split_time_giro4_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).split_time_giro4));
split_time_giro5_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).split_time_giro5));
intertempi_giro1_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).intertempi_giro1));
intertempi_giro2_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).intertempi_giro2));
intertempi_giro3_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).intertempi_giro3));
intertempi_giro4_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).intertempi_giro4));
intertempi_giro5_M=NaN(max(classi_M),length(classi_M),length(XC_long.men.LW
12(1).intertempi_giro5));
```

```
for i=1:length(nome_classi)
    for j=1:size(XC_long.men.(nome_classi{i}))
        if classi_M(i)~=0

tempo_finale_M(j,i)=XC_long.men.(nome_classi{i})(j).tempo_finale;
            for k=1:size(split_time_giro1_M,3)

split_time_giro1_M(j,i,k)=XC_long.men.(nome_classi{i})(j).split_time_giro1(
k);

split_time_giro2_M(j,i,k)=XC_long.men.(nome_classi{i})(j).split_time_giro2(
k);

split_time_giro3_M(j,i,k)=XC_long.men.(nome_classi{i})(j).split_time_giro3(
k);

split_time_giro4_M(j,i,k)=XC_long.men.(nome_classi{i})(j).split_time_giro4(
k);

split_time_giro5_M(j,i,k)=XC_long.men.(nome_classi{i})(j).split_time_giro5(
k);
            end
            for m=1:size(intertempi_giro1_M,3)

intertempi_giro1_M(j,i,m)=XC_long.men.(nome_classi{i})(j).intertempi_giro1(
m);

intertempi_giro2_M(j,i,m)=XC_long.men.(nome_classi{i})(j).intertempi_giro2(
m);

intertempi_giro3_M(j,i,m)=XC_long.men.(nome_classi{i})(j).intertempi_giro3(
m);

intertempi_giro4_M(j,i,m)=XC_long.men.(nome_classi{i})(j).intertempi_giro4(
m);

intertempi_giro5_M(j,i,m)=XC_long.men.(nome_classi{i})(j).intertempi_giro5(
m);
            end
        end
    end
end

tempo_finale_M_MEAN=nanmean(tempo_finale_M);
tempo_finale_M_STD=nanstd(tempo_finale_M);

for k=1:size(split_time_giro1_M,3)
    split_time_giro1_M_MEAN(k,:)=nanmean(split_time_giro1_M(:,:,k));
    split_time_giro2_M_MEAN(k,:)=nanmean(split_time_giro2_M(:,:,k));
    split_time_giro3_M_MEAN(k,:)=nanmean(split_time_giro3_M(:,:,k));
    split_time_giro4_M_MEAN(k,:)=nanmean(split_time_giro4_M(:,:,k));
    split_time_giro5_M_MEAN(k,:)=nanmean(split_time_giro5_M(:,:,k));
    split_time_giro1_M_STD(k,:)=nanstd(split_time_giro1_M(:,:,k));
    split_time_giro2_M_STD(k,:)=nanstd(split_time_giro2_M(:,:,k));
    split_time_giro3_M_STD(k,:)=nanstd(split_time_giro3_M(:,:,k));
    split_time_giro4_M_STD(k,:)=nanstd(split_time_giro4_M(:,:,k));
    split_time_giro5_M_STD(k,:)=nanstd(split_time_giro5_M(:,:,k));
end

for m=1:size(intertempi_giro1_M,3)
    intertempi_giro1_M_MEAN(m,:)=nanmean(intertempi_giro1_M(:,:,m));
```

```
    intertempi_giro2_M_MEAN(m,:)=nanmean(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_MEAN(m,:)=nanmean(intertempi_giro3_M(:,:,m));
    intertempi_giro4_M_MEAN(m,:)=nanmean(intertempi_giro4_M(:,:,m));
    intertempi_giro5_M_MEAN(m,:)=nanmean(intertempi_giro5_M(:,:,m));
    intertempi_giro1_M_STD(m,:)=nanstd(intertempi_giro1_M(:,:,m));
    intertempi_giro2_M_STD(m,:)=nanstd(intertempi_giro2_M(:,:,m));
    intertempi_giro3_M_STD(m,:)=nanstd(intertempi_giro3_M(:,:,m));
    intertempi_giro4_M_STD(m,:)=nanstd(intertempi_giro4_M(:,:,m));
    intertempi_giro5_M_STD(m,:)=nanstd(intertempi_giro5_M(:,:,m));
end

%% RIEMPIMENTO STRUTTURE

% RIEMPIMENTO PER LE DONNE
%MEDIA
XC_long.women.MEAN.t_finale=tempo_finale_W_MEAN;
XC_long.women.MEAN.split_time_giro1=split_time_giro1_W_MEAN;
XC_long.women.MEAN.split_time_giro2=split_time_giro2_W_MEAN;
XC_long.women.MEAN.split_time_giro3=split_time_giro3_W_MEAN;
XC_long.women.MEAN.split_time_giro4=split_time_giro4_W_MEAN;
XC_long.women.MEAN.intertempi_giro1=intertempi_giro1_W_MEAN;
XC_long.women.MEAN.intertempi_giro2=intertempi_giro2_W_MEAN;
XC_long.women.MEAN.intertempi_giro3=intertempi_giro3_W_MEAN;
XC_long.women.MEAN.intertempi_giro4=intertempi_giro4_W_MEAN;

%DEVIAZIONE STANDARD
XC_long.women.STD.t_finale=tempo_finale_W_STD;
XC_long.women.STD.split_time_giro1=split_time_giro1_W_STD;
XC_long.women.STD.split_time_giro2=split_time_giro2_W_STD;
XC_long.women.STD.split_time_giro3=split_time_giro3_W_STD;
XC_long.women.STD.split_time_giro4=split_time_giro4_W_STD;
XC_long.women.STD.intertempi_giro1=intertempi_giro1_W_STD;
XC_long.women.STD.intertempi_giro2=intertempi_giro2_W_STD;
XC_long.women.STD.intertempi_giro3=intertempi_giro3_W_STD;
XC_long.women.STD.intertempi_giro4=intertempi_giro4_W_STD;

% RIEMPIMENTO PER GLI UOMINI
%MEDIA
XC_long.men.MEAN.t_finale=tempo_finale_M_MEAN;
XC_long.men.MEAN.split_time_giro1=split_time_giro1_M_MEAN;
XC_long.men.MEAN.split_time_giro2=split_time_giro2_M_MEAN;
XC_long.men.MEAN.split_time_giro3=split_time_giro3_M_MEAN;
XC_long.men.MEAN.split_time_giro4=split_time_giro4_M_MEAN;
XC_long.men.MEAN.split_time_giro5=split_time_giro5_M_MEAN;
XC_long.men.MEAN.intertempi_giro1=intertempi_giro1_M_MEAN;
XC_long.men.MEAN.intertempi_giro2=intertempi_giro2_M_MEAN;
XC_long.men.MEAN.intertempi_giro3=intertempi_giro3_M_MEAN;
XC_long.men.MEAN.intertempi_giro4=intertempi_giro4_M_MEAN;
XC_long.men.MEAN.intertempi_giro5=intertempi_giro5_M_MEAN;

%DEVIAZIONE STANDARD
XC_long.men.STD.t_finale=tempo_finale_M_STD;
XC_long.men.STD.split_time_giro1=split_time_giro1_M_STD;
XC_long.men.STD.split_time_giro2=split_time_giro2_M_STD;
XC_long.men.STD.split_time_giro3=split_time_giro3_M_STD;
XC_long.men.STD.split_time_giro4=split_time_giro4_M_STD;
XC_long.men.STD.split_time_giro5=split_time_giro5_M_STD;
XC_long.men.STD.intertempi_giro1=intertempi_giro1_M_STD;
XC_long.men.STD.intertempi_giro2=intertempi_giro2_M_STD;
XC_long.men.STD.intertempi_giro3=intertempi_giro3_M_STD;
```

```
XC_long.men.STD.intertempi_giro4=intertempi_giro4_M_STD;
XC_long.men.STD.intertempi_giro5=intertempi_giro5_M_STD;

%% SALVATAGGIO STRUTTURA COMPLETA

save([filepath_save2 '\XC_long_finale.mat'],'-struct','XC_long');

%% (ex grafici_tempo)

% Creazione dei grafici

%%

c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};

ngiri_W=size(giro_W,2);
ngiri_M=size(giro_M,2);
nintertempi_W=size(XC_long.women.MEAN.intertempi_giro1,1);
nintertempi_M=size(XC_long.men.MEAN.intertempi_giro1,1);
nsplit_time_W=size(XC_long.women.MEAN.split_time_giro1,1);
nsplit_time_M=size(XC_long.men.MEAN.split_time_giro1,1);

%% RAPPRESENTAZIONE GRAFICA DEI DATI
figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
ylim([0
100*(1+7.5*XC_long.women.STD.t_finale(end)./XC_long.women.MEAN.t_finale(end
))]);
yyaxis right
b=bar(c,XC_long.women.MEAN.t_finale,'r');
hold on
errorbar(XC_long.women.MEAN.t_finale,XC_long.women.STD.t_finale,'.k','LineW
idth',1);
ylim([0
XC_long.women.MEAN.t_finale(end)+7.5*XC_long.women.STD.t_finale(end)]);
ylabel('tempo di gara [s]');
xlabel('classi');
title('CROSS COUNTRY LONG - DONNE');
hold off

figure()
yyaxis left
ylabel('tempo_% rispetto alla classe LW12');
ylim([0
100*(1+7.5*XC_long.men.STD.t_finale(end)./XC_long.men.MEAN.t_finale(end))])
;
yyaxis right
b=bar(c,XC_long.men.MEAN.t_finale,'b');
hold on
errorbar(XC_long.men.MEAN.t_finale,XC_long.men.STD.t_finale,'.k','LineWidth
',1);
ylim([0 XC_long.men.MEAN.t_finale(end)+7.5*XC_long.men.STD.t_finale(end)]);
ylabel('tempo di gara [s]');
xlabel('classi');
title('CROSS COUNTRY LONG - UOMINI');
hold off
```

```
%%
% SOLO DONNE
k=1;
for i=1:ngiri_W:ngiri_W*nintertempi_W
    intertempi_mean_W(i,:)=XC_long.women.MEAN.intertempi_giro1(k,:);
    intertempi_mean_W((i+1),:)=XC_long.women.MEAN.intertempi_giro2(k,:);
    intertempi_mean_W((i+2),:)=XC_long.women.MEAN.intertempi_giro3(k,:);
    intertempi_mean_W((i+3),:)=XC_long.women.MEAN.intertempi_giro4(k,:);
    intertempi_std_W(i,:)=XC_long.women.STD.intertempi_giro1(k,:);
    intertempi_std_W((i+1),:)=XC_long.women.STD.intertempi_giro2(k,:);
    intertempi_std_W((i+2),:)=XC_long.women.STD.intertempi_giro3(k,:);
    intertempi_std_W((i+3),:)=XC_long.women.STD.intertempi_giro4(k,:);
    k=k+1;
end

ngroups=size(intertempi_mean_W(1:ngiri_W,:)',1);
nbars=size(intertempi_mean_W(1:ngiri_W,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_W
figure()
int_mean=intertempi_mean_W((j-1)*ngiri_W+1:j*ngiri_W,:);
    int_std=intertempi_std_W((j-1)*ngiri_W+1:j*ngiri_W,:);
    ylabel('%');
    yyaxis left
    ylim([0 100*(1+5*max(int_std(:,end)./int_mean(:,end)))]);
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+5*int_std(:,end))]);
    ylabel('[s]');
    xlabel('classi');
    title('CROSS COUNTRY LONG - DONNE');
    hold off
end


%%
% SOLO UOMINI
k=1;
for i=1:ngiri_M:ngiri_M*nintertempi_M
    intertempi_mean_M(i,:)=XC_long.men.MEAN.intertempi_giro1(k,:);
    intertempi_mean_M((i+1),:)=XC_long.men.MEAN.intertempi_giro2(k,:);
    intertempi_mean_M((i+2),:)=XC_long.men.MEAN.intertempi_giro3(k,:);
    intertempi_mean_M((i+3),:)=XC_long.men.MEAN.intertempi_giro4(k,:);
    intertempi_mean_M((i+4),:)=XC_long.men.MEAN.intertempi_giro5(k,:);
    intertempi_std_M(i,:)=XC_long.men.STD.intertempi_giro1(k,:);
    intertempi_std_M((i+1),:)=XC_long.men.STD.intertempi_giro2(k,:);
    intertempi_std_M((i+2),:)=XC_long.men.STD.intertempi_giro3(k,:);
    intertempi_std_M((i+3),:)=XC_long.men.STD.intertempi_giro4(k,:);
    intertempi_std_M((i+4),:)=XC_long.men.STD.intertempi_giro5(k,:);
```

```
    k=k+1;
end

ngroups=size(intertempi_mean_M(1:ngiri_M,:)',1);
nbars=size(intertempi_mean_M(1:ngiri_M,:)',2);
groupwidth=min(0.8, nbars/(nbars+1.5));

for j=1:nintertempi_M
figure()
int_mean=intertempi_mean_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    int_std=intertempi_std_M((j-1)*ngiri_M+1:j*ngiri_M,:);
    yyaxis left
    ylim([0 100*(1+7.5*max(int_std(:,end)./int_mean(:,end)))]);
    ylabel('%');
    yyaxis right
    b=bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    hold on
    for i=1:nbars
        vett=(1:ngroups)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylim([0 max(int_mean(:,end)+7.5*int_std(:,end))]);
    ylabel('[s]');
    xlabel('classi');
    title('CROSS COUNTRY LONG - UOMINI');
    hold off
end

%%
%figure(8)

split_time_mean_W=[zeros(1,5); XC_long.women.MEAN.split_time_giro1(1:8,:);
XC_long.women.MEAN.split_time_giro2(1:8,:);
XC_long.women.MEAN.split_time_giro3(1:8,:);
XC_long.women.MEAN.split_time_giro4(1:8,:);
XC_long.women.MEAN.split_time_giro4(11,:)];
split_time_std_W=[zeros(1,5); XC_long.women.STD.split_time_giro1(1:8,:);
XC_long.women.STD.split_time_giro2(1:8,:);
XC_long.women.STD.split_time_giro3(1:8,:);
XC_long.women.STD.split_time_giro4(1:8,:);
XC_long.women.STD.split_time_giro4(11,:)];


figure(8)
subplot(1,2,1);
vettW=[0:size(split_time_mean_W,1)-1];

for i=1:size(split_time_mean_W,2)
    [p,S(i)]=polyfit(vettW',split_time_mean_W(:,i),1);
    [y,delta]=polyval(p,vettW,S(i));
    plot(vettW,split_time_mean_W(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettW,y,'k');
%      errorbar(vettW,y,delta,'.k');
end
title('CROSS COUNTRY LONG - DONNE')
```

```
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-250 3600])
hold off

subplot(1,2,2);
for i=1:size(split_time_mean_W,2)
        plot(vettW,split_time_mean_W(:,i)-min(split_time_mean_W,[],2),'-
o','LineWidth',1.5);
        hold on
end
title('CROSS COUNTRY LONG - DONNE')
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
hold off

saveas(gcf,[filepath_save '\split time_W.fig']);

%%
% figure(9)
split_time_mean_M=[zeros(1,5); XC_long.men.MEAN.split_time_giro1(1:8,:);
XC_long.men.MEAN.split_time_giro2(1:8,:);
XC_long.men.MEAN.split_time_giro3(1:8,:);
XC_long.men.MEAN.split_time_giro4(1:8,:);
XC_long.men.MEAN.split_time_giro5(1:8,:);
XC_long.men.MEAN.split_time_giro5(11,:)];
split_time_std_M=[zeros(1,5); XC_long.men.STD.split_time_giro1(1:8,:);
XC_long.men.STD.split_time_giro2(1:8,:);
XC_long.men.STD.split_time_giro3(1:8,:);
XC_long.men.STD.split_time_giro4(1:8,:);
XC_long.men.STD.split_time_giro5(1:8,:);
XC_long.men.STD.split_time_giro5(11,:)];


figure(9)
subplot(1,2,1);
vettM=[0:size(split_time_mean_M,1)-1];

for i=1:size(split_time_mean_M,2)
    [p,S(i)]=polyfit(vettM',split_time_mean_M(:,i),1);
    [y,delta]=polyval(p,vettM,S(i));
    plot(vettM,split_time_mean_M(:,i),'-o','LineWidth',1.5);
    hold on
    plot(vettM,y,'k');
%     errorbar(vettM,y,delta,'.k');
end
title('CROSS COUNTRY LONG - UOMINI')
xlabel('n° dello split time');
ylabel('tempo di gara [s]');
ylim([-250 4000])
hold off

subplot(1,2,2);
for i=1:size(split_time_mean_M,2)
    plot(vettM,split_time_mean_M(:,i)-min(split_time_mean_M,[],2),'-
o','LineWidth',1.5);
    hold on
end
```

```
title('CROSS COUNTRY LONG - UOMINI')
legend('LW10','LW10.5','LW11','LW11.5','LW12','Location','southoutside','Or
ientation','horizontal');
xlabel('n° dello split time');
ylabel('distanza temporale media tra le classi [s]');
hold off
saveas(gcf,[filepath_save '\split_time_M.fig']);
```

APPENDICE C

c.1) Biathlon sprint

```
%% BIATHLON SPRINT
    % Donne: 3 giri
    % Uomini: 3 giri

% !!!!!!!!!!!!!!! MANCA L'INTERTEMPO K7-K8(DOWNHILL) !!!!!!!!!!!!!!!!!!!!!!

clc
clear all
close all

genere={'DONNE','UOMINI'};
nome_gara='B_sprint';
B_sprint=load([cd '\' nome_gara '\B_sprint_finale.mat']);

classe={'LW10','LW10_5','LW11','LW11_5','LW12'};
c1=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE'};

filepath_save1=[cd '\' nome_gara '\' genere{1}];
filepath_save2=[cd '\' nome_gara '\' genere{2}];
filepath_save11=[cd '\' nome_gara '\' genere{1} '\GRAFICI'];
filepath_save22=[cd '\' nome_gara '\' genere{2} '\GRAFICI'];

%% DONNE

%!!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta donna.
C_W=[10.5 10.5 11 12 10.5 12 12 12 12 12];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% DONNE
for i=1:length(classe)
   if classi_W(i)~=0
       for j=1:classi_W(i)
           int_temp=[B_sprint.women.(classe{i})(j).intertempi_giro1;
B_sprint.women.(classe{i})(j).intertempi_giro2;
B_sprint.women.(classe{i})(j).intertempi_giro3];
           B_sprint.women.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
end

%% DONNE
% n° atleti: - classe LW10 = 0
%            - classe LW10_5 = 3
%            - classe LW11 = 1
```

```
%             - classe LW11_5 = 0
%             - classe LW12 = 6

%% DONNE
% aggiungo il campo intertempi_medi alla struttura B_sprint
matrW_10=[];
matrW_10_5=[B_sprint.women.LW10_5(1).intertempi_medi;
B_sprint.women.LW10_5(2).intertempi_medi;
B_sprint.women.LW10_5(3).intertempi_medi];
matrW_11=[B_sprint.women.LW11(1).intertempi_medi];
matrW_11_5=[];
matrW_12=[B_sprint.women.LW12(1).intertempi_medi;
B_sprint.women.LW12(2).intertempi_medi;
B_sprint.women.LW12(3).intertempi_medi;
B_sprint.women.LW12(4).intertempi_medi;
B_sprint.women.LW12(5).intertempi_medi;
B_sprint.women.LW12(6).intertempi_medi];

dim_maxW=[size(matrW_10,1) size(matrW_10_5,1) size(matrW_11,1)
size(matrW_11_5,1) size(matrW_12,1)];
atletiW=max(dim_maxW);
intertempi=5;

statisticaW=NaN(3,6,intertempi);
temporaneaW=NaN(atletiW,length(classe));
p_valueW=NaN(1,intertempi);
ristrettaW=NaN(intertempi,length(classe));
tempW=NaN(atletiW,length(classe),intertempi);

for k=1:intertempi
    temporaneaW(1:dim_maxW(2),2)=matrW_10_5(:,k);
    temporaneaW(1:dim_maxW(3),3)=matrW_11(:,k);
    temporaneaW(1:dim_maxW(5),5)=matrW_12(:,k);

    [p,tbl,stats]=kruskalwallis(temporaneaW);
    p_valueW(k)=p;
    if p<0.05
        result=multcompare(stats,'Display','off');
        statisticaW(:,:,k)=result;
    end
    ristrettaW(k,:)=nanmean(temporaneaW);
    tempW(:,:,k)=temporaneaW;
end

for j =1:intertempi
    figure()
    boxplot(tempW(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('BIATHLON SPRINT - DONNE');
    hold on
end
hold off

for i=1:size(tempW,3)
    media_giriW(i,:)=nanmean(tempW(:,:,i));
    std_giriW(i,:)=nanstd(tempW(:,:,i));
end

%% UOMINI
```

```
%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 12 12 11 11.5 12 12 12 10 12 12 12 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];

%% UOMINI
for i=1:length(classe)
   if classi_M(i)~=0
       for j=1:classi_M(i)
           int_temp=[B_sprint.men.(classe{i})(j).intertempi_giro1;
B_sprint.men.(classe{i})(j).intertempi_giro2;
B_sprint.men.(classe{i})(j).intertempi_giro3];
           B_sprint.men.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
end

%% UOMINI
% n° atleti: - classe LW10 = 1
%            - classe LW10_5 = 0
%            - classe LW11 = 1
%            - classe LW11_5 = 2
%            - classe LW12 = 10

%% UOMINI
% aggiungo il campo intertempi_medi alla struttura B_sprint
matrM_10=[B_sprint.men.LW10(1).intertempi_medi];
matrM_10_5=[];
matrM_11=[B_sprint.men.LW11(1).intertempi_medi];
matrM_11_5=[B_sprint.men.LW11_5(1).intertempi_medi;
B_sprint.men.LW11_5(2).intertempi_medi];
matrM_12=[B_sprint.men.LW12(1).intertempi_medi;
B_sprint.men.LW12(2).intertempi_medi; B_sprint.men.LW12(3).intertempi_medi;
B_sprint.men.LW12(4).intertempi_medi; B_sprint.men.LW12(5).intertempi_medi;
B_sprint.men.LW12(6).intertempi_medi; B_sprint.men.LW12(7).intertempi_medi;
B_sprint.men.LW12(8).intertempi_medi; B_sprint.men.LW12(9).intertempi_medi;
B_sprint.men.LW12(10).intertempi_medi];

dim_maxM=[size(matrM_10,1) size(matrM_10_5,1) size(matrM_11,1)
size(matrM_11_5,1) size(matrM_12,1)];
atletiM=max(dim_maxM);
intertempi=5;

statisticaM=NaN(6,6,intertempi);
temporaneaM=NaN(atletiM,length(classe));
p_valueM=NaN(1,intertempi);
ristrettaM=NaN(intertempi,length(classe));
tempM=NaN(atletiM,length(classe),intertempi);

for k=1:intertempi
    temporaneaM(1:dim_maxM(1),1)=matrM_10(:,k);
```

```
        temporaneaM(1:dim_maxM(3),3)=matrM_11(:,k);
        temporaneaM(1:dim_maxM(4),4)=matrM_11_5(:,k);
        temporaneaM(1:dim_maxM(5),5)=matrM_12(:,k);

        [p,tbl,stats]=kruskalwallis(temporaneaM);
        p_valueM(1,k)=p;
        if p<0.05
            result=multcompare(stats,'Display','off');
            statisticaM(:,:,k)=result;
        end
        ristrettaM(k,:)=nanmean(temporaneaM);
        tempM(:,:,k)=temporaneaM;
end

for j =1:intertempi
    figure()
    boxplot(tempM(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('BIATHLON SPRINT - UOMINI');
    hold on
end
hold off

for i=1:size(tempM,3)
    media_giriM(i,:)=nanmean(tempM(:,:,i));
    std_giriM(i,:)=nanstd(tempM(:,:,i));
end

%% SALVATAGGIO

save ([filepath_save1 '\B_sprint_statisticaW.mat'],'statisticaW');
save ([filepath_save1 '\B_sprint_ristrettaW.mat'],'ristrettaW');
save ([filepath_save1 '\B_sprint_p_valueW.mat'],'p_valueW');

save ([filepath_save2 '\B_sprint_statisticaM.mat'],'statisticaM');
save ([filepath_save2 '\B_sprint_ristrettaM.mat'],'ristrettaM');
save ([filepath_save2 '\B_sprint_p_valueM.mat'],'p_valueM');
```

c.2) Biathlon individual

```
%% BIATHLON INDIVIDUAL
    % Donne: 5 giri
    % Uomini: 5 giri

clc
clear all
close all

genere={'DONNE','UOMINI'};
nome_gara='B_individual';
B_individual=load([cd '\' nome_gara '\B_individual_finale.mat']);

classe={'LW10','LW10_5','LW11','LW11_5','LW12'};
c1=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5 
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};
```

```
filepath_save1=[cd '\' nome_gara '\' genere{1}];
filepath_save2=[cd '\' nome_gara '\' genere{2}];
filepath_save11=[cd '\' nome_gara '\' genere{1} '\GRAFICI'];
filepath_save22=[cd '\' nome_gara '\' genere{2} '\GRAFICI'];

%% DONNE

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta donna.
C_W=[10.5 11 12 12 12 12 12 12];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% DONNE
for i=1:length(classe)
   if classi_W(i)~=0
       for j=1:classi_W(i)
           int_temp=[B_individual.women.(classe{i})(j).intertempi_giro1;
B_individual.women.(classe{i})(j).intertempi_giro2;
B_individual.women.(classe{i})(j).intertempi_giro3;
B_individual.women.(classe{i})(j).intertempi_giro4;
B_individual.women.(classe{i})(j).intertempi_giro5];

B_individual.women.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
end

%% DONNE
% n° atleti: - classe LW10 = 0
%            - classe LW10_5 = 1
%            - classe LW11 = 1
%            - classe LW11_5 = 0
%            - classe LW12 = 6

%% DONNE
% aggiungo il campo intertempi_medi alla struttura B_individual
matrW_10=[];
matrW_10_5=[B_individual.women.LW10_5(1).intertempi_medi];
matrW_11=[B_individual.women.LW11(1).intertempi_medi];
matrW_11_5=[];
matrW_12=[B_individual.women.LW12(1).intertempi_medi;
B_individual.women.LW12(2).intertempi_medi;
B_individual.women.LW12(3).intertempi_medi;
B_individual.women.LW12(4).intertempi_medi;
B_individual.women.LW12(5).intertempi_medi;
B_individual.women.LW12(6).intertempi_medi];

dim_maxW=[size(matrW_10,1) size(matrW_10_5,1) size(matrW_11,1)
size(matrW_11_5,1) size(matrW_12,1)];
atletiW=max(dim_maxW);
intertempi=6;
```

```
statisticaW=NaN(3,6,intertempi);
temporaneaW=NaN(atletiW,length(classe));
p_valueW=NaN(1,intertempi);
ristrettaW=NaN(intertempi,length(classe));
tempW=NaN(atletiW,length(classe),intertempi);

for k=1:intertempi
    temporaneaW(1:dim_maxW(2),2)=matrW_10_5(:,k);
    temporaneaW(1:dim_maxW(3),3)=matrW_11(:,k);
    temporaneaW(1:dim_maxW(5),5)=matrW_12(:,k);

    [p,tbl,stats]=kruskalwallis(temporaneaW);
    p_valueW(k)=p;
    if p<0.05
        result=multcompare(stats,'Display','off');
        statisticaW(:,:,k)=result;
    end
    ristrettaW(k,:)=nanmean(temporaneaW);
    tempW(:,:,k)=temporaneaW;
end

figure()
for j =1:intertempi
    figure()
    boxplot(tempW(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('BIATHLON INDIVIDUAL - DONNE');
    hold on
end
hold off

for i=1:size(tempW,3)
    media_giriW(i,:)=nanmean(tempW(:,:,i));
    std_giriW(i,:)=nanstd(tempW(:,:,i));
end

%% UOMINI

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 12 12 11.5 12 12 12 12 12 12 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];

%% UOMINI
for i=1:length(classe)
   if classi_M(i)~=0
       for j=1:classi_M(i)
           int_temp=[B_individual.men.(classe{i})(j).intertempi_giro1;
B_individual.men.(classe{i})(j).intertempi_giro2;
```

```
B_individual.men.(classe{i})(j).intertempi_giro3;
B_individual.men.(classe{i})(j).intertempi_giro4;
B_individual.men.(classe{i})(j).intertempi_giro5];

B_individual.men.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
end

%% UOMINI
% n° atleti: - classe LW10 = 0
%            - classe LW10_5 = 0
%            - classe LW11 = 0
%            - classe LW11_5 = 2
%            - classe LW12 = 10

%% UOMINI
% aggiungo il campo intertempi_medi alla struttura B_individual
matrM_10=[];
matrM_10_5=[];
matrM_11=[];
matrM_11_5=[B_individual.men.LW11_5(1).intertempi_medi;
B_individual.men.LW11_5(2).intertempi_medi];
matrM_12=[B_individual.men.LW12(1).intertempi_medi;
B_individual.men.LW12(2).intertempi_medi;
B_individual.men.LW12(3).intertempi_medi;
B_individual.men.LW12(4).intertempi_medi;
B_individual.men.LW12(5).intertempi_medi;
B_individual.men.LW12(6).intertempi_medi;
B_individual.men.LW12(7).intertempi_medi;
B_individual.men.LW12(8).intertempi_medi;
B_individual.men.LW12(9).intertempi_medi;
B_individual.men.LW12(10).intertempi_medi];

dim_maxM=[size(matrM_10,1) size(matrM_10_5,1) size(matrM_11,1)
size(matrM_11_5,1) size(matrM_12,1)];
atletiM=max(dim_maxM);
intertempi=6;

statisticaM=NaN(1,6,intertempi);
temporaneaM=NaN(atletiM,length(classe));
p_valueM=NaN(1,intertempi);
ristrettaM=NaN(intertempi,length(classe));
tempM=NaN(atletiM,length(classe),intertempi);

for k=1:intertempi
    temporaneaM(1:dim_maxM(4),4)=matrM_11_5(:,k);
    temporaneaM(1:dim_maxM(5),5)=matrM_12(:,k);

    [p,tbl,stats]=kruskalwallis(temporaneaM);
    p_valueM(1,k)=p;
    if p<0.05
        result=multcompare(stats,'Display','off');
        statisticaM(:,:,k)=result;
    end
    ristrettaM(k,:)=nanmean(temporaneaM);
    tempM(:,:,k)=temporaneaM;
end

for j =1:intertempi
```

```
    figure()
    boxplot(tempM(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('BIATHLON INDIVIDUAL - UOMINI');
    hold on
end
hold off

for i=1:size(tempM,3)
    media_giriM(i,:)=nanmean(tempM(:,:,i));
    std_giriM(i,:)=nanstd(tempM(:,:,i));
end

%% SALVATAGGIO

save ([filepath_save1 '\B_individual_statisticaW.mat'],'statisticaW');
save ([filepath_save1 '\B_individual_ristrettaW.mat'],'ristrettaW');
save ([filepath_save1 '\B_individual_p_valueW.mat'],'p_valueW');

save ([filepath_save2 '\B_individual_statisticaM.mat'],'statisticaM');
save ([filepath_save2 '\B_individual_ristrettaM.mat'],'ristrettaM');
save ([filepath_save2 '\B_individual_p_valueM.mat'],'p_valueM');
```

c.3) Cross country middle

```
%% CROSS COUNTRY MIDDLE DISTANCE
    % Donne: 2 giri
    % Uomini: 3 giri

clc
clear all
close all

genere={'DONNE','UOMINI'};
nome_gara='XC_middle';
XC_middle=load([cd '\' nome_gara '\XC_middle_finale.mat']);

classe={'LW10','LW10_5','LW11','LW11_5','LW12'};
c1=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};


filepath_save1=[cd '\' nome_gara '\' genere{1}];
filepath_save2=[cd '\' nome_gara '\' genere{2}];
filepath_save11=[cd '\' nome_gara '\' genere{1} '\GRAFICI'];
filepath_save22=[cd '\' nome_gara '\' genere{2} '\GRAFICI'];

%% DONNE

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta donna.
C_W=[10.5 12 10.5 12 11 10.5 10.5 12 12 12 12 12 11];

a=find(C_W==10);
b=find(C_W==10.5);
```

```
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% DONNE
% aggiungo il campo intertempi_medi alla struttura XC_middle
for i=1:length(classe)
   if classi_W(i)~=0
       for j=1:classi_W(i)
           int_temp=[XC_middle.women.(classe{i})(j).intertempi_giro1;
XC_middle.women.(classe{i})(j).intertempi_giro2];

XC_middle.women.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
end

%% DONNE
% n° atleti: - classe LW10 = 0
%            - classe LW10_5 = 4
%            - classe LW11 = 2
%            - classe LW11_5 = 0
%            - classe LW12 = 7

% matr_(classe) = creo una matrice per ogni classe:
%                 - n° colonne = n° di intertempi (6) = per ogni classe
%                 - n° righe = n° atleti (dipende dalla classe)
%
% temporanea = creo una matrice in cui le colonne corrispondono al n° di
% classi, mentre le righe corrispondono al max n° di atleti presenti in una
% delle 5 classi.
%                 - n° colonne = n° di classi (5)
%                 - n° righe = n° max di atleti presenti in una delle 5
%                 classi;

%% DONNE
matrW_10=[];
matrW_10_5=[XC_middle.women.LW10_5(1).intertempi_medi;
XC_middle.women.LW10_5(2).intertempi_medi;
XC_middle.women.LW10_5(3).intertempi_medi;
XC_middle.women.LW10_5(4).intertempi_medi];
matrW_11=[XC_middle.women.LW11(1).intertempi_medi;
XC_middle.women.LW11(2).intertempi_medi];
matrW_11_5=[];
matrW_12=[XC_middle.women.LW12(1).intertempi_medi;
XC_middle.women.LW12(2).intertempi_medi;
XC_middle.women.LW12(3).intertempi_medi;
XC_middle.women.LW12(4).intertempi_medi;
XC_middle.women.LW12(5).intertempi_medi;
XC_middle.women.LW12(6).intertempi_medi;
XC_middle.women.LW12(7).intertempi_medi];

dim_maxW=[size(matrW_10,1) size(matrW_10_5,1) size(matrW_11,1)
size(matrW_11_5,1) size(matrW_12,1)];
atletiW=max(dim_maxW);
intertempi=6;
```

```
statisticaW=NaN(3,6,intertempi);
temporaneaW=NaN(atletiW,length(classe));
p_valueW=NaN(1,intertempi);
ristrettaW=NaN(intertempi,length(classe));
tempW=NaN(atletiW,length(classe),intertempi);

for k=1:intertempi
    temporaneaW(1:dim_maxW(2),2)=matrW_10_5(:,k);
    temporaneaW(1:dim_maxW(3),3)=matrW_11(:,k);
    temporaneaW(1:dim_maxW(5),5)=matrW_12(:,k);

    % KRUSKAL-WALLIS TEST (per elementi indipendenti tra loro, cioè atleti
diversi)
    % p = p_value      --> 0<p<1        --> se p<0.05 --> almeno una classe
è
    % statisticamente differente da un'altra
    %                                       se p>0.05 --> non ho differenze
    % statisticamente significative tra le classi
    [p,tbl,stats]=kruskalwallis(temporaneaW);
    p_valueW(k)=p;
    % se p<0.05 --> utilizzo la funzione "multcompare" per ottenere una
    % tabella che identifica quale/i coppia/e sono statisticamente
differenti
    if p<0.05
        result=multcompare(stats,'Display','off');
        statisticaW(:,:,k)=result;
    end
    ristrettaW(k,:)=nanmean(temporaneaW);
    tempW(:,:,k)=temporaneaW;
end

for j =1:intertempi
    figure()
    boxplot(tempW(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('CROSS COUNTRY MIDDLE - DONNE');
    hold on
end
hold off

for i=1:size(tempW,3)
    media_giriW(i,:)=nanmean(tempW(:,:,i));
    std_giriW(i,:)=nanstd(tempW(:,:,i));
end

%% UOMINI

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 12 11 11.5 12 10 12 12 12 12 11 12 11 12 12 12 12 12 10 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];
```

```matlab
%% UOMINI
for i=1:length(classe)
   if classi_M(i)~=0
       for j=1:classi_M(i)
           int_temp=[XC_middle.men.(classe{i})(j).intertempi_giro1;
XC_middle.men.(classe{i})(j).intertempi_giro2;
XC_middle.men.(classe{i})(j).intertempi_giro3];
           XC_middle.men.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
end

%% UOMINI
% n° atleti: - classe LW10 = 2
%            - classe LW10_5 = 0
%            - classe LW11 = 3
%            - classe LW11_5 = 2
%            - classe LW12 = 14

%% UOMINI
% aggiungo il campo intertempi_medi alla struttura XC_middle
matrM_10=[XC_middle.men.LW10(1).intertempi_medi;
XC_middle.men.LW10(2).intertempi_medi];
matrM_10_5=[];
matrM_11=[XC_middle.men.LW11(1).intertempi_medi;
XC_middle.men.LW11(2).intertempi_medi;
XC_middle.men.LW11(3).intertempi_medi];
matrM_11_5=[XC_middle.men.LW11_5(1).intertempi_medi;
XC_middle.men.LW11_5(2).intertempi_medi];
matrM_12=[XC_middle.men.LW12(1).intertempi_medi;
XC_middle.men.LW12(2).intertempi_medi;
XC_middle.men.LW12(3).intertempi_medi;
XC_middle.men.LW12(4).intertempi_medi;
XC_middle.men.LW12(5).intertempi_medi;
XC_middle.men.LW12(6).intertempi_medi;
XC_middle.men.LW12(7).intertempi_medi;
XC_middle.men.LW12(8).intertempi_medi;
XC_middle.men.LW12(9).intertempi_medi;
XC_middle.men.LW12(10).intertempi_medi;
XC_middle.men.LW12(11).intertempi_medi;
XC_middle.men.LW12(12).intertempi_medi;
XC_middle.men.LW12(13).intertempi_medi;
XC_middle.men.LW12(14).intertempi_medi];

dim_maxM=[size(matrM_10,1) size(matrM_10_5,1) size(matrM_11,1)
size(matrM_11_5,1) size(matrM_12,1)];
atletiM=max(dim_maxM);
intertempi=6;

statisticaM=NaN(6,6,intertempi);
temporaneaM=NaN(atletiM,length(classe));
p_valueM=NaN(1,intertempi);
ristrettaM=NaN(intertempi,length(classe));
tempM=NaN(atletiM,length(classe),intertempi);

for k=1:intertempi
    temporaneaM(1:dim_maxM(1),1)=matrM_10(:,k);
    temporaneaM(1:dim_maxM(3),3)=matrM_11(:,k);
    temporaneaM(1:dim_maxM(4),4)=matrM_11_5(:,k);
```

```
    temporaneaM(1:dim_maxM(5),5)=matrM_12(:,k);

    [p,tbl,stats]=kruskalwallis(temporaneaM);
    p_valueM(1,k)=p;
    if p<0.05
        result=multcompare(stats,'Display','off');
        statisticaM(:,:,k)=result;
    end
    ristrettaM(k,:)=nanmean(temporaneaM);
    tempM(:,:,k)=temporaneaM;
end

for j =1:intertempi
    figure()
    boxplot(tempM(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('CROSS COUNTRY MIDDLE - UOMINI');
    hold on
end
hold off

for i=1:size(tempM,3)
    media_giriM(i,:)=nanmean(tempM(:,:,i));
    std_giriM(i,:)=nanstd(tempM(:,:,i));
end

%% SALVATAGGIO

save ([filepath_save1 '\XC_middle_statisticaW.mat'],'statisticaW');
save ([filepath_save1 '\XC_middle_ristrettaW.mat'],'ristrettaW');
save ([filepath_save1 '\XC_middle_p_valueW.mat'],'p_valueW');

save ([filepath_save2 '\XC_middle_statisticaM.mat'],'statisticaM');
save ([filepath_save2 '\XC_middle_ristrettaM.mat'],'ristrettaM');
save ([filepath_save2 '\XC_middle_p_valueM.mat'],'p_valueM');
```

c.4) Cross country long

```
%% CROSS COUNTRY LONG DISTANCE
    % Donne: 4 giri
    % Uomini: 5 giri

clc
clear all
close all

genere={'DONNE','UOMINI'};
nome_gara='XC_long';
XC_long=load([cd '\' nome_gara '\XC_long_finale.mat']);

classe={'LW10','LW10_5','LW11','LW11_5','LW12'};
c1=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};

filepath_save1=[cd '\' nome_gara '\' genere{1}];
filepath_save2=[cd '\' nome_gara '\' genere{2}];
```

```
filepath_save11=[cd '\' nome_gara '\' genere{1} '\GRAFICI'];
filepath_save22=[cd '\' nome_gara '\' genere{2} '\GRAFICI'];

%% DONNE

%classi di appartenenza di ogni atleta donna.
C_W=[12 12 11 10.5 10.5 12 12 12 12 11];

a=find(C_W==10);
b=find(C_W==10.5);
c=find(C_W==11);
d=find(C_W==11.5);
e=find(C_W==12);

%individuo il numero di atlete che appartengono ad ogni classe
classi_W=[length(a) length(b) length(c) length(d) length(e)];

%% DONNE
for i=1:length(classe)
   if classi_W(i)~=0
       for j=1:classi_W(i)
           int_temp=[XC_long.women.(classe{i})(j).intertempi_giro1;
XC_long.women.(classe{i})(j).intertempi_giro2;
XC_long.women.(classe{i})(j).intertempi_giro3;
XC_long.women.(classe{i})(j).intertempi_giro4];
           XC_long.women.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
end

%% DONNE
% n° atleti: - classe LW10 = 0
%            - classe LW10_5 = 2
%            - classe LW11 = 2
%            - classe LW11_5 = 0
%            - classe LW12 = 6

%% DONNE
% aggiungo il campo intertempi_medi alla struttura XC_long
matrW_10=[];
matrW_10_5=[XC_long.women.LW10_5(1).intertempi_medi;
XC_long.women.LW10_5(2).intertempi_medi];
matrW_11=[XC_long.women.LW11(1).intertempi_medi;
XC_long.women.LW11(2).intertempi_medi];
matrW_11_5=[];
matrW_12=[XC_long.women.LW12(1).intertempi_medi;
XC_long.women.LW12(2).intertempi_medi;
XC_long.women.LW12(3).intertempi_medi;
XC_long.women.LW12(4).intertempi_medi;
XC_long.women.LW12(5).intertempi_medi;
XC_long.women.LW12(6).intertempi_medi];

dim_maxW=[size(matrW_10,1) size(matrW_10_5,1) size(matrW_11,1)
size(matrW_11_5,1) size(matrW_12,1)];
atletiW=max(dim_maxW);
intertempi=6;

statisticaW=NaN(3,6,intertempi);
temporaneaW=NaN(atletiW,length(classe));
p_valueW=NaN(1,intertempi);
```

```
ristrettaW=NaN(intertempi,length(classe));
tempW=NaN(atletiW,length(classe),intertempi);

for k=1:intertempi
    temporaneaW(1:dim_maxW(2),2)=matrW_10_5(:,k);
    temporaneaW(1:dim_maxW(3),3)=matrW_11(:,k);
    temporaneaW(1:dim_maxW(5),5)=matrW_12(:,k);

    [p,tbl,stats]=kruskalwallis(temporaneaW);
    p_valueW(k)=p;
    if p<0.05
        result=multcompare(stats,'Display','off');
        statisticaW(:,:,k)=result;
    end
    ristrettaW(k,:)=nanmean(temporaneaW);
    tempW(:,:,k)=temporaneaW;
end

for j =1:intertempi
    figure()
    boxplot(tempW(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('CROSS COUNTRY LONG - DONNE');
    hold on
end
hold off

for i=1:size(tempW,3)
    media_giriW(i,:)=nanmean(tempW(:,:,i));
    std_giriW(i,:)=nanstd(tempW(:,:,i));
end

%% UOMINI

%!!!!!!!!!!!LE CLASSI SONO DA INSERIRE MANUALMENTE!!!!!!!!!!
%classi di appartenenza di ogni atleta uomo.
C_M=[12 12 11 12 11.5 10 12 12 12 11 12 11 12 12 12 12 12 12 10 11.5];

f=find(C_M==10);
g=find(C_M==10.5);
h=find(C_M==11);
l=find(C_M==11.5);
m=find(C_M==12);

%individuo il numero di atleti che appartengono ad ogni classe
classi_M=[length(f) length(g) length(h) length(l) length(m)];

%% UOMINI
for i=1:length(classe)
   if classi_M(i)~=0
       for j=1:classi_M(i)
           int_temp=[XC_long.men.(classe{i})(j).intertempi_giro1;
XC_long.men.(classe{i})(j).intertempi_giro2;
XC_long.men.(classe{i})(j).intertempi_giro3;
XC_long.men.(classe{i})(j).intertempi_giro4;
XC_long.men.(classe{i})(j).intertempi_giro5];
           XC_long.men.(classe{i})(j).intertempi_medi=nanmean(int_temp);
       end
   end
```

```
end

%% UOMINI
% n° atleti: - classe LW10 = 2
%            - classe LW10_5 = 0
%            - classe LW11 = 3
%            - classe LW11_5 = 2
%            - classe LW12 = 13

%% UOMINI
% aggiungo il campo intertempi_medi alla struttura XC_long
matrM_10=[XC_long.men.LW10(1).intertempi_medi;
XC_long.men.LW10(2).intertempi_medi];
matrM_10_5=[];
matrM_11=[XC_long.men.LW11(1).intertempi_medi;
XC_long.men.LW11(2).intertempi_medi; XC_long.men.LW11(3).intertempi_medi];
matrM_11_5=[XC_long.men.LW11_5(1).intertempi_medi;
XC_long.men.LW11_5(2).intertempi_medi];
matrM_12=[XC_long.men.LW12(1).intertempi_medi;
XC_long.men.LW12(2).intertempi_medi; XC_long.men.LW12(3).intertempi_medi;
XC_long.men.LW12(4).intertempi_medi; XC_long.men.LW12(5).intertempi_medi;
XC_long.men.LW12(6).intertempi_medi; XC_long.men.LW12(7).intertempi_medi;
XC_long.men.LW12(8).intertempi_medi; XC_long.men.LW12(9).intertempi_medi;
XC_long.men.LW12(10).intertempi_medi; XC_long.men.LW12(11).intertempi_medi;
XC_long.men.LW12(12).intertempi_medi;
XC_long.men.LW12(13).intertempi_medi];

dim_maxM=[size(matrM_10,1) size(matrM_10_5,1) size(matrM_11,1)
size(matrM_11_5,1) size(matrM_12,1)];
atletiM=max(dim_maxM);
intertempi=6;

statisticaM=NaN(6,6,intertempi);
temporaneaM=NaN(atletiM,length(classe));
p_valueM=NaN(1,intertempi);
ristrettaM=NaN(intertempi,length(classe));
tempM=NaN(atletiM,length(classe),intertempi);

for k=1:intertempi
    temporaneaM(1:dim_maxM(1),1)=matrM_10(:,k);
    temporaneaM(1:dim_maxM(3),3)=matrM_11(:,k);
    temporaneaM(1:dim_maxM(4),4)=matrM_11_5(:,k);
    temporaneaM(1:dim_maxM(5),5)=matrM_12(:,k);

    [p,tbl,stats]=kruskalwallis(temporaneaM);
    p_valueM(k)=p;
    if p<0.05
        result=multcompare(stats,'Display','off');
        statisticaM(:,:,k)=result;
    end
    ristrettaM(k,:)=nanmean(temporaneaM);
    tempM(:,:,k)=temporaneaM;
end

for j =1:intertempi
    figure()
    boxplot(tempM(:,:,j))
    set(gca,'XTickLabel',{'LW10','LW10.5','LW11','LW11.5','LW12'});
    ylabel('[s]')
    title('CROSS COUNTRY LONG - UOMINI');
```

```
    hold on
end
hold off

for i=1:size(tempM,3)
    media_giriM(i,:)=nanmean(tempM(:,:,i));
    std_giriM(i,:)=nanstd(tempM(:,:,i));
end

%% SALVATAGGIO

save ([filepath_save1 '\XC_long_statisticaW.mat'],'statisticaW');
save ([filepath_save1 '\XC_long_ristrettaW.mat'],'ristrettaW');
save ([filepath_save1 '\XC_long_p_valueW.mat'],'p_valueW');

save ([filepath_save2 '\XC_long_statisticaM.mat'],'statisticaM');
save ([filepath_save2 '\XC_long_ristrettaM.mat'],'ristrettaM');
save ([filepath_save2 '\XC_long_p_valueM.mat'],'p_valueM');
```

APPENDICE D

d.1) Atleti migliori vs atleti peggiori

d.1.1) Biathlon sprint

```
clear all
close all
clc

nome_gara='B_SPRINT';

B_sprint=load([cd '\' nome_gara '\B_sprint_finale']);

confronto=struct('women',[],'men',[]);

%% INSERIMENTO DEGLI ATLETI best (3) e worst (3)

% DONNE
best12_W=[4 5 6];
confronto.women.best=B_sprint.women.LW12(best12_W);

worst11_W=1;
worst10_5_W=[1 2];
confronto.women.worst=B_sprint.women.LW10_5(worst10_5_W);
confronto.women.worst(3)=B_sprint.women.LW11(worst11_W);

% UOMINI
best12_M=[7 8 10];
confronto.men.best=B_sprint.men.LW12(best12_M);

worst12_M=[3 4];
worst11_M=1;
confronto.men.worst=B_sprint.men.LW12(worst12_M);
confronto.men.worst(3)=B_sprint.men.LW11(worst11_M);

%% CALCOLO DI MEADIA E DEVIAZIONE STANDARD
giriW=3;
giriM=3;
 % DONNE
for m=1:length(confronto.women.best(1).intertempi_giro1)
        % BEST

A1_bestW(:,m)=[confronto.women.best(1).intertempi_giro1(m);confronto.women.
best(1).intertempi_giro2(m);confronto.women.best(1).intertempi_giro3(m)];

A2_bestW(:,m)=[confronto.women.best(2).intertempi_giro1(m);confronto.women.
best(2).intertempi_giro2(m);confronto.women.best(2).intertempi_giro3(m)];

A3_bestW(:,m)=[confronto.women.best(3).intertempi_giro1(m);confronto.women.
best(3).intertempi_giro2(m);confronto.women.best(3).intertempi_giro3(m)];
        % WORST

A1_worstW(:,m)=[confronto.women.worst(1).intertempi_giro1(m);confronto.wome
n.worst(1).intertempi_giro2(m);confronto.women.worst(1).intertempi_giro3(m)
];

A2_worstW(:,m)=[confronto.women.worst(2).intertempi_giro1(m);confronto.wome
```

```
n.worst(2).intertempi_giro2(m);confronto.women.worst(2).intertempi_giro3(m)
];

A3_worstW(:,m)=[confronto.women.worst(3).intertempi_giro1(m);confronto.wome
n.worst(3).intertempi_giro2(m);confronto.women.worst(3).intertempi_giro3(m)
];
end

for k=1:size(A1_bestW,2)
    % BEST

A_bestW(:,k)=[nanmean(A1_bestW(:,k));nanmean(A2_bestW(:,k));nanmean(A3_best
W(:,k))];
    %WORST

A_worstW(:,k)=[nanmean(A1_worstW(:,k));nanmean(A2_worstW(:,k));nanmean(A3_w
orstW(:,k))];
end

confronto.women.MEAN.best=nanmean(A_bestW);
confronto.women.MEAN.worst=nanmean(A_worstW);
confronto.women.STD.best=nanstd(A_bestW);
confronto.women.STD.worst=nanstd(A_worstW);

    % UOMINI
for m=1:length(confronto.men.best(1).intertempi_giro1)
        % BEST

A1_bestM(:,m)=[confronto.men.best(1).intertempi_giro1(m);confronto.men.best
(1).intertempi_giro2(m);confronto.men.best(1).intertempi_giro3(m)];

A2_bestM(:,m)=[confronto.men.best(2).intertempi_giro1(m);confronto.men.best
(2).intertempi_giro2(m);confronto.men.best(2).intertempi_giro3(m)];

A3_bestM(:,m)=[confronto.men.best(3).intertempi_giro1(m);confronto.men.best
(3).intertempi_giro2(m);confronto.men.best(3).intertempi_giro3(m)];
        % WORST

A1_worstM(:,m)=[confronto.men.worst(1).intertempi_giro1(m);confronto.men.wo
rst(1).intertempi_giro2(m);confronto.men.worst(1).intertempi_giro3(m)];

A2_worstM(:,m)=[confronto.men.worst(2).intertempi_giro1(m);confronto.men.wo
rst(2).intertempi_giro2(m);confronto.men.worst(2).intertempi_giro3(m)];

A3_worstM(:,m)=[confronto.men.worst(3).intertempi_giro1(m);confronto.men.wo
rst(3).intertempi_giro2(m);confronto.men.worst(3).intertempi_giro3(m)];
end

for k=1:size(A1_bestM,2)
    % BEST

A_bestM(:,k)=[nanmean(A1_bestM(:,k));nanmean(A2_bestM(:,k));nanmean(A3_best
M(:,k))];
    %WORST

A_worstM(:,k)=[nanmean(A1_worstM(:,k));nanmean(A2_worstM(:,k));nanmean(A3_w
orstM(:,k))];
end

confronto.men.MEAN.best=nanmean(A_bestM);
```

```
confronto.men.MEAN.worst=nanmean(A_worstM);
confronto.men.STD.best=nanstd(A_bestM);
confronto.men.STD.worst=nanstd(A_worstM);

save([cd '\B_sprint_BW.mat'],'-struct','confronto');

%% grafico
int_sprint={'K1-K2','K2-K3','K1-K3','K5-K6','K7-K8'};


%%
% DONNE
ngroups_W=2;     % n° sottoraggruppamenti
nbars_W=3;       % n° giri
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));

figure(1)
for j=1:length(int_sprint)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    legend('giro 1','giro 2','giro 3');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('classi');
    title(['DONNE: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end

%%
% UOMINI
ngroups_M=2;     % n° sottoraggruppamenti
nbars_M=3;  % n° giri
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));

figure(2)
for j=1:length(int_sprint)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_M
```

```
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    legend('giro 1','giro 2','giro 3');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('classi');
    title(['UOMINI: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end

%%
% DONNE
ngroups_W=3;     % n° giri
nbars_W=2;       % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));

figure(3)
for j=1:length(int_sprint)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2','giro 3'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    legend('best','worst');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('giri');
    title(['DONNE: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end

%%
% UOMINI
ngroups_M=3;     % n° giri
nbars_M=2;   % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));

figure(4)
for j=1:length(int_sprint)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2','giro 3'});
    hold on
    for i=1:nbars_M
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
```

```
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    legend('best','worst');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('giri');
    title(['UOMINI: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end
```

d.1.2) Biathlon individual

```
clear all
close all
clc

nome_gara='B_SPRINT';

B_sprint=load([cd '\' nome_gara '\B_sprint_finale']);

confronto=struct('women',[],'men',[]);

%% INSERIMENTO DEGLI ATLETI best (3) e worst (3)

% DONNE
best12_W=[4 5 6];
confronto.women.best=B_sprint.women.LW12(best12_W);

worst11_W=1;
worst10_5_W=[1 2];
confronto.women.worst=B_sprint.women.LW10_5(worst10_5_W);
confronto.women.worst(3)=B_sprint.women.LW11(worst11_W);

% UOMINI
best12_M=[7 8 10];
confronto.men.best=B_sprint.men.LW12(best12_M);

worst12_M=[3 4];
worst11_M=1;
confronto.men.worst=B_sprint.men.LW12(worst12_M);
confronto.men.worst(3)=B_sprint.men.LW11(worst11_M);

%% CALCOLO DI MEADIA E DEVIAZIONE STANDARD
giriW=3;
giriM=3;
 % DONNE
for m=1:length(confronto.women.best(1).intertempi_giro1)
        % BEST

A1_bestW(:,m)=[confronto.women.best(1).intertempi_giro1(m);confronto.women.
best(1).intertempi_giro2(m);confronto.women.best(1).intertempi_giro3(m)];

A2_bestW(:,m)=[confronto.women.best(2).intertempi_giro1(m);confronto.women.
best(2).intertempi_giro2(m);confronto.women.best(2).intertempi_giro3(m)];

A3_bestW(:,m)=[confronto.women.best(3).intertempi_giro1(m);confronto.women.
best(3).intertempi_giro2(m);confronto.women.best(3).intertempi_giro3(m)];
        % WORST
```

```
A1_worstW(:,m)=[confronto.women.worst(1).intertempi_giro1(m);confronto.wome
n.worst(1).intertempi_giro2(m);confronto.women.worst(1).intertempi_giro3(m)
];

A2_worstW(:,m)=[confronto.women.worst(2).intertempi_giro1(m);confronto.wome
n.worst(2).intertempi_giro2(m);confronto.women.worst(2).intertempi_giro3(m)
];

A3_worstW(:,m)=[confronto.women.worst(3).intertempi_giro1(m);confronto.wome
n.worst(3).intertempi_giro2(m);confronto.women.worst(3).intertempi_giro3(m)
];
end

for k=1:size(A1_bestW,2)
    % BEST

A_bestW(:,k)=[nanmean(A1_bestW(:,k));nanmean(A2_bestW(:,k));nanmean(A3_best
W(:,k))];
    %WORST

A_worstW(:,k)=[nanmean(A1_worstW(:,k));nanmean(A2_worstW(:,k));nanmean(A3_w
orstW(:,k))];
end

confronto.women.MEAN.best=nanmean(A_bestW);
confronto.women.MEAN.worst=nanmean(A_worstW);
confronto.women.STD.best=nanstd(A_bestW);
confronto.women.STD.worst=nanstd(A_worstW);

    % UOMINI
for m=1:length(confronto.men.best(1).intertempi_giro1)
        % BEST

A1_bestM(:,m)=[confronto.men.best(1).intertempi_giro1(m);confronto.men.best
(1).intertempi_giro2(m);confronto.men.best(1).intertempi_giro3(m)];

A2_bestM(:,m)=[confronto.men.best(2).intertempi_giro1(m);confronto.men.best
(2).intertempi_giro2(m);confronto.men.best(2).intertempi_giro3(m)];

A3_bestM(:,m)=[confronto.men.best(3).intertempi_giro1(m);confronto.men.best
(3).intertempi_giro2(m);confronto.men.best(3).intertempi_giro3(m)];
        % WORST

A1_worstM(:,m)=[confronto.men.worst(1).intertempi_giro1(m);confronto.men.wo
rst(1).intertempi_giro2(m);confronto.men.worst(1).intertempi_giro3(m)];

A2_worstM(:,m)=[confronto.men.worst(2).intertempi_giro1(m);confronto.men.wo
rst(2).intertempi_giro2(m);confronto.men.worst(2).intertempi_giro3(m)];

A3_worstM(:,m)=[confronto.men.worst(3).intertempi_giro1(m);confronto.men.wo
rst(3).intertempi_giro2(m);confronto.men.worst(3).intertempi_giro3(m)];
end

for k=1:size(A1_bestM,2)
    % BEST

A_bestM(:,k)=[nanmean(A1_bestM(:,k));nanmean(A2_bestM(:,k));nanmean(A3_best
M(:,k))];
    %WORST
```

```
A_worstM(:,k)=[nanmean(A1_worstM(:,k));nanmean(A2_worstM(:,k));nanmean(A3_w
orstM(:,k))];
end

confronto.men.MEAN.best=nanmean(A_bestM);
confronto.men.MEAN.worst=nanmean(A_worstM);
confronto.men.STD.best=nanstd(A_bestM);
confronto.men.STD.worst=nanstd(A_worstM);

save([cd '\B_sprint_BW.mat'],'-struct','confronto');

%% grafico
int_sprint={'K1-K2','K2-K3','K1-K3','K5-K6','K7-K8'};


%%
% DONNE
ngroups_W=2;     % n° sottoraggruppamenti
nbars_W=3;       % n° giri
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));

figure(1)
for j=1:length(int_sprint)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    legend('giro 1','giro 2','giro 3');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('classi');
    title(['DONNE: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end

%%
% UOMINI
ngroups_M=2;     % n° sottoraggruppamenti
nbars_M=3;  % n° giri
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));

figure(2)
for j=1:length(int_sprint)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
```

```
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_M
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    legend('giro 1','giro 2','giro 3');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('classi');
    title(['UOMINI: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end

%%
% DONNE
ngroups_W=3;    % n° giri
nbars_W=2;      % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));

figure(3)
for j=1:length(int_sprint)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2','giro 3'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    legend('best','worst');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('giri');
    title(['DONNE: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end

%%
% UOMINI
ngroups_M=3;    % n° giri
nbars_M=2;  % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));

figure(4)
for j=1:length(int_sprint)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
```

```
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2','giro 3'});
    hold on
    for i=1:nbars_M
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    legend('best','worst');
    ylabel(['intertempo ' int_sprint(j) ' [s]']);
    xlabel('giri');
    title(['UOMINI: confronto tempi medi dell intertempo'  int_sprint(j)]);
    hold off
end
```

d.1.3) Cross country middle

```
clear all
close all
clc

nome_gara='XC_MIDDLE';

XC_middle=load([cd '\' nome_gara '\XC_middle_finale']);

confronto=struct('women',[],'men',[]);

filepath_save=[cd '\' nome_gara '\GRAFICI'];

%% INSERIMENTO DEGLI ATLETI best (3) e worst (3)

% DONNE
best_W=[4 6 7];
confronto.women.best=XC_middle.women.LW12(best_W);

worst_W=[1 2 3];
confronto.women.worst=XC_middle.women.LW10_5(worst_W);

% UOMINI
best12_M=[12 14];
best11_5_M=2;
confronto.men.best=XC_middle.men.LW12(best12_M);
confronto.men.best(3)=XC_middle.men.LW11_5(best11_5_M);

worst12_M=[1 2];
worst10_M=1;
confronto.men.worst=XC_middle.men.LW12(worst12_M);
confronto.men.worst(3)=XC_middle.men.LW10(worst10_M);

%% CALCOLO DI MEADIA E DEVIAZIONE STANDARD

giriW=2;
giriM=3;
 % DONNE
for m=1:length(confronto.women.best(1).intertempi_giro1)
        % BEST
```

```
A1_bestW(:,m)=[confronto.women.best(1).intertempi_giro1(m);confronto.women.
best(1).intertempi_giro2(m)];

A2_bestW(:,m)=[confronto.women.best(2).intertempi_giro1(m);confronto.women.
best(2).intertempi_giro2(m)];

A3_bestW(:,m)=[confronto.women.best(3).intertempi_giro1(m);confronto.women.
best(3).intertempi_giro2(m)];
        % WORST

A1_worstW(:,m)=[confronto.women.worst(1).intertempi_giro1(m);confronto.wome
n.worst(1).intertempi_giro2(m)];

A2_worstW(:,m)=[confronto.women.worst(2).intertempi_giro1(m);confronto.wome
n.worst(2).intertempi_giro2(m)];

A3_worstW(:,m)=[confronto.women.worst(3).intertempi_giro1(m);confronto.wome
n.worst(3).intertempi_giro2(m)];
end

for k=1:size(A1_bestW,2)
    % BEST

A_bestW(:,k)=[nanmean(A1_bestW(:,k));nanmean(A2_bestW(:,k));nanmean(A3_best
W(:,k))];
    %WORST

A_worstW(:,k)=[nanmean(A1_worstW(:,k));nanmean(A2_worstW(:,k));nanmean(A3_w
orstW(:,k))];
end

confronto.women.MEAN.best=nanmean(A_bestW);
confronto.women.MEAN.worst=nanmean(A_worstW);
confronto.women.STD.best=nanstd(A_bestW);
confronto.women.STD.worst=nanstd(A_worstW);

    % UOMINI
for m=1:length(confronto.men.best(1).intertempi_giro1)
        % BEST

A1_bestM(:,m)=[confronto.men.best(1).intertempi_giro1(m);confronto.men.best
(1).intertempi_giro2(m);confronto.men.best(1).intertempi_giro3(m)];

A2_bestM(:,m)=[confronto.men.best(2).intertempi_giro1(m);confronto.men.best
(2).intertempi_giro2(m);confronto.men.best(2).intertempi_giro3(m)];

A3_bestM(:,m)=[confronto.men.best(3).intertempi_giro1(m);confronto.men.best
(3).intertempi_giro2(m);confronto.men.best(3).intertempi_giro3(m)];
        % WORST

A1_worstM(:,m)=[confronto.men.worst(1).intertempi_giro1(m);confronto.men.wo
rst(1).intertempi_giro2(m);confronto.men.worst(1).intertempi_giro3(m)];

A2_worstM(:,m)=[confronto.men.worst(2).intertempi_giro1(m);confronto.men.wo
rst(2).intertempi_giro2(m);confronto.men.worst(2).intertempi_giro3(m)];

A3_worstM(:,m)=[confronto.men.worst(3).intertempi_giro1(m);confronto.men.wo
rst(3).intertempi_giro2(m);confronto.men.worst(3).intertempi_giro3(m)];
end
```

```
for k=1:size(A1_bestM,2)
    % BEST

A_bestM(:,k)=[nanmean(A1_bestM(:,k));nanmean(A2_bestM(:,k));nanmean(A3_best
M(:,k))];
    %WORST

A_worstM(:,k)=[nanmean(A1_worstM(:,k));nanmean(A2_worstM(:,k));nanmean(A3_w
orstM(:,k))];
end

confronto.men.MEAN.best=nanmean(A_bestM);
confronto.men.MEAN.worst=nanmean(A_worstM);
confronto.men.STD.best=nanstd(A_bestM);
confronto.men.STD.worst=nanstd(A_worstM);

save([cd '\XC_middle_BW.mat'],'-struct','confronto');

%% grafico
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};



%%
% DONNE
ngroups_W=2;    % n° sottoraggruppamenti
nbars_W=2;      % n° giri
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));

figure(1)
suptitle('DONNE: intertempi medi in funzione delle classi Best - Worst')
for j=1:length(int)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylabel('[s]');
    xlabel('classi');
    title([int(j)]);
    hold off
end

saveas(gcf, [filepath_save '\intertempiW_BW.fig']);

%%
% UOMINI
ngroups_M=2;    % n° sottoraggruppamenti
nbars_M=3;  % n° giri
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));
```

```
figure(2)
suptitle('UOMINI: intertempi medi in funzione delle classi Best - Worst')
for j=1:length(int)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_M
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    ylabel('[s]');
    xlabel('classi');
    title([int(j)]);
    hold off
end

saveas(gcf, [filepath_save '\intertempiM_BW.fig']);

%%
% DONNE
ngroups_W=2;     % n° giri
nbars_W=2;       % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));


figure(3)
suptitle('DONNE: intertempi medi in funzione dei giri')
for j=1:length(int)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    ylabel('[s]');
    xlabel('giri');
    title([int(j)]);
    hold off
end

saveas(gcf, [filepath_save '\intertempiW_BW vs2.fig']);
```

```
%%
% UOMINI
ngroups_M=3;     % n° giri
nbars_M=2;  % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));

figure(4)
suptitle('UOMINI: intertempi medi in funzione dei giri')
for j=1:length(int)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2','giro 3'});
    hold on
    for i=1:nbars_M
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    ylabel('[s]');
    xlabel('giri');
    title([int(j)]);
    hold off
end

saveas(gcf, [filepath_save '\intertempiM_BW vs2.fig']);
```

d.1.4) Cross country long

```
clear all
close all
clc

nome_gara='XC_LONG';

XC_long=load([cd '\' nome_gara '\XC_long_finale']);

confronto=struct('women',[],'men',[]);

%% INSERIMENTO DEGLI ATLETI best (3) e worst (3)

% DONNE
best_W=[3 5 6];
confronto.women.best=XC_long.women.LW12(best_W);

worst12_W=1;
worst10_5_W=[1 2];
confronto.women.worst=XC_long.women.LW10_5(worst10_5_W);
confronto.women.worst(3)=XC_long.women.LW12(worst12_W);

% UOMINI
best12_M=[12 13];
```

```
best11_5_M=2;
confronto.men.best=XC_long.men.LW12(best12_M);
confronto.men.best(3)=XC_long.men.LW11_5(best11_5_M);

worst12_M=1;
worst11_M=3;
worst10_M=1;
confronto.men.worst(1)=XC_long.men.LW12(worst12_M);
confronto.men.worst(2)=XC_long.men.LW11(worst11_M);
confronto.men.worst(3)=XC_long.men.LW10(worst10_M);

%% CALCOLO DI MEADIA E DEVIAZIONE STANDARD

giriW=4;
giriM=5;
 % DONNE
for m=1:length(confronto.women.best(1).intertempi_giro1)
        % BEST

A1_bestW(:,m)=[confronto.women.best(1).intertempi_giro1(m);confronto.women.
best(1).intertempi_giro2(m);confronto.women.best(1).intertempi_giro3(m);con
fronto.women.best(1).intertempi_giro4(m)];

A2_bestW(:,m)=[confronto.women.best(2).intertempi_giro1(m);confronto.women.
best(2).intertempi_giro2(m);confronto.women.best(2).intertempi_giro3(m);con
fronto.women.best(2).intertempi_giro4(m)];

A3_bestW(:,m)=[confronto.women.best(3).intertempi_giro1(m);confronto.women.
best(3).intertempi_giro2(m);confronto.women.best(3).intertempi_giro3(m);con
fronto.women.best(3).intertempi_giro4(m)];
        % WORST

A1_worstW(:,m)=[confronto.women.worst(1).intertempi_giro1(m);confronto.wome
n.worst(1).intertempi_giro2(m);confronto.women.worst(1).intertempi_giro3(m)
;confronto.women.worst(1).intertempi_giro4(m)];

A2_worstW(:,m)=[confronto.women.worst(2).intertempi_giro1(m);confronto.wome
n.worst(2).intertempi_giro2(m);confronto.women.worst(2).intertempi_giro3(m)
;confronto.women.worst(2).intertempi_giro4(m)];

A3_worstW(:,m)=[confronto.women.worst(3).intertempi_giro1(m);confronto.wome
n.worst(3).intertempi_giro2(m);confronto.women.worst(3).intertempi_giro3(m)
;confronto.women.worst(3).intertempi_giro4(m)];
end

for k=1:size(A1_bestW,2)
    % BEST

A_bestW(:,k)=[nanmean(A1_bestW(:,k));nanmean(A2_bestW(:,k));nanmean(A3_best
W(:,k))];
    %WORST

A_worstW(:,k)=[nanmean(A1_worstW(:,k));nanmean(A2_worstW(:,k));nanmean(A3_w
orstW(:,k))];
end

confronto.women.MEAN.best=nanmean(A_bestW);
confronto.women.MEAN.worst=nanmean(A_worstW);
confronto.women.STD.best=nanstd(A_bestW);
confronto.women.STD.worst=nanstd(A_worstW);
```

```
    % UOMINI
for m=1:length(confronto.men.best(1).intertempi_giro1)
        % BEST

A1_bestM(:,m)=[confronto.men.best(1).intertempi_giro1(m);confronto.men.best
(1).intertempi_giro2(m);confronto.men.best(1).intertempi_giro3(m);confronto
.men.best(1).intertempi_giro4(m);confronto.men.best(1).intertempi_giro5(m)]
;

A2_bestM(:,m)=[confronto.men.best(2).intertempi_giro1(m);confronto.men.best
(2).intertempi_giro2(m);confronto.men.best(2).intertempi_giro3(m);confronto
.men.best(2).intertempi_giro4(m);confronto.men.best(2).intertempi_giro5(m)]
;

A3_bestM(:,m)=[confronto.men.best(3).intertempi_giro1(m);confronto.men.best
(3).intertempi_giro2(m);confronto.men.best(3).intertempi_giro3(m);confronto
.men.best(3).intertempi_giro4(m);confronto.men.best(3).intertempi_giro5(m)]
;
        % WORST

A1_worstM(:,m)=[confronto.men.worst(1).intertempi_giro1(m);confronto.men.wo
rst(1).intertempi_giro2(m);confronto.men.worst(1).intertempi_giro3(m);confr
onto.men.worst(1).intertempi_giro4(m);confronto.men.worst(1).intertempi_gir
o5(m)];

A2_worstM(:,m)=[confronto.men.worst(2).intertempi_giro1(m);confronto.men.wo
rst(2).intertempi_giro2(m);confronto.men.worst(2).intertempi_giro3(m);confr
onto.men.worst(2).intertempi_giro4(m);confronto.men.worst(2).intertempi_gir
o5(m)];

A3_worstM(:,m)=[confronto.men.worst(3).intertempi_giro1(m);confronto.men.wo
rst(3).intertempi_giro2(m);confronto.men.worst(3).intertempi_giro3(m);confr
onto.men.worst(3).intertempi_giro4(m);confronto.men.worst(3).intertempi_gir
o5(m)];
end

for k=1:size(A1_bestM,2)
    % BEST

A_bestM(:,k)=[nanmean(A1_bestM(:,k));nanmean(A2_bestM(:,k));nanmean(A3_best
M(:,k))];
    %WORST

A_worstM(:,k)=[nanmean(A1_worstM(:,k));nanmean(A2_worstM(:,k));nanmean(A3_w
orstM(:,k))];
end

confronto.men.MEAN.best=nanmean(A_bestM);
confronto.men.MEAN.worst=nanmean(A_worstM);
confronto.men.STD.best=nanstd(A_bestM);
confronto.men.STD.worst=nanstd(A_worstM);

save([cd '\XC_long_BW.mat'],'-struct','confronto');

%% grafico
int={'K1-K2','K2-K3','K1-K3','K4-K5','K5-K6','K7-K8'};


%%
```

```
% DONNE
ngroups_W=2;     % n° sottoraggruppamenti
nbars_W=4;       % n° giri
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));

figure(1)
for j=1:length(int)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    legend('giro 1','giro 2','giro 3','giro 4');
    ylabel(['intertempo ' int(j) ' [s]']);
    xlabel('classi');
    title(['DONNE: confronto tempi medi dell intertempo'  int(j)]);
    hold off
end

%%
% UOMINI
ngroups_M=2;     % n° sottoraggruppamenti
nbars_M=5;   % n° giri
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));

figure(2)
for j=1:length(int)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'Best','Worst'});
    hold on
    for i=1:nbars_M
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
    legend('giro 1','giro 2','giro 3','giro 4','giro 5');
    ylabel(['intertempo ' int(j) ' [s]']);
    xlabel('classi');
    title(['UOMINI: confronto tempi medi dell intertempo'  int(j)]);
    hold off
end

%%
% DONNE
```

```
ngroups_W=4;     % n° giri
nbars_W=2;       % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_W/(nbars_W+1.5));

figure(3)
for j=1:length(int)
    int_mean=[confronto.women.best_MEAN.int_giri(:,j)
confronto.women.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.women.best_STD.int_giri(:,j)
confronto.women.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2','giro 3','giro 4'});
    hold on
    for i=1:nbars_W
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_W);
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    legend('best','worst');
    ylabel(['intertempo ' int(j) ' [s]']);
    xlabel('giri');
    title(['DONNE: confronto tempi medi dell intertempo'  int(j)]);
    hold off
end

%%
% UOMINI
ngroups_M=5;     % n° giri
nbars_M=2;   % n° sottoraggruppamenti
groupwidth=min(0.8, nbars_M/(nbars_M+1.5));

figure(4)
for j=1:length(int)
    int_mean=[confronto.men.best_MEAN.int_giri(:,j)
confronto.men.worst_MEAN.int_giri(:,j)];
    int_std=[confronto.men.best_STD.int_giri(:,j)
confronto.men.worst_STD.int_giri(:,j)];
    subplot(3,2,j);
    bar(int_mean,'FaceColor','flat');
    for k = 1:size(int_mean,2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'giro 1','giro 2','giro 3','giro 4','giro 5'});
    hold on
    for i=1:nbars_M
        vett=(1:ngroups_M)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars_M);
        errorbar(vett,int_mean(:,i),int_std(:,i),'.k','LineWidth',1);
    end
    legend('best','worst');
    ylabel(['intertempo ' int(j) ' [s]']);
    xlabel('giri');
    title(['UOMINI: confronto tempi medi dell intertempo'  int(j)]);
    hold off
end
```

d.1.5) Differenza delle medie

```
%% BEST vs WORST

clc
clear all
close all

nome='Best_Worst';
B_sprint_BW=load([cd '\' nome '\B_sprint_BW.mat']);
B_individual_BW=load([cd '\' nome '\B_individual_BW.mat']);
XC_middle_BW=load([cd '\' nome '\XC_middle_BW.mat']);
XC_long_BW=load([cd '\' nome '\XC_long_BW.mat']);

%% ELABORAZIONE DATI: DIFFERENZA DELLE MEDIE

% BIATHLON SPRINT
B_sprint_BW.women.MEAN.differenza_medie=B_sprint_BW.women.MEAN.worst-
B_sprint_BW.women.MEAN.best;
B_sprint_BW.men.MEAN.differenza_medie=B_sprint_BW.men.MEAN.worst-
B_sprint_BW.men.MEAN.best;

%BIATHLON INDIVIDUAL
B_individual_BW.women.MEAN.differenza_medie=B_individual_BW.women.MEAN.wors
t-B_individual_BW.women.MEAN.best;
B_individual_BW.men.MEAN.differenza_medie=B_individual_BW.men.MEAN.worst-
B_individual_BW.men.MEAN.best;

% CROSS COUNTRY MIDDLE
XC_middle_BW.women.MEAN.differenza_medie=XC_middle_BW.women.MEAN.worst-
XC_middle_BW.women.MEAN.best;
XC_middle_BW.men.MEAN.differenza_medie=XC_middle_BW.men.MEAN.worst-
XC_middle_BW.men.MEAN.best;

% CROSS COUNTRY LONG
XC_long_BW.women.MEAN.differenza_medie=XC_long_BW.women.MEAN.worst-
XC_long_BW.women.MEAN.best;
XC_long_BW.men.MEAN.differenza_medie=XC_long_BW.men.MEAN.worst-
XC_long_BW.men.MEAN.best;
```

d.2) Atleti partecipanti ad ogni gara

d.2.1) Creazione della struttura

```
clear all
close all
clc

nome_gara={'B_SPRINT' 'B_INDIVIDUAL' 'XC_MIDDLE' 'XC_LONG'};

B_sprint=load([cd '\' nome_gara{1} '\B_sprint_finale']);
B_individual=load([cd '\' nome_gara{2} '\B_individual_finale']);
XC_middle=load([cd '\' nome_gara{3} '\XC_middle_finale']);
XC_long=load([cd '\' nome_gara{4} '\XC_long_finale']);

confronto=struct('women',[],'men',[]);
```

```
%% INSERIMENTO DEGLI ATLETI ALL RACES

    % DONNE
sprint_W=[1 3 4 5 6];
individual_W=[1 3 4 5 6];
middle_W=[2 5 4 7 6];
long_W=[2 4 3 6 5];

confronto.women.B_sprint=B_sprint.women.LW12(sprint_W);
confronto.women.B_individual=B_individual.women.LW12(individual_W);
confronto.women.XC_middle=XC_middle.women.LW12(middle_W);
confronto.women.XC_long=XC_long.women.LW12(long_W);

    % UOMINI
sprint_M=[1 2 5 6 7 9 10];
individual_M=[1 2 5 6 7 9 10];
middle_M=[4 8 7 10 14 13 12];
long_M=[3 6 5 8 12 11 10];

confronto.men.B_sprint=B_sprint.men.LW12(sprint_M);
confronto.men.B_individual=B_individual.men.LW12(individual_M);
confronto.men.XC_middle=XC_middle.men.LW12(middle_M);
confronto.men.XC_long=XC_long.men.LW12(long_M);

confronto.men.B_sprint(8)=B_sprint.men.LW11_5(2);
confronto.men.B_individual(8)=B_individual.men.LW11_5(2);
confronto.men.XC_middle(8)=XC_middle.men.LW11_5(2);
confronto.men.XC_long(8)=XC_long.men.LW11_5(2);

%% CALCOLO DI MEDIA E DEVIAZIONE STANDARD

    % DONNE
for j=1:size(confronto.women.XC_middle,1)
    for m=1:length(confronto.women.XC_middle(1).intertempi_giro1)
        % B_sprint
        if m<4

int_g1_sprint_W(j,m)=confronto.women.B_sprint(j).intertempi_giro1(m);

int_g2_sprint_W(j,m)=confronto.women.B_sprint(j).intertempi_giro2(m);

int_g3_sprint_W(j,m)=confronto.women.B_sprint(j).intertempi_giro3(m);
        elseif m==4
            int_g1_sprint_W(j,m)=NaN;
            int_g2_sprint_W(j,m)=NaN;
            int_g3_sprint_W(j,m)=NaN;
        elseif m>4 && m<7

int_g1_sprint_W(j,m)=confronto.women.B_sprint(j).intertempi_giro1(m-1);

int_g2_sprint_W(j,m)=confronto.women.B_sprint(j).intertempi_giro2(m-1);

int_g3_sprint_W(j,m)=confronto.women.B_sprint(j).intertempi_giro3(m-1);
       end
        % B_individual

int_g1_individual_W(j,m)=confronto.women.B_individual(j).intertempi_giro1(m
);
```

```
int_g2_individual_W(j,m)=confronto.women.B_individual(j).intertempi_giro2(m
);

int_g3_individual_W(j,m)=confronto.women.B_individual(j).intertempi_giro3(m
);

int_g4_individual_W(j,m)=confronto.women.B_individual(j).intertempi_giro4(m
);

int_g5_individual_W(j,m)=confronto.women.B_individual(j).intertempi_giro5(m
);
        % XC_middle

int_g1_middle_W(j,m)=confronto.women.XC_middle(j).intertempi_giro1(m);

int_g2_middle_W(j,m)=confronto.women.XC_middle(j).intertempi_giro2(m);
        % XC_long
        int_g1_long_W(j,m)=confronto.women.XC_long(j).intertempi_giro1(m);
        int_g2_long_W(j,m)=confronto.women.XC_long(j).intertempi_giro2(m);
        int_g3_long_W(j,m)=confronto.women.XC_long(j).intertempi_giro3(m);
        int_g4_long_W(j,m)=confronto.women.XC_long(j).intertempi_giro4(m);
    end
end

% Media di ogni atleta appartenente alla stessa classe (in questo caso
% fanno tutti parte della LW12
for k=1:size(int_g1_middle_W,2)
    % B_sprint
    int_g1_sprint_W_MEAN(k)=nanmean(int_g1_sprint_W(:,k));
    int_g2_sprint_W_MEAN(k)=nanmean(int_g2_sprint_W(:,k));
    int_g3_sprint_W_MEAN(k)=nanmean(int_g3_sprint_W(:,k));
    int_g1_sprint_W_STD(k)=nanstd(int_g1_sprint_W(:,k));
    int_g2_sprint_W_STD(k)=nanstd(int_g2_sprint_W(:,k));
    int_g3_sprint_W_STD(k)=nanstd(int_g3_sprint_W(:,k));

    % B_individual
    int_g1_individual_W_MEAN(k)=nanmean(int_g1_individual_W(:,k));
    int_g2_individual_W_MEAN(k)=nanmean(int_g2_individual_W(:,k));
    int_g3_individual_W_MEAN(k)=nanmean(int_g3_individual_W(:,k));
    int_g4_individual_W_MEAN(k)=nanmean(int_g4_individual_W(:,k));
    int_g5_individual_W_MEAN(k)=nanmean(int_g5_individual_W(:,k));
    int_g1_individual_W_STD(k)=nanstd(int_g1_individual_W(:,k));
    int_g2_individual_W_STD(k)=nanstd(int_g2_individual_W(:,k));
    int_g3_individual_W_STD(k)=nanstd(int_g3_individual_W(:,k));
    int_g4_individual_W_STD(k)=nanstd(int_g4_individual_W(:,k));
    int_g5_individual_W_STD(k)=nanstd(int_g5_individual_W(:,k));

    % XC_middle
    int_g1_middle_W_MEAN(k)=nanmean(int_g1_middle_W(:,k));
    int_g2_middle_W_MEAN(k)=nanmean(int_g2_middle_W(:,k));
    int_g1_middle_W_STD(k)=nanstd(int_g1_middle_W(:,k));
    int_g2_middle_W_STD(k)=nanstd(int_g2_middle_W(:,k));

    % XC_long
    int_g1_long_W_MEAN(k)=nanmean(int_g1_long_W(:,k));
    int_g2_long_W_MEAN(k)=nanmean(int_g2_long_W(:,k));
    int_g3_long_W_MEAN(k)=nanmean(int_g3_long_W(:,k));
    int_g4_long_W_MEAN(k)=nanmean(int_g4_long_W(:,k));
    int_g1_long_W_STD(k)=nanstd(int_g1_long_W(:,k));
    int_g2_long_W_STD(k)=nanstd(int_g2_long_W(:,k));
```

```
    int_g3_long_W_STD(k)=nanstd(int_g3_long_W(:,k));
    int_g4_long_W_STD(k)=nanstd(int_g4_long_W(:,k));
end

    % UOMINI
for j=1:size(confronto.men.XC_middle,1)
    for m=1:length(confronto.men.XC_middle(1).intertempi_giro1)
        % B_sprint
        if m<4

int_g1_sprint_M(j,m)=confronto.men.B_sprint(j).intertempi_giro1(m);

int_g2_sprint_M(j,m)=confronto.men.B_sprint(j).intertempi_giro2(m);

int_g3_sprint_M(j,m)=confronto.men.B_sprint(j).intertempi_giro3(m);
        elseif m==4
            int_g1_sprint_M(j,m)=NaN;
            int_g2_sprint_M(j,m)=NaN;
            int_g3_sprint_M(j,m)=NaN;
        elseif m>4 && m<7

int_g1_sprint_M(j,m)=confronto.men.B_sprint(j).intertempi_giro1(m-1);

int_g2_sprint_M(j,m)=confronto.men.B_sprint(j).intertempi_giro2(m-1);

int_g3_sprint_M(j,m)=confronto.men.B_sprint(j).intertempi_giro3(m-1);
       end
        % B_individual

int_g1_individual_M(j,m)=confronto.men.B_individual(j).intertempi_giro1(m);

int_g2_individual_M(j,m)=confronto.men.B_individual(j).intertempi_giro2(m);

int_g3_individual_M(j,m)=confronto.men.B_individual(j).intertempi_giro3(m);

int_g4_individual_M(j,m)=confronto.men.B_individual(j).intertempi_giro4(m);

int_g5_individual_M(j,m)=confronto.men.B_individual(j).intertempi_giro5(m);
        % XC_middle

int_g1_middle_M(j,m)=confronto.men.XC_middle(j).intertempi_giro1(m);

int_g2_middle_M(j,m)=confronto.men.XC_middle(j).intertempi_giro2(m);

int_g3_middle_M(j,m)=confronto.men.XC_middle(j).intertempi_giro3(m);
        % XC_long
        int_g1_long_M(j,m)=confronto.men.XC_long(j).intertempi_giro1(m);
        int_g2_long_M(j,m)=confronto.men.XC_long(j).intertempi_giro2(m);
        int_g3_long_M(j,m)=confronto.men.XC_long(j).intertempi_giro3(m);
        int_g4_long_M(j,m)=confronto.men.XC_long(j).intertempi_giro4(m);
        int_g5_long_M(j,m)=confronto.men.XC_long(j).intertempi_giro5(m);
    end
end


for k=1:size(int_g1_middle_M,2)
    % B_sprint
    int_g1_sprint_M_MEAN(k)=nanmean(int_g1_sprint_M(1:7,k));
    int_g2_sprint_M_MEAN(k)=nanmean(int_g2_sprint_M(1:7,k));
    int_g3_sprint_M_MEAN(k)=nanmean(int_g3_sprint_M(1:7,k));
    int_g1_sprint_M_STD(k)=nanstd(int_g1_sprint_M(1:7,k));
```

```
    int_g2_sprint_M_STD(k)=nanstd(int_g2_sprint_M(1:7,k));
    int_g3_sprint_M_STD(k)=nanstd(int_g3_sprint_M(1:7,k));

    % B_individual
    int_g1_individual_M_MEAN(k)=nanmean(int_g1_individual_M(1:7,k));
    int_g2_individual_M_MEAN(k)=nanmean(int_g2_individual_M(1:7,k));
    int_g3_individual_M_MEAN(k)=nanmean(int_g3_individual_M(1:7,k));
    int_g4_individual_M_MEAN(k)=nanmean(int_g4_individual_M(1:7,k));
    int_g5_individual_M_MEAN(k)=nanmean(int_g5_individual_M(1:7,k));
    int_g1_individual_M_STD(k)=nanstd(int_g1_individual_M(1:7,k));
    int_g2_individual_M_STD(k)=nanstd(int_g2_individual_M(1:7,k));
    int_g3_individual_M_STD(k)=nanstd(int_g3_individual_M(1:7,k));
    int_g4_individual_M_STD(k)=nanstd(int_g4_individual_M(1:7,k));
    int_g5_individual_M_STD(k)=nanstd(int_g5_individual_M(1:7,k));

    % XC_middle
    int_g1_middle_M_MEAN(k)=nanmean(int_g1_middle_M(1:7,k));
    int_g2_middle_M_MEAN(k)=nanmean(int_g2_middle_M(1:7,k));
    int_g3_middle_M_MEAN(k)=nanmean(int_g3_middle_M(1:7,k));
    int_g1_middle_M_STD(k)=nanstd(int_g1_middle_M(1:7,k));
    int_g2_middle_M_STD(k)=nanstd(int_g2_middle_M(1:7,k));
    int_g3_middle_M_STD(k)=nanstd(int_g3_middle_M(1:7,k));

    % XC_long
    int_g1_long_M_MEAN(k)=nanmean(int_g1_long_M(1:7,k));
    int_g2_long_M_MEAN(k)=nanmean(int_g2_long_M(1:7,k));
    int_g3_long_M_MEAN(k)=nanmean(int_g3_long_M(1:7,k));
    int_g4_long_M_MEAN(k)=nanmean(int_g4_long_M(1:7,k));
    int_g5_long_M_MEAN(k)=nanmean(int_g5_long_M(1:7,k));
    int_g1_long_M_STD(k)=nanstd(int_g1_long_M(1:7,k));
    int_g2_long_M_STD(k)=nanstd(int_g2_long_M(1:7,k));
    int_g3_long_M_STD(k)=nanstd(int_g3_long_M(1:7,k));
    int_g4_long_M_STD(k)=nanstd(int_g4_long_M(1:7,k));
    int_g5_long_M_STD(k)=nanstd(int_g5_long_M(1:7,k));
end

%% RIEMPIMENTO STRUTTURA

    % DONNE
% MEDIA
    % B_sprint
confronto.women.B_sprint_MEAN.int_giri(1,:)=int_g1_sprint_W_MEAN;
confronto.women.B_sprint_MEAN.int_giri(2,:)=int_g2_sprint_W_MEAN;
confronto.women.B_sprint_MEAN.int_giri(3,:)=int_g3_sprint_W_MEAN;
    % B_individual
confronto.women.B_individual_MEAN.int_giri(1,:)=int_g1_individual_W_MEAN;
confronto.women.B_individual_MEAN.int_giri(2,:)=int_g2_individual_W_MEAN;
confronto.women.B_individual_MEAN.int_giri(3,:)=int_g3_individual_W_MEAN;
confronto.women.B_individual_MEAN.int_giri(4,:)=int_g4_individual_W_MEAN;
confronto.women.B_individual_MEAN.int_giri(5,:)=int_g5_individual_W_MEAN;
    % XC_middle
confronto.women.XC_middle_MEAN.int_giri(1,:)=int_g1_middle_W_MEAN;
confronto.women.XC_middle_MEAN.int_giri(2,:)=int_g2_middle_W_MEAN;
    % XC_long
confronto.women.XC_long_MEAN.int_giri(1,:)=int_g1_long_W_MEAN;
confronto.women.XC_long_MEAN.int_giri(2,:)=int_g2_long_W_MEAN;
confronto.women.XC_long_MEAN.int_giri(3,:)=int_g3_long_W_MEAN;
confronto.women.XC_long_MEAN.int_giri(4,:)=int_g4_long_W_MEAN;

% STD
```

```
    % B_sprint
confronto.women.B_sprint_STD.int_giri(1,:)=int_g1_sprint_W_STD;
confronto.women.B_sprint_STD.int_giri(2,:)=int_g2_sprint_W_STD;
confronto.women.B_sprint_STD.int_giri(3,:)=int_g3_sprint_W_STD;
    % B_individual
confronto.women.B_individual_STD.int_giri(1,:)=int_g1_individual_W_STD;
confronto.women.B_individual_STD.int_giri(2,:)=int_g2_individual_W_STD;
confronto.women.B_individual_STD.int_giri(3,:)=int_g3_individual_W_STD;
confronto.women.B_individual_STD.int_giri(4,:)=int_g4_individual_W_STD;
confronto.women.B_individual_STD.int_giri(5,:)=int_g5_individual_W_STD;
    % XC_middle
confronto.women.XC_middle_STD.int_giri(1,:)=int_g1_middle_W_STD;
confronto.women.XC_middle_STD.int_giri(2,:)=int_g2_middle_W_STD;
    % XC_long
confronto.women.XC_long_STD.int_giri(1,:)=int_g1_long_W_STD;
confronto.women.XC_long_STD.int_giri(2,:)=int_g2_long_W_STD;
confronto.women.XC_long_STD.int_giri(3,:)=int_g3_long_W_STD;
confronto.women.XC_long_STD.int_giri(4,:)=int_g4_long_W_STD;



    % UOMINI
% MEDIA
    % B_sprint
confronto.men.B_sprint_MEAN.int_giri(1,:)=int_g1_sprint_M_MEAN;
confronto.men.B_sprint_MEAN.int_giri(2,:)=int_g2_sprint_M_MEAN;
confronto.men.B_sprint_MEAN.int_giri(3,:)=int_g3_sprint_M_MEAN;
% per la classe 11.5
confronto.men.B_sprint_MEAN.int_giri(4,:)=int_g1_sprint_M(8,:);
confronto.men.B_sprint_MEAN.int_giri(5,:)=int_g2_sprint_M(8,:);
confronto.men.B_sprint_MEAN.int_giri(6,:)=int_g3_sprint_M(8,:);
    % B_individual
confronto.men.B_individual_MEAN.int_giri(1,:)=int_g1_individual_M_MEAN;
confronto.men.B_individual_MEAN.int_giri(2,:)=int_g2_individual_M_MEAN;
confronto.men.B_individual_MEAN.int_giri(3,:)=int_g3_individual_M_MEAN;
confronto.men.B_individual_MEAN.int_giri(4,:)=int_g4_individual_M_MEAN;
confronto.men.B_individual_MEAN.int_giri(5,:)=int_g5_individual_M_MEAN;
% per la classe 11.5
confronto.men.B_individual_MEAN.int_giri(6,:)=int_g1_individual_M(8,:);
confronto.men.B_individual_MEAN.int_giri(7,:)=int_g2_individual_M(8,:);
confronto.men.B_individual_MEAN.int_giri(8,:)=int_g3_individual_M(8,:);
confronto.men.B_individual_MEAN.int_giri(9,:)=int_g4_individual_M(8,:);
confronto.men.B_individual_MEAN.int_giri(10,:)=int_g5_individual_M(8,:);
    % XC_middle
confronto.men.XC_middle_MEAN.int_giri(1,:)=int_g1_middle_M_MEAN;
confronto.men.XC_middle_MEAN.int_giri(2,:)=int_g2_middle_M_MEAN;
confronto.men.XC_middle_MEAN.int_giri(3,:)=int_g3_middle_M_MEAN;
% per la classe 11.5
confronto.men.XC_middle_MEAN.int_giri(4,:)=int_g1_middle_M(8,:);
confronto.men.XC_middle_MEAN.int_giri(5,:)=int_g2_middle_M(8,:);
confronto.men.XC_middle_MEAN.int_giri(6,:)=int_g3_middle_M(8,:);
    % XC_long
confronto.men.XC_long_MEAN.int_giri(1,:)=int_g1_long_M_MEAN;
confronto.men.XC_long_MEAN.int_giri(2,:)=int_g2_long_M_MEAN;
confronto.men.XC_long_MEAN.int_giri(3,:)=int_g3_long_M_MEAN;
confronto.men.XC_long_MEAN.int_giri(4,:)=int_g4_long_M_MEAN;
confronto.men.XC_long_MEAN.int_giri(5,:)=int_g5_long_M_MEAN;
% per la classe 11.5
confronto.men.XC_long_MEAN.int_giri(6,:)=int_g1_long_M(8,:);
confronto.men.XC_long_MEAN.int_giri(7,:)=int_g2_long_M(8,:);
confronto.men.XC_long_MEAN.int_giri(8,:)=int_g3_long_M(8,:);
confronto.men.XC_long_MEAN.int_giri(9,:)=int_g4_long_M(8,:);
```

```
confronto.men.XC_long_MEAN.int_giri(10,:)=int_g5_long_M(8,:);

% STD
    % B_sprint
confronto.men.B_sprint_STD.int_giri(1,:)=int_g1_sprint_M_STD;
confronto.men.B_sprint_STD.int_giri(2,:)=int_g2_sprint_M_STD;
confronto.men.B_sprint_STD.int_giri(3,:)=int_g3_sprint_M_STD;
% per la classe 11.5
confronto.men.B_sprint_STD.int_giri(4,:)=zeros(1,6);
confronto.men.B_sprint_STD.int_giri(5,:)=zeros(1,6);
confronto.men.B_sprint_STD.int_giri(6,:)=zeros(1,6);

    % B_individual
confronto.men.B_individual_STD.int_giri(1,:)=int_g1_individual_M_STD;
confronto.men.B_individual_STD.int_giri(2,:)=int_g2_individual_M_STD;
confronto.men.B_individual_STD.int_giri(3,:)=int_g3_individual_M_STD;
confronto.men.B_individual_STD.int_giri(4,:)=int_g4_individual_M_STD;
confronto.men.B_individual_STD.int_giri(5,:)=int_g5_individual_M_STD;
% per la classe 11.5
confronto.men.B_individual_STD.int_giri(6,:)=zeros(1,6);
confronto.men.B_individual_STD.int_giri(7,:)=zeros(1,6);
confronto.men.B_individual_STD.int_giri(8,:)=zeros(1,6);
confronto.men.B_individual_STD.int_giri(9,:)=zeros(1,6);
confronto.men.B_individual_STD.int_giri(10,:)=zeros(1,6);

    % XC_middle
confronto.men.XC_middle_STD.int_giri(1,:)=int_g1_middle_M_STD;
confronto.men.XC_middle_STD.int_giri(2,:)=int_g2_middle_M_STD;
confronto.men.XC_middle_STD.int_giri(3,:)=int_g3_middle_M_STD;
% per la classe 11.5
confronto.men.XC_middle_STD.int_giri(4,:)=zeros(1,6);
confronto.men.XC_middle_STD.int_giri(5,:)=zeros(1,6);
confronto.men.XC_middle_STD.int_giri(6,:)=zeros(1,6);

    % XC_long
confronto.men.XC_long_STD.int_giri(1,:)=int_g1_long_M_STD;
confronto.men.XC_long_STD.int_giri(2,:)=int_g2_long_M_STD;
confronto.men.XC_long_STD.int_giri(3,:)=int_g3_long_M_STD;
confronto.men.XC_long_STD.int_giri(4,:)=int_g4_long_M_STD;
confronto.men.XC_long_STD.int_giri(5,:)=int_g5_long_M_STD;
% per la classe 11.5
confronto.men.XC_long_STD.int_giri(6,:)=zeros(1,6);
confronto.men.XC_long_STD.int_giri(7,:)=zeros(1,6);
confronto.men.XC_long_STD.int_giri(8,:)=zeros(1,6);
confronto.men.XC_long_STD.int_giri(9,:)=zeros(1,6);
confronto.men.XC_long_STD.int_giri(10,:)=zeros(1,6);


save([cd '\all_races.mat'],'-struct','confronto');

% int_giri = ho mediato i valori dei segmenti di tutti gli atleti
% appartenenti alla stessa classe in base al giro.

%% grafico
int={'K1-K2','K2-K3','K1-K3','K4-K5','K5-K6','K7-K8'};

% DONNE
ngroups_W=4;
nbars=5;
groupwidth=min(0.8, nbars/(nbars+1.5));
```

```
figure(1)
for j=1:length(int)
    colonna1_MEAN=[confronto.women.B_sprint_MEAN.int_giri(:,j);NaN;NaN];
    colonna2_MEAN=[confronto.women.B_individual_MEAN.int_giri(:,j)];

colonna3_MEAN=[confronto.women.XC_middle_MEAN.int_giri(:,j);NaN;NaN;NaN];
    colonna4_MEAN=[confronto.women.XC_long_MEAN.int_giri(:,j);NaN];
    int_mean=[colonna1_MEAN colonna2_MEAN colonna3_MEAN colonna4_MEAN];
    colonna1_STD=[confronto.women.B_sprint_STD.int_giri(:,j);NaN;NaN];
    colonna2_STD=[confronto.women.B_individual_STD.int_giri(:,j)];
    colonna3_STD=[confronto.women.XC_middle_STD.int_giri(:,j);NaN;NaN;NaN];
    colonna4_STD=[confronto.women.XC_long_STD.int_giri(:,j);NaN];
    int_std=[colonna1_STD colonna2_STD colonna3_STD colonna4_STD];
    subplot(3,2,j);
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'B sprint','B individual','XC middle','XC
long'});
    hold on
    for i=1:nbars
        vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
        errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
    end
%dfxscw      ylim([0 max(int_mean(:,j,:)+10*int_std(:,j,:))]);
    ylabel(['intertempo ' int(j) ' [s]']);
    xlabel('gare');
    title(['DONNE (LW12): tempi medi dell intertempo'  int(j)]);
    hold off
end


% UOMINI
ngroups_M=4;
nbars=5;
groupwidth=min(0.8, nbars/(nbars+1.5));

% figure(2) media degli atleti appartanenti alla classe LW12
figure(2)
for j=1:length(int)
    colonna1_MEAN=[confronto.men.B_sprint_MEAN.int_giri(1:3,j);NaN;NaN];
    colonna2_MEAN=[confronto.men.B_individual_MEAN.int_giri(1:5,j)];
    colonna3_MEAN=[confronto.men.XC_middle_MEAN.int_giri(1:3,j);NaN;NaN];
    colonna4_MEAN=[confronto.men.XC_long_MEAN.int_giri(1:5,j)];

    int_mean=[colonna1_MEAN colonna2_MEAN colonna3_MEAN colonna4_MEAN];

    colonna1_STD=[confronto.men.B_sprint_STD.int_giri(1:3,j);NaN;NaN];
    colonna2_STD=[confronto.men.B_individual_STD.int_giri(1:5,j)];
    colonna3_STD=[confronto.men.XC_middle_STD.int_giri(1:3,j);NaN;NaN];
    colonna4_STD=[confronto.men.XC_long_STD.int_giri(1:5,j)];

    int_std=[colonna1_STD colonna2_STD colonna3_STD colonna4_STD];

    subplot(3,2,j);
%     yyaxis left
%     ylim([0 100*(1+10*max(int_std(:,j,:)./int_mean(:,j,:)))]);
%    ylabel(['intertempo_%' int(j) 'rispetto a LW12']);
```

```
%     yyaxis right
%     for p=1:4
        bar(int_mean','FaceColor','flat');
        for k = 1:size(int_mean',2)
            b(k).CData = k;
        end
        set(gca,'XTickLabel',{'B sprint','B individual','XC middle','XC
long'});
        hold on
        for i=1:nbars
            vett=(1:ngroups_W)-groupwidth/2+(2*i-1)*groupwidth/(2*nbars);
            errorbar(vett,int_mean(i,:)',int_std(i,:)','.k','LineWidth',1);
        end
%     end
%     ylim([0 max(int_mean(:,j,:)+10*int_std(:,j,:))]);
    ylabel(['intertempo ' int(j) ' [s]']);
    xlabel('gare');
    title(['UOMINI (LW12): tempi medi dell intertempo'  int(j)]);
    hold off
end


ngroups_M=4;
nbars=1;
groupwidth=min(0.8, nbars/(nbars+1.5));

% figure(3) Unico rappresentante della classe LW11.5
figure(3)
for j=1:length(int)
    colonna1_MEAN=[confronto.men.B_sprint_MEAN.int_giri(4:6,j);NaN;NaN];
    colonna2_MEAN=[confronto.men.B_individual_MEAN.int_giri(6:10,j)];
    colonna3_MEAN=[confronto.men.XC_middle_MEAN.int_giri(4:6,j);NaN;NaN];
    colonna4_MEAN=[confronto.men.XC_long_MEAN.int_giri(6:10,j)];

    int_mean=[colonna1_MEAN colonna2_MEAN colonna3_MEAN colonna4_MEAN];

    subplot(3,2,j);
%     yyaxis left
%     ylim([0 100*(1+10*max(int_std(:,j,:)./int_mean(:,j,:)))]);
%    ylabel(['intertempo_%' int(j) 'rispetto a LW12']);
%     yyaxis right
    bar(int_mean','FaceColor','flat');
    for k = 1:size(int_mean',2)
        b(k).CData = k;
    end
    set(gca,'XTickLabel',{'B sprint','B individual','XC middle','XC
long'});
    ylabel(['intertempo ' int(j) ' [s]']);
    xlabel('gare');
    title(['Ivan Golubkov (LW11.5): intertempo'  int(j)]);

end
```

d.2.2) Statistica

```
%% ALL RACES

clc
```

```
clear all
close all

nome='All_races';
all_races=load([cd '\' nome '\all_races.mat']);

genere={'DONNE','UOMINI'};
gara=categorical({'1','2','3','4'});
int={'K1-K2 UPHILL MIDDLE','K2-K3 UPHILL STEEP','K1-K3 UPHILL TOTAL','K4-K5
FLAT','K5-K6 CURVE','K7-K8 DOWNHILL'};

filepath_save1=[cd '\' nome '\' genere{1}];
filepath_save2=[cd '\' nome '\' genere{2}];
filepath_save11=[cd '\' nome '\' genere{1} '\GRAFICI'];
filepath_save22=[cd '\' nome '\' genere{2} '\GRAFICI'];

ngare=4;
intertempi=6;
natletiW=size(all_races.women.XC_middle,1);
natletiM=size(all_races.men.XC_middle,1);

%% DONNE
for i=1:natletiW
        % B_sprint (3 giri)
   int_temp=[all_races.women.B_sprint(i).intertempi_giro1;
all_races.women.B_sprint(i).intertempi_giro2;
all_races.women.B_sprint(i).intertempi_giro3];
   all_races.women.B_sprint(i).intertempi_medi=nanmean(int_temp);
   all_races.women.B_sprint(i).std_intertempi=nanstd(int_temp);
        % B_individual (5 giri)
   int_temp=[all_races.women.B_individual(i).intertempi_giro1;
all_races.women.B_individual(i).intertempi_giro2;
all_races.women.B_individual(i).intertempi_giro3;
all_races.women.B_individual(i).intertempi_giro4;
all_races.women.B_individual(i).intertempi_giro5;];
   all_races.women.B_individual(i).intertempi_medi=nanmean(int_temp);
   all_races.women.B_individual(i).std_intertempi=nanstd(int_temp);
        % XC_middle (2 giri)
   int_temp=[all_races.women.XC_middle(i).intertempi_giro1;
all_races.women.XC_middle(i).intertempi_giro2];
   all_races.women.XC_middle(i).intertempi_medi=nanmean(int_temp);
   all_races.women.XC_middle(i).std_intertempi=nanstd(int_temp);
        % XC_long (4 giri)
   int_temp=[all_races.women.XC_long(i).intertempi_giro1;
all_races.women.XC_long(i).intertempi_giro2;
all_races.women.XC_long(i).intertempi_giro3;
all_races.women.XC_long(i).intertempi_giro4];
   all_races.women.XC_long(i).intertempi_medi=nanmean(int_temp);
   all_races.women.XC_long(i).std_intertempi=nanstd(int_temp);
end

matrW_B_sprint=[all_races.women.B_sprint(1).intertempi_medi NaN;
all_races.women.B_sprint(2).intertempi_medi NaN;
all_races.women.B_sprint(3).intertempi_medi NaN;
all_races.women.B_sprint(4).intertempi_medi NaN;
all_races.women.B_sprint(5).intertempi_medi NaN];
matrW_B_individual=[all_races.women.B_individual(1).intertempi_medi;
all_races.women.B_individual(2).intertempi_medi;
all_races.women.B_individual(3).intertempi_medi;
```

```
all_races.women.B_individual(4).intertempi_medi;
all_races.women.B_individual(5).intertempi_medi];
matrW_XC_middle=[all_races.women.XC_middle(1).intertempi_medi;
all_races.women.XC_middle(2).intertempi_medi;
all_races.women.XC_middle(3).intertempi_medi;
all_races.women.XC_middle(4).intertempi_medi;
all_races.women.XC_middle(5).intertempi_medi];
matrW_XC_long=[all_races.women.XC_long(1).intertempi_medi;
all_races.women.XC_long(2).intertempi_medi;
all_races.women.XC_long(3).intertempi_medi;
all_races.women.XC_long(4).intertempi_medi;
all_races.women.XC_long(5).intertempi_medi];


statisticaW=NaN(6,6,intertempi);
p_valueW=NaN(1,intertempi);

% Devo considerare a parte il caso k = 6 (tratto K7-K8 DOWNHILL) perché non
è
% stato rilevato nella gara B_sprint (nel caso della statistica). Per la
% parte grafica inserisco un NaN nella relativa posizione del tratto K7-K8
% all'interno della matrice ristretta.
tempW=zeros(natletiW,ngare,intertempi);
for k=1:intertempi
    if k==6
        temporaneaW_temp(:,1)=matrW_B_individual(:,k);
        temporaneaW_temp(:,2)=matrW_XC_middle(:,k);
        temporaneaW_temp(:,3)=matrW_XC_long(:,k);

        [p,tbl,stats]=friedman(temporaneaW_temp);
        p_valueW(k)=p;
        if p<0.05
            result=multcompare(stats);
            statisticaW_k7k8=result;
        end
        ristrettaW_temp=nanmean(temporaneaW_temp);
        ristrettaW(k,:)=[NaN ristrettaW_temp];
        tempW(:,1,k)=NaN(5,1);
        tempW(:,2:4,k)=temporaneaW_temp;
    else
        temporaneaW(:,1)=matrW_B_sprint(:,k);
        temporaneaW(:,2)=matrW_B_individual(:,k);
        temporaneaW(:,3)=matrW_XC_middle(:,k);
        temporaneaW(:,4)=matrW_XC_long(:,k);

        [p,tbl,stats]=friedman(temporaneaW);
        p_valueW(k)=p;
        if p<0.05
            result=multcompare(stats,'Display','off');
            statisticaW(:,:,k)=result;
        end
        ristrettaW(k,:)=nanmean(temporaneaW);
        tempW(:,:,k)=temporaneaW;
    end
end

for j =1:intertempi
    figure()
    boxplot(tempW(:,:,j))
```

```
    set(gca,'XTickLabel',{'B sprint','B individual','XC middle','XC
long'});
    ylabel('[s]');
    title('CONFRONTO GARE - DONNE');
    hold on
end
hold off

%% UOMINI
for i=1:natletiM
        % B_sprint (3 giri)
   int_temp=[all_races.men.B_sprint(i).intertempi_giro1;
all_races.men.B_sprint(i).intertempi_giro2;
all_races.men.B_sprint(i).intertempi_giro3];
   all_races.men.B_sprint(i).intertempi_medi=nanmean(int_temp);
   all_races.men.B_sprint(i).std_intertempi=nanstd(int_temp);
        % B_individual (5 giri)
   int_temp=[all_races.men.B_individual(i).intertempi_giro1;
all_races.men.B_individual(i).intertempi_giro2;
all_races.men.B_individual(i).intertempi_giro3;
all_races.men.B_individual(i).intertempi_giro4;
all_races.men.B_individual(i).intertempi_giro5;];
   all_races.men.B_individual(i).intertempi_medi=nanmean(int_temp);
   all_races.men.B_individual(i).std_intertempi=nanstd(int_temp);
        % XC_middle (3 giri)
   int_temp=[all_races.men.XC_middle(i).intertempi_giro1;
all_races.men.XC_middle(i).intertempi_giro2;
all_races.men.XC_middle(i).intertempi_giro3];
   all_races.men.XC_middle(i).intertempi_medi=nanmean(int_temp);
   all_races.men.XC_middle(i).std_intertempi=nanstd(int_temp);
        % XC_long (5 giri)
   int_temp=[all_races.men.XC_long(i).intertempi_giro1;
all_races.men.XC_long(i).intertempi_giro2;
all_races.men.XC_long(i).intertempi_giro3;
all_races.men.XC_long(i).intertempi_giro4;
all_races.men.XC_long(i).intertempi_giro5];
   all_races.men.XC_long(i).intertempi_medi=nanmean(int_temp);
   all_races.men.XC_long(i).std_intertempi=nanstd(int_temp);
end

matrM_B_sprint=[all_races.men.B_sprint(1).intertempi_medi NaN;
all_races.men.B_sprint(2).intertempi_medi NaN;
all_races.men.B_sprint(3).intertempi_medi NaN;
all_races.men.B_sprint(4).intertempi_medi NaN;
all_races.men.B_sprint(5).intertempi_medi NaN;
all_races.men.B_sprint(6).intertempi_medi NaN;
all_races.men.B_sprint(7).intertempi_medi NaN;
all_races.men.B_sprint(8).intertempi_medi NaN];
matrM_B_individual=[all_races.men.B_individual(1).intertempi_medi;
all_races.men.B_individual(2).intertempi_medi;
all_races.men.B_individual(3).intertempi_medi;
all_races.men.B_individual(4).intertempi_medi;
all_races.men.B_individual(5).intertempi_medi;
all_races.men.B_individual(6).intertempi_medi;
all_races.men.B_individual(7).intertempi_medi;
all_races.men.B_individual(8).intertempi_medi];
matrM_XC_middle=[all_races.men.XC_middle(1).intertempi_medi;
all_races.men.XC_middle(2).intertempi_medi;
all_races.men.XC_middle(3).intertempi_medi;
all_races.men.XC_middle(4).intertempi_medi;
all_races.men.XC_middle(5).intertempi_medi;
```

```
all_races.men.XC_middle(6).intertempi_medi;
all_races.men.XC_middle(7).intertempi_medi;
all_races.men.XC_middle(8).intertempi_medi];
matrM_XC_long=[all_races.men.XC_long(1).intertempi_medi;
all_races.men.XC_long(2).intertempi_medi;
all_races.men.XC_long(3).intertempi_medi;
all_races.men.XC_long(4).intertempi_medi;
all_races.men.XC_long(5).intertempi_medi;
all_races.men.XC_long(6).intertempi_medi;
all_races.men.XC_long(7).intertempi_medi;
all_races.men.XC_long(8).intertempi_medi];


statisticaM=NaN(6,6,intertempi);
p_valueM=NaN(1,intertempi);

tempM=zeros(natletiM,ngare,intertempi);
for k=1:intertempi
    if k==6
        temporaneaM_temp(:,1)=matrM_B_individual(:,k);
        temporaneaM_temp(:,2)=matrM_XC_middle(:,k);
        temporaneaM_temp(:,3)=matrM_XC_long(:,k);

        [p,tbl,stats]=friedman(temporaneaM_temp);
        p_valueM(k)=p;
        if p<0.05
            result=multcompare(stats);
            statisticaM_k7k8=result;
        end
        ristrettaM_temp=nanmean(temporaneaM_temp);
        ristrettaM(k,:)=[NaN ristrettaM_temp];
        tempM(:,1,k)=NaN(8,1);
        tempM(:,2:4,k)=temporaneaM_temp;
    else
        temporaneaM(:,1)=matrM_B_sprint(:,k);
        temporaneaM(:,2)=matrM_B_individual(:,k);
        temporaneaM(:,3)=matrM_XC_middle(:,k);
        temporaneaM(:,4)=matrM_XC_long(:,k);

        [p,tbl,stats]=friedman(temporaneaM);
        p_valueM(k)=p;
        if p<0.05
            result=multcompare(stats,'Display','off');
            statisticaM(:,:,k)=result;
        end
        ristrettaM(k,:)=nanmean(temporaneaM);
        tempM(:,:,k)=temporaneaM;
    end
end

for j =1:intertempi
    figure()
    boxplot(tempM(:,:,j))
    set(gca,'XTickLabel',{'B sprint','B individual','XC middle','XC
long'});
    ylabel('[s]');
    title('CONFRONTO GARE - UOMINI');
    hold on
end
hold off
```

```
%% SALVATAGGIO
% Nella statistica_k7k8 manca la gara B_sprint(sia per gli uomini che per
% le donne), per cui:
%           - 1 = B_individual
%           - 2 = XC_middle
%           - 3 = XC_long
% Nel post processing inserisco correttamente statistica_k7k8 all'interno
% della matrice generale statistica.
save ([filepath_save1 '\all_races_statisticaW.mat'],'statisticaW');
save ([filepath_save1
'\all_races_statisticaW_k7k8.mat'],'statisticaW_k7k8');
save ([filepath_save1 '\all_races_ristrettaW.mat'],'ristrettaW');
save ([filepath_save1 '\all_races_p_valueW.mat'],'p_valueW');

save ([filepath_save2 '\all_races_statisticaM.mat'],'statisticaM');
save ([filepath_save2
'\all_races_statisticaM_k7k8.mat'],'statisticaM_k7k8');
save ([filepath_save2 '\all_races_ristrettaM.mat'],'ristrettaM');
save ([filepath_save2 '\all_races_p_valueM.mat'],'p_valueM');
```

APPENDICE E

e.1) Acquisizione dati e rappresentazione percorso gara

```
%% STEP 1
clear all
close all
clc

% Caricamento dei dati da file excel.
filepath = [cd];
filename = 'skitrack_rielaborato.xlsx';
[num,txt,total] = xlsread([filepath '\' filename]);

% !!!!!!!!!! ATTENZIONE!!!!!!!! fino alla riga 186 di num i punti si
susseguono,
% le ultime 4 righe rappresentano il traguardo, sono da graficare sopra il
% grafico precedente, non tutto insieme!!!!!!!!!!!

% Salvo la colonna contente i numeri dei punti: poiché a determinati
% punti corrispondono i punti di rilevamento dei tempi (i K) questo vettore
% serve poi per trovare la posizione di tali punti nei vettori delle
direzioni
% nord ed est.
% Dati relativi all'altitudine del percorso e alle coordinate dei sensori
% posti lungo il percorso
punti=num(:,1);
x_est=num(:,2);
y_nord=num(:,3);
z_altitudine=num(:,4);

% Posizione dei sensori nota.
sensori=[10 44 48 52 75 80 84 98 101];
x_sensori=x_est(sensori)-x_est(1);  % coord x --> EST
y_sensori=y_nord(sensori)-y_nord(1);  % coord y --> NORD
z_sensori=z_altitudine(sensori);  % coord z --> quota

%%
% Calcolo ogni coordinata NORD in gradi decimali.
% deg_N=num(:,2);
% prim_N=num(:,3);
% sec_N=num(:,4);
% nord_deg=deg_N+(prim_N+(sec_N/60))/60;

% Calcolo ogni coordinata EST in gradi decimali.
% deg_E=num(:,6);
% prim_E=num(:,7);
% sec_E=num(:,8);
% est_deg=deg_E+(prim_E+(sec_E/60))/60;

% Trasformazione da coordinate WGS84 (espresse in gradi decimali)
% a coordinate piane (espresse in metri)

% !!!!!!!!!!!! DA SISTEMARE I VALORI DI RIFERIMENTO !!!!!!!!!!!
% lla=[nord_deg est_deg altitudine];
% llo=[0 45];      %!!!!!!
% psio=5;          %!!!!!!
% href=-100;       %!!!!!!!
% ellipsoidModel='WGS84';
```

```
% flatheart_pos=lla2flat(lla,llo,psio,href,ellipsoidModel);
%
% ELL=[est_deg nord_deg altitudine];
% ellips='wgs84';
% CART=ell2cart(ELL,ellips);
%
% lon=nord_deg.*(pi/180);
% lat=est_deg.*(pi/180);
% h=altitudine;
% [x,y,z]=ell2xyz(lat,lon,h);

%%
% Punti contigui del tracciato di gara
punti_gara=punti(1:186);
y_nord_gara=y_nord(1:186)-y_nord(1);
x_est_gara=x_est(1:186)-x_est(1);
z_alt_gara=z_altitudine(1:186);

% tratto finale della gara (non compreso nei giri, tranne che nell'ultimo)
pti_fin=[165 190 189 188 187];
punti_fin=punti(pti_fin);
y_nord_fin=y_nord(pti_fin)-y_nord(1);
x_est_fin=x_est(pti_fin)-x_est(1);
z_alt_fin=z_altitudine(pti_fin);

%%
% (figure(1)) Rappresentazione 2D del percorso di gara con segnate anche le
% posizioni dei marker.
figure()
plot(x_est_gara,y_nord_gara,'b','LineWidth',1.5);
title('mappa 2D (dall alto) del tracciato di gara con la posizioni dei
sensori');
hold on
plot(x_est_fin,y_nord_fin,'r','LineWidth',1.5);
plot(x_sensori,y_sensori,'or','LineWidth',3);
text(x_sensori(1),y_sensori(1),'START^{ }')
text(x_sensori(2),y_sensori(2),'K1^{ }')
text(x_sensori(3),y_sensori(3),'K2^{ }')
text(x_sensori(4),y_sensori(4),'K3^{ }')
text(x_sensori(5),y_sensori(5),'K4^{ }')
text(x_sensori(6),y_sensori(6),'K5^{ }')
text(x_sensori(7),y_sensori(7),'K6^{ }')
text(x_sensori(8),y_sensori(8),'K7^{ }')
text(x_sensori(9),y_sensori(9),'K8^{ }')
hold off
xlabel('EST [m]')
ylabel('NORD [m]')
saveas(gcf,[cd '\STEP1' '\percorso_gara_2D.fig']);

%% SALVATAGGIO

filepath_save=[cd '\STEP1'];
save([filepath_save '\y_nord.mat'],'y_nord');
save([filepath_save '\x_est.mat'],'x_est');
save([filepath_save '\z_altitudine.mat'],'z_altitudine');
save([filepath_save '\punti.mat'],'punti');
```

e.2) Segmenti

```
%% STEP 2

clc
clear all
close all

filepath=[cd '\STEP1'];
load([filepath '\y_nord.mat']);
load([filepath '\x_est.mat']);
load([filepath '\z_altitudine.mat']);
load([filepath '\punti.mat']);

% posizione dei sensori nota
sensori=[10 44 48 52 75 80 84 98 101];

%Punti contigui del tracciato di gara
punti_gara=punti(1:186);
y_nord_gara=y_nord(1:186);
x_est_gara=x_est(1:186);
z_alt_gara=z_altitudine(1:186);

% tratto finale della gara (non compreso nei giri, tranne che nell'ultimo)
pti_fin=[165 190 189 188 187];
punti_fin=punti(pti_fin);
y_nord_fin=y_nord(pti_fin);
x_est_fin=x_est(pti_fin);
z_alt_fin=z_altitudine(pti_fin);
z_sensori=z_alt_gara(sensori);

%% NO TRATTO FINALE
dist3D_pp(1)=0;
dist2D_pp(1)=0;
pendenza_percentuale_pp(1)=NaN; % non ho un pto precedente al primo per
poterlo calcolare
pendenza_gradi_pp(1)=NaN;

% Calcolo tutte le distanze 3D e 2D e la pendenza percentuale e in gradi
% tra due punti successivi.
for i=1:length(punti_gara)-1
    dist3D_pp(i+1)=sqrt((y_nord(i+1)-y_nord(i))^2+(x_est(i+1)-
x_est(i))^2+(z_altitudine(i+1)-z_altitudine(i))^2);
    dist2D_pp(i+1)=sqrt((y_nord(i+1)-y_nord(i))^2+(x_est(i+1)-x_est(i))^2);
    pendenza_percentuale_pp(i+1)=(z_alt_gara(i+1)-
z_alt_gara(i))/(dist2D_pp(i+1))*100;
    pendenza_gradi_pp(i+1)=atan2d(z_alt_gara(i+1)-
z_alt_gara(i),dist2D_pp(i+1));
end

% distanza incrementale tra ogni pto del percorso
l_p3D(1)=0;
l_p2D(1)=0;
for i=1:length(punti_gara)-1
    l_p3D(i+1)=l_p3D(i)+dist3D_pp(i+1);
    l_p2D(i+1)=l_p2D(i)+dist2D_pp(i+1);
end

% Calcolo la distanza 3D e 2D di ogni punto da quello di partenza. Il pto
```

```
% di parzenza è in posizione 10
l_STARTp3D=0;
l_STARTp2D=0;
for i=1:length(punti_gara)-1-9
    l_STARTp3D(i+1)=l_STARTp3D(i)+dist3D_pp(i+9);
    l_STARTp2D(i+1)=l_STARTp2D(i)+dist2D_pp(i+9);
end

% Distanza tra i vari sensori --> ottengo la lunghezza dei vari segmenti.
% è compresa anche la distanza tra start e K1.
% Insieme calcolo anche la pendenza media di ogni segmento.
for i=1:length(sensori)-1
    l_KK3D(i)=l_p3D(sensori(i+1))-l_p3D(sensori(i));
    l_KK2D(i)=l_p2D(sensori(i+1))-l_p2D(sensori(i));
%     Vado a valutare la pendenza dei sengmenti considerando che le
%     distanze pto - pto tra i 2 K non sono omogenee, ma cambiano di volta
%     in volta --> valuto il "peso" del valore di pendenza pto-pto in base
%     alla sua lunghezza rispetto alla lunghezza totale del segmento
    peso_pendenza_perc_pp=NaN(1,sensori(i+1)-sensori(i));
    peso_pendenza_gradi_pp=NaN(1,sensori(i+1)-sensori(i));
    for j=sensori(i):sensori(i+1)-1
        peso_temp_pp=(dist2D_pp(j+1))/l_KK2D(i);
        peso_pendenza_perc_pp(j+1-
sensori(i))=pendenza_percentuale_pp(j+1)*peso_temp_pp;
        peso_pendenza_gradi_pp(j+1-
sensori(i))=pendenza_gradi_pp(j+1)*peso_temp_pp;
    end
    pendenza_percentuale_segmenti(i)=sum(peso_pendenza_perc_pp);
    pendenza_gradi_segmenti(i)=sum(peso_pendenza_gradi_pp);
end
    % legenda dei valori in pendenza:
    % 1) K1-START
    % 2) K2-K1
    % 3) K3-K2
    % 4) K4-K3
    % 5) K5-K4
    % 6) K6-K5
    % 7) K7-K6
    % 8) K8-K7

% CALCOLO PENDENZA SEGMENTO K1-K3
l_K1K33D=l_p3D(sensori(4))-l_p3D(sensori(2));
l_K1K32D=l_p2D(sensori(4))-l_p2D(sensori(2));

for q=sensori(2):sensori(4)-1
    peso_temp_ppK1K3=(dist2D_pp(q+1))/l_K1K32D;
    peso_pendenza_perc_ppK1K3(q+1-
sensori(2))=pendenza_percentuale_pp(q+1)*peso_temp_ppK1K3;
    peso_pendenza_gradi_ppK1K3(q+1-
sensori(2))=pendenza_gradi_pp(q+1)*peso_temp_ppK1K3;
end
pendenza_percentuale_K1K3=sum(peso_pendenza_perc_ppK1K3);
pendenza_gradi_K1K3=sum(peso_pendenza_gradi_ppK1K3);

%% LUNGHEZZA DEI GIRI + GARE

%           - Biathlon sprint:       DONNE: 2 km         UOMINI 2.5 km
%           - Biathlon individual:   DONNE: 2.5 km       UOMINI 3 km
%           - Cross country middle:  DONNE: 2.5 km       UOMINI 2.5 km
%           - Cross country long:    DONNE: 3 km         UOMINI 3 km
```

```
%%
figure()
plot(l_p2D,z_alt_gara,'-b','LineWidth',1.5)
ylabel('Altitudine [m]')
xlabel('Distanza percorso [m]')
hold on
plot(l_p2D(sensori),z_sensori,'or','LineWidth',3);
hold on
% permettono di inserire l'etichetta ad ogni punto rosso rappresentante i
% sensori.
text(l_p2D(sensori(1)),z_sensori(1),'START^{ }')
text(l_p2D(sensori(2)),z_sensori(2),'K1^{ }')
text(l_p2D(sensori(3)),z_sensori(3),'K2^{ }')
text(l_p2D(sensori(4)),z_sensori(4),'K3^{ }')
text(l_p2D(sensori(5)),z_sensori(5),'K4^{ }')
text(l_p2D(sensori(6)),z_sensori(6),'K5^{ }')
text(l_p2D(sensori(7)),z_sensori(7),'K6^{ }')
text(l_p2D(sensori(8)),z_sensori(8),'K7^{ }')
text(l_p2D(sensori(9)),z_sensori(9),'K8^{ }')
title('Andamento del tracciato di gara')
hold off
saveas(gcf,[cd '\STEP2' '\andamento_tracciato_gara.fig']);

etichetta={'START^{ }' 'K1^{ }' 'K2^{ }' 'K3^{ }' 'K4^{ }' 'K5^{ }' 'K6^{
}' 'K7^{ }' 'K8^{ }'};
tratti={'MISTO' 'UPHILL MIDDLE' 'UPHILL STEEP' 'MISTO' 'FLAT' 'CURVE'
'MISTO' 'DOWNHILL'};
lim_sup=6;
lim_inf=-6;
lim=lim_sup;
for u=1:length(sensori)-1
    figure(u)
    dist_x=l_p2D(sensori(u):sensori(u+1))-l_p2D(sensori(u));
    dist_y=z_alt_gara(sensori(u):sensori(u+1))-z_alt_gara(sensori(u));
    plot(dist_x,dist_y,'-b','LineWidth',1.5)
    if u==length(sensori)-1
        lim=lim_inf;
        ylim([lim inf]);
    else
        ylim([-inf lim]);
    end
    ylabel('Altitudine [m]')
    xlabel('Distanza percorso [m]')
    hold on
    plot(l_p2D(sensori(u))-l_p2D(sensori(u)),z_sensori(u)-
z_sensori(u),'or','LineWidth',3);
    hold on
    plot(l_p2D(sensori(u+1))-l_p2D(sensori(u)),z_sensori(u+1)-
z_sensori(u),'or','LineWidth',3);
    hold on
    text(l_p2D(sensori(u))-l_p2D(sensori(u)),z_sensori(u)-
z_sensori(u),etichetta(u));
    text(l_p2D(sensori(u+1))-l_p2D(sensori(u)),z_sensori(u+1)-
z_sensori(u),etichetta(u+1));
    title(tratti(u));
    hold off
end
% saveas(gcf,[cd '\STEP2' '\' 'filename_save' '.fig']);
%% SALVATAGGIO LUNGHEZZE SEGMENTI + GIRI + GARA TOTALE
filepath_save=[cd '\STEP2'];
```

```
save([filepath_save '\l_segmenti3D.mat'],'l_KK3D');
save([filepath_save '\l_segmentoK1K33D.mat'],'l_K1K33D');
save([filepath_save '\l_segmenti2D.mat'],'l_KK2D');
save([filepath_save '\l_segmentoK1K32D.mat'],'l_K1K32D');
save([filepath_save
'\pendenza_percentuale_seg.mat'],'pendenza_percentuale_segmenti');
save([filepath_save '\pendenza_gradi_seg.mat'],'pendenza_gradi_segmenti');
save([filepath_save
'\pendenza_percentuale_K1K3.mat'],'pendenza_percentuale_K1K3');
save([filepath_save '\pendenza_gradi_K1K3.mat'],'pendenza_gradi_K1K3');
save([filepath_save '\distanza2D_0_pto.mat'],'l_p2D');
```

APPENDICE F

f.1) Biathlon sprint

```
%% BIATHLON SPRINT
clc
clear all
close all

nome_gara='\Biathlon_sprint';
filepath= [cd nome_gara];
filepath_save=[cd nome_gara];
filepath_save2=[cd nome_gara '\STEP2_GRAFICI'];
B_sprint_T=load([filepath '\B_sprint_finale.mat']);
load([cd '\dati' '\l_segmenti3D.mat']);
load([cd '\dati' '\l_segmentoK1K33D.mat']);

% Creazione del vettore classi
c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
nsegmentiW=length(B_sprint_T.women.MEAN.intertempi_giro1);
nsegmentiM=length(B_sprint_T.men.MEAN.intertempi_giro1);
nclassi=5;
classe={'LW10' 'LW10_5' 'LW11' 'LW11_5' 'LW12'};

%% DATI NOTI E CALCOLATI SULLE DISTANZE
% dall'IPC:
l_B_sprintW=6000;  % metri
l_B_sprintM=7500;

% Per i segmenti K1-K2, K2-K3, K1-K3, K4-K5, K5-K6 e K7-K8 devo considerare
% le lunghezze:

lseg=[l_KK3D(2) l_KK3D(3) l_KK3D(2)+l_KK3D(3) l_KK3D(5) l_KK3D(6)];
% segmenti intermedi misti
lSTARTK1=l_KK3D(1);
lK3K4=l_KK3D(4);
lK6K7=l_KK3D(7);
%% CALCOLO DELLE VELOCITà PER OGNI ATLETA
% Inverto tutti i valori all'interno dei campi delle struct e li moltiplico
% per il corretto valore della distanza --> in questo modo ottengo i valori
% di velocità in m/s --> moltiplicando anche per 3.6 ottengo i valori delle
% velocità in km/h.

% DONNE
for i=1:nclassi
    if isempty(B_sprint_T.women.(classe{i}))==0
        for j=1:length(B_sprint_T.women.(classe{i}))

B_sprint_V.women.(classe{i})(j).first_name=B_sprint_T.women.(classe{i})(j).
first_name;

B_sprint_V.women.(classe{i})(j).last_name=B_sprint_T.women.(classe{i})(j).l
ast_name;

B_sprint_V.women.(classe{i})(j).v_gara=l_B_sprintW*3.6/B_sprint_T.women.(cl
asse{i})(j).finish_time;
            for k=1:length(lseg)

B_sprint_V.women.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/B_sprint_T.women.(cl
asse{i})(j).intertempi_giro1(k);
```

```
B_sprint_V.women.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/B_sprint_T.women.(cl
asse{i})(j).intertempi_giro2(k);

B_sprint_V.women.(classe{i})(j).vseg_g3(k)=3.6*lseg(k)/B_sprint_T.women.(cl
asse{i})(j).intertempi_giro3(k);
            end
        end
    else
        B_sprint_V.women.(classe{i}).v_gara=[];
        B_sprint_V.women.(classe{i}).vseg_g1=[];
        B_sprint_V.women.(classe{i}).vseg_g2=[];
        B_sprint_V.women.(classe{i}).vseg_g3=[];
    end
end

% UOMINI
for i=1:nclassi
    if isempty(B_sprint_T.men.(classe{i}))==0
        for j=1:length(B_sprint_T.men.(classe{i}))

B_sprint_V.men.(classe{i})(j).first_name=B_sprint_T.men.(classe{i})(j).firs
t_name;

B_sprint_V.men.(classe{i})(j).last_name=B_sprint_T.men.(classe{i})(j).last_
name;

B_sprint_V.men.(classe{i})(j).v_gara=l_B_sprintM*3.6/B_sprint_T.men.(classe
{i})(j).finish_time;
            for k=1:length(lseg)

B_sprint_V.men.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/B_sprint_T.men.(classe
{i})(j).intertempi_giro1(k);

B_sprint_V.men.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/B_sprint_T.men.(classe
{i})(j).intertempi_giro2(k);

B_sprint_V.men.(classe{i})(j).vseg_g3(k)=3.6*lseg(k)/B_sprint_T.men.(classe
{i})(j).intertempi_giro3(k);
            end
        end
    else
        B_sprint_V.men.(classe{i}).v_gara=[];
        B_sprint_V.men.(classe{i}).vseg_g1=[];
        B_sprint_V.men.(classe{i}).vseg_g2=[];
        B_sprint_V.men.(classe{i}).vseg_g3=[];
    end
end

%% CALCOLO DELLE VELOCITà MEDIE E STD PER CLASSI

% DONNE
atletiW_classi=[0 3 1 0 6];
vgaraW=NaN(max(atletiW_classi),nclassi);
vseg_g1W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g2W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g3W=NaN(max(atletiW_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiW_classi(i)~=0
         for j=1:size(B_sprint_V.women.(classe{i}),2)
```

```
                vgaraW(j,i)=B_sprint_V.women.(classe{i})(j).v_gara;
                for m=1:length(lseg)
                    vseg_g1W(j,i,m)=B_sprint_V.women.(classe{i})(j).vseg_g1(m);
                    vseg_g2W(j,i,m)=B_sprint_V.women.(classe{i})(j).vseg_g2(m);
                    vseg_g3W(j,i,m)=B_sprint_V.women.(classe{i})(j).vseg_g3(m);
                end
            end
    end
end

for i=1:nclassi
    B_sprint_V.women.MEAN.v_gara=nanmean(vgaraW);
    B_sprint_V.women.STD.v_gara=nanstd(vgaraW);
end

for m=1:length(lseg)
    B_sprint_V.women.MEAN.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    B_sprint_V.women.MEAN.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
    B_sprint_V.women.MEAN.vseg_g3(m,:)=nanmean(vseg_g3W(:,:,m));
    B_sprint_V.women.STD.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    B_sprint_V.women.STD.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
    B_sprint_V.women.STD.vseg_g3(m,:)=nanmean(vseg_g3W(:,:,m));
end


% UOMINI
atletiM_classi=[1 0 1 2 10];
vgaraM=NaN(max(atletiM_classi),nclassi);
vseg_g1M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g2M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g3M=NaN(max(atletiM_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(B_sprint_V.men.(classe{i}),2)
            vgaraM(j,i)=B_sprint_V.men.(classe{i})(j).v_gara;
            for m=1:length(lseg)
                vseg_g1M(j,i,m)=B_sprint_V.men.(classe{i})(j).vseg_g1(m);
                vseg_g2M(j,i,m)=B_sprint_V.men.(classe{i})(j).vseg_g2(m);
                vseg_g3M(j,i,m)=B_sprint_V.men.(classe{i})(j).vseg_g3(m);
            end
        end
    end
end

for i=1:nclassi
    B_sprint_V.men.MEAN.v_gara=nanmean(vgaraM);
    B_sprint_V.men.STD.v_gara=nanstd(vgaraM);
end

for m=1:length(lseg)
    B_sprint_V.men.MEAN.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    B_sprint_V.men.MEAN.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    B_sprint_V.men.MEAN.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
    B_sprint_V.men.STD.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    B_sprint_V.men.STD.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    B_sprint_V.men.STD.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
end

%% CALCOLO DEI COEFFICIENTI CORRETTIVI:
```

```
% calcolo del coeff correttivo medio in base al tempo totale di gara (anche
% se avessi utilizzato la velocità media di gara il risultato non sarebbe
% cambiato)

%DONNE
t_gW=[B_sprint_T.women.MEAN.t_finale(1) B_sprint_T.women.MEAN.t_finale(2)
B_sprint_T.women.MEAN.t_finale(3) B_sprint_T.women.MEAN.t_finale(4)
B_sprint_T.women.MEAN.t_finale(5)]/B_sprint_T.women.MEAN.t_finale(5);
B_sprint_V.women.t_perc_gara=t_gW*100;
coeff_gara=1./t_gW;
B_sprint_V.women.coeff_perc_gara=coeff_gara*100;

% UOMINI
t_gM=[B_sprint_T.men.MEAN.t_finale(1) B_sprint_T.men.MEAN.t_finale(2)
B_sprint_T.men.MEAN.t_finale(3) B_sprint_T.men.MEAN.t_finale(4)
B_sprint_T.men.MEAN.t_finale(5)]/B_sprint_T.men.MEAN.t_finale(5);
B_sprint_V.men.t_perc_gara=t_gM*100;
coeff_gara=1./t_gM;
B_sprint_V.men.coeff_perc_gara=coeff_gara*100;



% calcolo dei coeff correttivi in base ai singoli segmenti che si sono
% valutati: in questo caso devo utilizzare la velocità media di ogni
% segmento per avere una congruenza tra i coefficienti dei vari segmenti
% (tengo in considerazione la variazione di lunghezza dei diversi segmenti)


lseg_tot=sum(lseg([1 2 4 5]));    % lunghezza totale dei segmenti valutati
peso_seg=lseg/lseg_tot; % da non considerare il 3° valore

% DONNE
B_sprint_V.women.MEAN.vseg_gm([1 2 3
5],:)=(B_sprint_V.women.MEAN.vseg_g1([1 2 3
5],:)+B_sprint_V.women.MEAN.vseg_g2([1 2 3
5],:)+B_sprint_V.women.MEAN.vseg_g3([1 2 3 5],:))/3;
B_sprint_V.women.MEAN.vseg_gm(4,:)=(B_sprint_V.women.MEAN.vseg_g1(4,:)+B_sp
rint_V.women.MEAN.vseg_g2(4,:))/2;
coeff_segW=[B_sprint_V.women.MEAN.vseg_gm(:,1)
B_sprint_V.women.MEAN.vseg_gm(:,2) B_sprint_V.women.MEAN.vseg_gm(:,3)
B_sprint_V.women.MEAN.vseg_gm(:,4)
B_sprint_V.women.MEAN.vseg_gm(:,5)]./B_sprint_V.women.MEAN.vseg_gm(:,5);
B_sprint_V.women.coeff_perc_seg=100*coeff_segW;
B_sprint_V.women.coeff_perc_gara_medio=[nanmean(B_sprint_V.women.coeff_perc
_seg([1 2 4 5],1)) nanmean(B_sprint_V.women.coeff_perc_seg([1 2 4 5],2))
nanmean(B_sprint_V.women.coeff_perc_seg([1 2 4 5],3))
nanmean(B_sprint_V.women.coeff_perc_seg([1 2 4 5],4))
nanmean(B_sprint_V.women.coeff_perc_seg([1 2 4 5],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempW(i,j)=B_sprint_V.women.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
B_sprint_V.women.coeff_perc_gara_pesato=[sum(tempW([1 2 4 5],1))
sum(tempW([1 2 4 5],2)) sum(tempW([1 2 4 5],3)) sum(tempW([1 2 4 5],4))
sum(tempW([1 2 4 5],5))];
```

```
% UOMINI
B_sprint_V.men.MEAN.vseg_gm([1 2 3 5],:)=(B_sprint_V.men.MEAN.vseg_g1([1 2
3 5],:)+B_sprint_V.men.MEAN.vseg_g2([1 2 3
5],:)+B_sprint_V.men.MEAN.vseg_g3([1 2 3 5],:))/3;
B_sprint_V.men.MEAN.vseg_gm(4,:)=(B_sprint_V.men.MEAN.vseg_g1(4,:)+B_sprint
_V.men.MEAN.vseg_g2(4,:))/2;
coeff_segM=[B_sprint_V.men.MEAN.vseg_gm(:,1)
B_sprint_V.men.MEAN.vseg_gm(:,2) B_sprint_V.men.MEAN.vseg_gm(:,3)
B_sprint_V.men.MEAN.vseg_gm(:,4)
B_sprint_V.men.MEAN.vseg_gm(:,5)]./B_sprint_V.men.MEAN.vseg_gm(:,5);
B_sprint_V.men.coeff_perc_seg=100*coeff_segM;
B_sprint_V.men.coeff_perc_gara_medio=[nanmean(B_sprint_V.men.coeff_perc_seg
([1 2 4 5],1)) nanmean(B_sprint_V.men.coeff_perc_seg([1 2 4 5],2))
nanmean(B_sprint_V.men.coeff_perc_seg([1 2 4 5],3))
nanmean(B_sprint_V.men.coeff_perc_seg([1 2 4 5],4))
nanmean(B_sprint_V.men.coeff_perc_seg([1 2 4 5],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempM(i,j)=B_sprint_V.men.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
B_sprint_V.men.coeff_perc_gara_pesato=[sum(tempM([1 2 4 5],1)) sum(tempM([1
2 4 5],2)) sum(tempM([1 2 4 5],3)) sum(tempM([1 2 4 5],4)) sum(tempM([1 2 4
5],5))];

%% SALVATAGGIO STRUTTURA DELLE VELOCITà

save([filepath_save '\B_sprint_velocita.mat'],'-struct','B_sprint_V');
```

f.2) Biathlon individual

```
%% CROSS COUNTRY LONG DISTANCE
clc
clear all
close all

nome_gara='\Biathlon_individual';
filepath= [cd nome_gara];
filepath_save=[cd nome_gara];
filepath_save2=[cd nome_gara '\STEP2_GRAFICI'];
B_individual_T=load([filepath '\B_individual_finale.mat']);
load([cd '\dati' '\l_segmenti3D.mat']);
load([cd '\dati' '\l_segmentoK1K33D.mat']);

% Creazione del vettore classi
c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
nsegmentiW=length(B_individual_T.women.MEAN.intertempi_giro1);
nsegmentiM=length(B_individual_T.men.MEAN.intertempi_giro1);
nclassi=5;
classe={'LW10' 'LW10_5' 'LW11' 'LW11_5' 'LW12'};

%% DATI NOTI E CALCOLATI SULLE DISTANZE
% dall'IPC:
l_B_individualW=12500;  % metri
l_B_individualeM=15000;

% Per i segmenti K1-K2, K2-K3, K1-K3, K4-K5, K5-K6 e K7-K8 devo considerare
```

```
% le lunghezze:

lseg=[l_KK3D(2) l_KK3D(3) l_KK3D(2)+l_KK3D(3) l_KK3D(5) l_KK3D(6)
l_KK3D(8)];
% segmenti intermedi misti
lSTARTK1=l_KK3D(1);
lK3K4=l_KK3D(4);
lK6K7=l_KK3D(7);
%% CALCOLO DELLE VELOCITà PER OGNI ATLETA
% Inverto tutti i valori all'interno dei campi delle struct e li moltiplico
% per il corretto valore della distanza --> in questo modo ottengo i valori
% di velocità in m/s --> moltiplicando anche per 3.6 ottengo i valori delle
% velocità in km/h.

% DONNE
for i=1:nclassi
    if isempty(B_individual_T.women.(classe{i}))==0
        for j=1:length(B_individual_T.women.(classe{i}))

B_individual_V.women.(classe{i})(j).first_name=B_individual_T.women.(classe
{i})(j).first_name;

B_individual_V.women.(classe{i})(j).last_name=B_individual_T.women.(classe{
i})(j).last_name;

B_individual_V.women.(classe{i})(j).v_gara=l_B_individualW*3.6/B_individual
_T.women.(classe{i})(j).finish_time;
            for k=1:length(lseg)

B_individual_V.women.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/B_individual_T.w
omen.(classe{i})(j).intertempi_giro1(k);

B_individual_V.women.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/B_individual_T.w
omen.(classe{i})(j).intertempi_giro2(k);

B_individual_V.women.(classe{i})(j).vseg_g3(k)=3.6*lseg(k)/B_individual_T.w
omen.(classe{i})(j).intertempi_giro3(k);

B_individual_V.women.(classe{i})(j).vseg_g4(k)=3.6*lseg(k)/B_individual_T.w
omen.(classe{i})(j).intertempi_giro4(k);

B_individual_V.women.(classe{i})(j).vseg_g5(k)=3.6*lseg(k)/B_individual_T.w
omen.(classe{i})(j).intertempi_giro5(k);
            end
        end
    else
        B_individual_V.women.(classe{i}).v_gara=[];
        B_individual_V.women.(classe{i}).vseg_g1=[];
        B_individual_V.women.(classe{i}).vseg_g2=[];
        B_individual_V.women.(classe{i}).vseg_g3=[];
        B_individual_V.women.(classe{i}).vseg_g4=[];
        B_individual_V.women.(classe{i}).vseg_g5=[];
    end
end

% UOMINI
for i=1:nclassi
    if isempty(B_individual_T.men.(classe{i}))==0
        for j=1:length(B_individual_T.men.(classe{i}))
```

```
B_individual_V.men.(classe{i})(j).first_name=B_individual_T.men.(classe{i})
(j).first_name;

B_individual_V.men.(classe{i})(j).last_name=B_individual_T.men.(classe{i})(
j).last_name;

B_individual_V.men.(classe{i})(j).v_gara=l_B_individualeM*3.6/B_individual_
T.men.(classe{i})(j).finish_time;
            for k=1:length(lseg)

B_individual_V.men.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/B_individual_T.men
.(classe{i})(j).intertempi_giro1(k);

B_individual_V.men.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/B_individual_T.men
.(classe{i})(j).intertempi_giro2(k);

B_individual_V.men.(classe{i})(j).vseg_g3(k)=3.6*lseg(k)/B_individual_T.men
.(classe{i})(j).intertempi_giro3(k);

B_individual_V.men.(classe{i})(j).vseg_g4(k)=3.6*lseg(k)/B_individual_T.men
.(classe{i})(j).intertempi_giro4(k);

B_individual_V.men.(classe{i})(j).vseg_g5(k)=3.6*lseg(k)/B_individual_T.men
.(classe{i})(j).intertempi_giro5(k);
            end
        end
    else
        B_individual_V.men.(classe{i}).v_gara=[];
        B_individual_V.men.(classe{i}).vseg_g1=[];
        B_individual_V.men.(classe{i}).vseg_g2=[];
        B_individual_V.men.(classe{i}).vseg_g3=[];
        B_individual_V.men.(classe{i}).vseg_g4=[];
        B_individual_V.men.(classe{i}).vseg_g5=[];
    end
end

%% CALCOLO DELLE VELOCITà MEDIE E STD PER CLASSI

% DONNE
atletiW_classi=[0 1 1 0 6];
vgaraW=NaN(max(atletiW_classi),nclassi);
vseg_g1W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g2W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g3W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g4W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g5W=NaN(max(atletiW_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiW_classi(i)~=0
         for j=1:size(B_individual_V.women.(classe{i}),2)
            vgaraW(j,i)=B_individual_V.women.(classe{i})(j).v_gara;
            for m=1:length(lseg)

vseg_g1W(j,i,m)=B_individual_V.women.(classe{i})(j).vseg_g1(m);

vseg_g2W(j,i,m)=B_individual_V.women.(classe{i})(j).vseg_g2(m);

vseg_g3W(j,i,m)=B_individual_V.women.(classe{i})(j).vseg_g3(m);

vseg_g4W(j,i,m)=B_individual_V.women.(classe{i})(j).vseg_g4(m);
```

```
vseg_g5W(j,i,m)=B_individual_V.women.(classe{i})(j).vseg_g5(m);
            end
         end
    end
end

for i=1:nclassi
    B_individual_V.women.MEAN.v_gara=nanmean(vgaraW);
    B_individual_V.women.STD.v_gara=nanstd(vgaraW);
end

for m=1:length(lseg)
    B_individual_V.women.MEAN.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    B_individual_V.women.MEAN.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
    B_individual_V.women.MEAN.vseg_g3(m,:)=nanmean(vseg_g3W(:,:,m));
    B_individual_V.women.MEAN.vseg_g4(m,:)=nanmean(vseg_g4W(:,:,m));
    B_individual_V.women.MEAN.vseg_g5(m,:)=nanmean(vseg_g5W(:,:,m));
    B_individual_V.women.STD.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    B_individual_V.women.STD.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
    B_individual_V.women.STD.vseg_g3(m,:)=nanmean(vseg_g3W(:,:,m));
    B_individual_V.women.STD.vseg_g4(m,:)=nanmean(vseg_g4W(:,:,m));
    B_individual_V.women.STD.vseg_g5(m,:)=nanmean(vseg_g5W(:,:,m));
end


% UOMINI
atletiM_classi=[0 0 0 2 10];
vgaraM=NaN(max(atletiM_classi),nclassi);
vseg_g1M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g2M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g3M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g4M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g5M=NaN(max(atletiM_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(B_individual_V.men.(classe{i}),2)
            vgaraM(j,i)=B_individual_V.men.(classe{i})(j).v_gara;
            for m=1:length(lseg)

vseg_g1M(j,i,m)=B_individual_V.men.(classe{i})(j).vseg_g1(m);

vseg_g2M(j,i,m)=B_individual_V.men.(classe{i})(j).vseg_g2(m);

vseg_g3M(j,i,m)=B_individual_V.men.(classe{i})(j).vseg_g3(m);

vseg_g4M(j,i,m)=B_individual_V.men.(classe{i})(j).vseg_g4(m);

vseg_g5M(j,i,m)=B_individual_V.men.(classe{i})(j).vseg_g5(m);
            end
        end
    end
end

for i=1:nclassi
    B_individual_V.men.MEAN.v_gara=nanmean(vgaraM);
    B_individual_V.men.STD.v_gara=nanstd(vgaraM);
end
```

```
for m=1:length(lseg)
    B_individual_V.men.MEAN.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    B_individual_V.men.MEAN.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    B_individual_V.men.MEAN.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
    B_individual_V.men.MEAN.vseg_g4(m,:)=nanmean(vseg_g4M(:,:,m));
    B_individual_V.men.MEAN.vseg_g5(m,:)=nanmean(vseg_g5M(:,:,m));
    B_individual_V.men.STD.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    B_individual_V.men.STD.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    B_individual_V.men.STD.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
    B_individual_V.men.STD.vseg_g4(m,:)=nanmean(vseg_g4M(:,:,m));
    B_individual_V.men.STD.vseg_g5(m,:)=nanmean(vseg_g5M(:,:,m));
end

%% CALCOLO DEI COEFFICIENTI CORRETTIVI:

% calcolo del coeff correttivo medio in base al tempo totale di gara (anche
% se avessi utilizzato la velocità media di gara il risultato non sarebbe
% cambiato)

%DONNE
t_gW=[B_individual_T.women.MEAN.t_finale(1)
B_individual_T.women.MEAN.t_finale(2) B_individual_T.women.MEAN.t_finale(3)
B_individual_T.women.MEAN.t_finale(4)
B_individual_T.women.MEAN.t_finale(5)]/B_individual_T.women.MEAN.t_finale(5
);
B_individual_V.women.t_perc_gara=t_gW*100;
coeff_garaW=1./t_gW;
B_individual_V.women.coeff_perc_gara=coeff_garaW*100;

% UOMINI
t_gM=[B_individual_T.men.MEAN.t_finale(1)
B_individual_T.men.MEAN.t_finale(2) B_individual_T.men.MEAN.t_finale(3)
B_individual_T.men.MEAN.t_finale(4)
B_individual_T.men.MEAN.t_finale(5)]/B_individual_T.men.MEAN.t_finale(5);
B_individual_V.men.t_perc_gara=t_gM*100;
coeff_garaM=1./t_gM;
B_individual_V.men.coeff_perc_gara=coeff_garaM*100;


% calcolo dei coeff correttivi in base ai singoli segmenti che si sono
% valutati: in questo caso devo utilizzare la velocità media di ogni
% segmento per avere una congruenza tra i coefficienti dei vari segmenti
% (tengo in considerazione la variazione di lunghezza dei diversi segmenti)


lseg_tot=sum(lseg([1 2 4 5 6]));     % lunghezza totale dei segmenti
valutati
peso_seg=lseg/lseg_tot; % da non considerare il 3° valore

% DONNE
B_individual_V.women.MEAN.vseg_gm=(B_individual_V.women.MEAN.vseg_g1+B_indi
vidual_V.women.MEAN.vseg_g2+B_individual_V.women.MEAN.vseg_g3+B_individual_
V.women.MEAN.vseg_g4+B_individual_V.women.MEAN.vseg_g5)/5;
coeff_segW=[B_individual_V.women.MEAN.vseg_gm(:,1)
B_individual_V.women.MEAN.vseg_gm(:,2)
B_individual_V.women.MEAN.vseg_gm(:,3)
B_individual_V.women.MEAN.vseg_gm(:,4)
B_individual_V.women.MEAN.vseg_gm(:,5)]./B_individual_V.women.MEAN.vseg_gm(
:,5);
B_individual_V.women.coeff_perc_seg=100*coeff_segW;
```

```
B_individual_V.women.coeff_perc_gara_medio=[nanmean(B_individual_V.women.co
eff_perc_seg([1 2 4 5 6],1)) nanmean(B_individual_V.women.coeff_perc_seg([1
2 4 5 6],2)) nanmean(B_individual_V.women.coeff_perc_seg([1 2 4 5 6],3))
nanmean(B_individual_V.women.coeff_perc_seg([1 2 4 5 6],4))
nanmean(B_individual_V.women.coeff_perc_seg([1 2 4 5 6],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempW(i,j)=B_individual_V.women.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
B_individual_V.women.coeff_perc_gara_pesato=[sum(tempW([1 2 4 5 6],1))
sum(tempW([1 2 4 5 6],2)) sum(tempW([1 2 4 5 6],3)) sum(tempW([1 2 4 5
6],4)) sum(tempW([1 2 4 5 6],5))];


% UOMINI
B_individual_V.men.MEAN.vseg_gm=(B_individual_V.men.MEAN.vseg_g1+B_individu
al_V.men.MEAN.vseg_g2+B_individual_V.men.MEAN.vseg_g3+B_individual_V.men.ME
AN.vseg_g4+B_individual_V.men.MEAN.vseg_g5)/5;
coeff_segM=[B_individual_V.men.MEAN.vseg_gm(:,1)
B_individual_V.men.MEAN.vseg_gm(:,2) B_individual_V.men.MEAN.vseg_gm(:,3)
B_individual_V.men.MEAN.vseg_gm(:,4)
B_individual_V.men.MEAN.vseg_gm(:,5)]./B_individual_V.men.MEAN.vseg_gm(:,5)
;
B_individual_V.men.coeff_perc_seg=100*coeff_segM;
B_individual_V.men.coeff_perc_gara_medio=[nanmean(B_individual_V.men.coeff_
perc_seg([1 2 4 5 6],1)) nanmean(B_individual_V.men.coeff_perc_seg([1 2 4 5
6],2)) nanmean(B_individual_V.men.coeff_perc_seg([1 2 4 5 6],3))
nanmean(B_individual_V.men.coeff_perc_seg([1 2 4 5 6],4))
nanmean(B_individual_V.men.coeff_perc_seg([1 2 4 5 6],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempM(i,j)=B_individual_V.men.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
B_individual_V.men.coeff_perc_gara_pesato=[sum(tempM([1 2 4 5 6],1))
sum(tempM([1 2 4 5 6],2)) sum(tempM([1 2 4 5 6],3)) sum(tempM([1 2 4 5
6],4)) sum(tempM([1 2 4 5 6],5))];



%% CREAZIONE TRATTI MISTI:
% a) START-K1
% b) K3-K4
% c) K6-K7

% lSTARTK1=l_KK3D(1);
lmisto=[l_KK3D(4) l_KK3D(7)];

% DONNE
for i=1:length(classe)
    if isempty(B_individual_T.women.(classe{i}))==0
        for j=1:length(B_individual_T.women.(classe{i}))
            % calcolo START-K1
%
B_individual_T.women.(classe{i})(j).START_K1(1)=B_individual_T.women.(class
e{i})(j).split_time_giro1(1);
```

```
%
B_individual_T.women.(classe{i})(j).START_K1(2)=B_individual_T.women.(class
e{i})(j).split_time_giro2(1)-
B_individual_T.women.(classe{i})(j).split_time_giro1(11);
            % calcolo K3-K4

B_individual_T.women.(classe{i})(j).K3_K4(1)=B_individual_T.women.(classe{i
})(j).split_time_giro1(4)-
B_individual_T.women.(classe{i})(j).split_time_giro1(3);

B_individual_T.women.(classe{i})(j).K3_K4(2)=B_individual_T.women.(classe{i
})(j).split_time_giro2(4)-
B_individual_T.women.(classe{i})(j).split_time_giro2(3);

B_individual_T.women.(classe{i})(j).K3_K4(3)=B_individual_T.women.(classe{i
})(j).split_time_giro3(4)-
B_individual_T.women.(classe{i})(j).split_time_giro3(3);

B_individual_T.women.(classe{i})(j).K3_K4(4)=B_individual_T.women.(classe{i
})(j).split_time_giro4(4)-
B_individual_T.women.(classe{i})(j).split_time_giro4(3);

B_individual_T.women.(classe{i})(j).K3_K4(5)=B_individual_T.women.(classe{i
})(j).split_time_giro5(4)-
B_individual_T.women.(classe{i})(j).split_time_giro5(3);


B_individual_V.women.(classe{i})(j).K3_K4(1)=3.6*lmisto(1)/B_individual_T.w
omen.(classe{i})(j).K3_K4(1);

B_individual_V.women.(classe{i})(j).K3_K4(2)=3.6*lmisto(1)/B_individual_T.w
omen.(classe{i})(j).K3_K4(2);

B_individual_V.women.(classe{i})(j).K3_K4(3)=3.6*lmisto(1)/B_individual_T.w
omen.(classe{i})(j).K3_K4(3);

B_individual_V.women.(classe{i})(j).K3_K4(4)=3.6*lmisto(1)/B_individual_T.w
omen.(classe{i})(j).K3_K4(4);

B_individual_V.women.(classe{i})(j).K3_K4(5)=3.6*lmisto(1)/B_individual_T.w
omen.(classe{i})(j).K3_K4(5);
            % calcolo K6-K7

B_individual_T.women.(classe{i})(j).K6_K7(1)=B_individual_T.women.(classe{i
})(j).split_time_giro1(7)-
B_individual_T.women.(classe{i})(j).split_time_giro1(6);

B_individual_T.women.(classe{i})(j).K6_K7(2)=B_individual_T.women.(classe{i
})(j).split_time_giro2(7)-
B_individual_T.women.(classe{i})(j).split_time_giro2(6);

B_individual_T.women.(classe{i})(j).K6_K7(3)=B_individual_T.women.(classe{i
})(j).split_time_giro3(7)-
B_individual_T.women.(classe{i})(j).split_time_giro3(6);

B_individual_T.women.(classe{i})(j).K6_K7(4)=B_individual_T.women.(classe{i
})(j).split_time_giro4(7)-
B_individual_T.women.(classe{i})(j).split_time_giro4(6);

B_individual_T.women.(classe{i})(j).K6_K7(5)=B_individual_T.women.(classe{i
```

```
})(j).split_time_giro5(7)-
B_individual_T.women.(classe{i})(j).split_time_giro5(6);


B_individual_V.women.(classe{i})(j).K6_K7(1)=3.6*lmisto(2)/B_individual_T.w
omen.(classe{i})(j).K6_K7(1);

B_individual_V.women.(classe{i})(j).K6_K7(2)=3.6*lmisto(2)/B_individual_T.w
omen.(classe{i})(j).K6_K7(2);

B_individual_V.women.(classe{i})(j).K6_K7(3)=3.6*lmisto(2)/B_individual_T.w
omen.(classe{i})(j).K6_K7(3);

B_individual_V.women.(classe{i})(j).K6_K7(4)=3.6*lmisto(2)/B_individual_T.w
omen.(classe{i})(j).K6_K7(4);

B_individual_V.women.(classe{i})(j).K6_K7(5)=3.6*lmisto(2)/B_individual_T.w
omen.(classe{i})(j).K6_K7(5);
        end
    else
        B_individual_V.women.(classe{i}).K3_K4=[];
        B_individual_V.women.(classe{i}).K6_K7=[];
    end
end

% fare la media E LA STD dei valori K3K4 E K6K7 per ogni classe (creare una
% matrice per il g1 ed un altro per il g2 (avrò 2 matrici 2x5
% righe=segmenti misti; colonne=classi) --> mediare quindi i valori di
% velocità sui giri --> avrò una matrice 2x5

vmisto_g1W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g2W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g3W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g4W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g5W=NaN(max(atletiW_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiW_classi(i)~=0
        for j=1:size(B_individual_V.women.(classe{i}),2)
            vmisto_g1W(j,i,1)=B_individual_V.women.(classe{i})(j).K3_K4(1);
            vmisto_g1W(j,i,2)=B_individual_V.women.(classe{i})(j).K6_K7(1);
            vmisto_g2W(j,i,1)=B_individual_V.women.(classe{i})(j).K3_K4(2);
            vmisto_g2W(j,i,2)=B_individual_V.women.(classe{i})(j).K6_K7(2);
            vmisto_g3W(j,i,1)=B_individual_V.women.(classe{i})(j).K3_K4(3);
            vmisto_g3W(j,i,2)=B_individual_V.women.(classe{i})(j).K6_K7(3);
            vmisto_g4W(j,i,1)=B_individual_V.women.(classe{i})(j).K3_K4(4);
            vmisto_g4W(j,i,2)=B_individual_V.women.(classe{i})(j).K6_K7(4);
            vmisto_g5W(j,i,1)=B_individual_V.women.(classe{i})(j).K3_K4(5);
            vmisto_g5W(j,i,2)=B_individual_V.women.(classe{i})(j).K6_K7(5);
        end
    end
end

for m=1:length(lmisto)
    B_individual_V.women.MEAN.vmisto_g1(m,:)=nanmean(vmisto_g1W(:,:,m));
    B_individual_V.women.MEAN.vmisto_g2(m,:)=nanmean(vmisto_g2W(:,:,m));
    B_individual_V.women.MEAN.vmisto_g3(m,:)=nanmean(vmisto_g3W(:,:,m));
    B_individual_V.women.MEAN.vmisto_g4(m,:)=nanmean(vmisto_g4W(:,:,m));
    B_individual_V.women.MEAN.vmisto_g5(m,:)=nanmean(vmisto_g5W(:,:,m));
    B_individual_V.women.STD.vmisto_g1(m,:)=nanstd(vmisto_g1W(:,:,m));
```

```
    B_individual_V.women.STD.vmisto_g2(m,:)=nanstd(vmisto_g2W(:,:,m));
    B_individual_V.women.STD.vmisto_g3(m,:)=nanstd(vmisto_g3W(:,:,m));
    B_individual_V.women.STD.vmisto_g4(m,:)=nanstd(vmisto_g4W(:,:,m));
    B_individual_V.women.STD.vmisto_g5(m,:)=nanstd(vmisto_g5W(:,:,m));
end


% UOMINI
for i=1:length(classe)
    if isempty(B_individual_T.men.(classe{i}))==0
        for j=1:length(B_individual_T.men.(classe{i}))
            % calcolo START-K1
%
B_individual_T.women.(classe{i})(j).START_K1(1)=B_individual_T.women.(class
e{i})(j).split_time_giro1(1);
%
B_individual_T.women.(classe{i})(j).START_K1(2)=B_individual_T.women.(class
e{i})(j).split_time_giro2(1)-
B_individual_T.women.(classe{i})(j).split_time_giro1(11);
            % calcolo K3-K4

B_individual_T.men.(classe{i})(j).K3_K4(1)=B_individual_T.men.(classe{i})(j
).split_time_giro1(4)-
B_individual_T.men.(classe{i})(j).split_time_giro1(3);

B_individual_T.men.(classe{i})(j).K3_K4(2)=B_individual_T.men.(classe{i})(j
).split_time_giro2(4)-
B_individual_T.men.(classe{i})(j).split_time_giro2(3);

B_individual_T.men.(classe{i})(j).K3_K4(3)=B_individual_T.men.(classe{i})(j
).split_time_giro3(4)-
B_individual_T.men.(classe{i})(j).split_time_giro3(3);

B_individual_T.men.(classe{i})(j).K3_K4(4)=B_individual_T.men.(classe{i})(j
).split_time_giro4(4)-
B_individual_T.men.(classe{i})(j).split_time_giro4(3);

B_individual_T.men.(classe{i})(j).K3_K4(5)=B_individual_T.men.(classe{i})(j
).split_time_giro5(4)-
B_individual_T.men.(classe{i})(j).split_time_giro5(3);


B_individual_V.men.(classe{i})(j).K3_K4(1)=3.6*lmisto(1)/B_individual_T.men
.(classe{i})(j).K3_K4(1);

B_individual_V.men.(classe{i})(j).K3_K4(2)=3.6*lmisto(1)/B_individual_T.men
.(classe{i})(j).K3_K4(2);

B_individual_V.men.(classe{i})(j).K3_K4(3)=3.6*lmisto(1)/B_individual_T.men
.(classe{i})(j).K3_K4(3);

B_individual_V.men.(classe{i})(j).K3_K4(4)=3.6*lmisto(1)/B_individual_T.men
.(classe{i})(j).K3_K4(4);

B_individual_V.men.(classe{i})(j).K3_K4(5)=3.6*lmisto(1)/B_individual_T.men
.(classe{i})(j).K3_K4(5);
            % calcolo K6-K7

B_individual_T.men.(classe{i})(j).K6_K7(1)=B_individual_T.men.(classe{i})(j
).split_time_giro1(7)-
B_individual_T.men.(classe{i})(j).split_time_giro1(6);
```

```
B_individual_T.men.(classe{i})(j).K6_K7(2)=B_individual_T.men.(classe{i})(j
).split_time_giro2(7)-
B_individual_T.men.(classe{i})(j).split_time_giro2(6);

B_individual_T.men.(classe{i})(j).K6_K7(3)=B_individual_T.men.(classe{i})(j
).split_time_giro3(7)-
B_individual_T.men.(classe{i})(j).split_time_giro3(6);

B_individual_T.men.(classe{i})(j).K6_K7(4)=B_individual_T.men.(classe{i})(j
).split_time_giro4(7)-
B_individual_T.men.(classe{i})(j).split_time_giro4(6);

B_individual_T.men.(classe{i})(j).K6_K7(5)=B_individual_T.men.(classe{i})(j
).split_time_giro5(7)-
B_individual_T.men.(classe{i})(j).split_time_giro5(6);


B_individual_V.men.(classe{i})(j).K6_K7(1)=3.6*lmisto(2)/B_individual_T.men
.(classe{i})(j).K6_K7(1);

B_individual_V.men.(classe{i})(j).K6_K7(2)=3.6*lmisto(2)/B_individual_T.men
.(classe{i})(j).K6_K7(2);

B_individual_V.men.(classe{i})(j).K6_K7(3)=3.6*lmisto(2)/B_individual_T.men
.(classe{i})(j).K6_K7(3);

B_individual_V.men.(classe{i})(j).K6_K7(4)=3.6*lmisto(2)/B_individual_T.men
.(classe{i})(j).K6_K7(4);

B_individual_V.men.(classe{i})(j).K6_K7(5)=3.6*lmisto(2)/B_individual_T.men
.(classe{i})(j).K6_K7(5);
        end
    else
        B_individual_V.men.(classe{i}).K3_K4=[];
        B_individual_V.men.(classe{i}).K6_K7=[];
    end
end

vmisto_g1M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g2M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g3M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g4M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g5M=NaN(max(atletiM_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(B_individual_V.men.(classe{i}),2)
            vmisto_g1M(j,i,1)=B_individual_V.men.(classe{i})(j).K3_K4(1);
            vmisto_g1M(j,i,2)=B_individual_V.men.(classe{i})(j).K6_K7(1);
            vmisto_g2M(j,i,1)=B_individual_V.men.(classe{i})(j).K3_K4(2);
            vmisto_g2M(j,i,2)=B_individual_V.men.(classe{i})(j).K6_K7(2);
            vmisto_g3M(j,i,1)=B_individual_V.men.(classe{i})(j).K3_K4(3);
            vmisto_g3M(j,i,2)=B_individual_V.men.(classe{i})(j).K6_K7(3);
            vmisto_g4M(j,i,1)=B_individual_V.men.(classe{i})(j).K3_K4(4);
            vmisto_g4M(j,i,2)=B_individual_V.men.(classe{i})(j).K6_K7(4);
            vmisto_g5M(j,i,1)=B_individual_V.men.(classe{i})(j).K3_K4(5);
            vmisto_g5M(j,i,2)=B_individual_V.men.(classe{i})(j).K6_K7(5);
        end
    end
end
```

```
for m=1:length(lmisto)
    B_individual_V.men.MEAN.vmisto_g1(m,:)=nanmean(vmisto_g1M(:,:,m));
    B_individual_V.men.MEAN.vmisto_g2(m,:)=nanmean(vmisto_g2M(:,:,m));
    B_individual_V.men.MEAN.vmisto_g3(m,:)=nanmean(vmisto_g3M(:,:,m));
    B_individual_V.men.MEAN.vmisto_g4(m,:)=nanmean(vmisto_g4M(:,:,m));
    B_individual_V.men.MEAN.vmisto_g5(m,:)=nanmean(vmisto_g5M(:,:,m));
    B_individual_V.men.STD.vmisto_g1(m,:)=nanstd(vmisto_g1M(:,:,m));
    B_individual_V.men.STD.vmisto_g2(m,:)=nanstd(vmisto_g2M(:,:,m));
    B_individual_V.men.STD.vmisto_g3(m,:)=nanstd(vmisto_g3M(:,:,m));
    B_individual_V.men.STD.vmisto_g4(m,:)=nanstd(vmisto_g4M(:,:,m));
    B_individual_V.men.STD.vmisto_g5(m,:)=nanstd(vmisto_g5M(:,:,m));
end

%% PREVISIONE E CONFRONTO TRATTI MISTI

% Sono andata a considerare tutta la lunghezza dei tratti misti e la
% velocità media di tutto il tratto, senza considerare parti di salita e
% parti di pianura/discesa.
% DONNE
B_individual_V.women.MEAN.vmisto_gm=(B_individual_V.women.MEAN.vmisto_g1+B_
individual_V.women.MEAN.vmisto_g2+B_individual_V.women.MEAN.vmisto_g3+B_ind
ividual_V.women.MEAN.vmisto_g4+B_individual_V.women.MEAN.vmisto_g5)/5;
coeff_mistoW=[B_individual_V.women.MEAN.vmisto_gm(:,1)
B_individual_V.women.MEAN.vmisto_gm(:,2)
B_individual_V.women.MEAN.vmisto_gm(:,3)
B_individual_V.women.MEAN.vmisto_gm(:,4)
B_individual_V.women.MEAN.vmisto_gm(:,5)]./B_individual_V.women.MEAN.vmisto
_gm(:,5);
B_individual_V.women.coeff_perc_misto=100*coeff_mistoW;

% UOMINI
B_individual_V.men.MEAN.vmisto_gm=(B_individual_V.men.MEAN.vmisto_g1+B_indi
vidual_V.men.MEAN.vmisto_g2+B_individual_V.men.MEAN.vmisto_g3+B_individual_
V.men.MEAN.vmisto_g4+B_individual_V.men.MEAN.vmisto_g5)/5;
coeff_mistoM=[B_individual_V.men.MEAN.vmisto_gm(:,1)
B_individual_V.men.MEAN.vmisto_gm(:,2)
B_individual_V.men.MEAN.vmisto_gm(:,3)
B_individual_V.men.MEAN.vmisto_gm(:,4)
B_individual_V.men.MEAN.vmisto_gm(:,5)]./B_individual_V.men.MEAN.vmisto_gm(
:,5);
B_individual_V.men.coeff_perc_misto=100*coeff_mistoM;

% tempo REALE segmento K3-K4 e K6-K7:
% DONNE
tmisto_g1W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g2W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g3W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g4W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g5W=NaN(max(atletiW_classi),nclassi,length(lmisto));
for i=1:nclassi
    if atletiW_classi(i)~=0
        for j=1:size(B_individual_T.women.(classe{i}),1)
            tmisto_g1W(j,i,1)=B_individual_T.women.(classe{i})(j).K3_K4(1);
            tmisto_g1W(j,i,2)=B_individual_T.women.(classe{i})(j).K6_K7(1);
            tmisto_g2W(j,i,1)=B_individual_T.women.(classe{i})(j).K3_K4(2);
            tmisto_g2W(j,i,2)=B_individual_T.women.(classe{i})(j).K6_K7(2);
            tmisto_g3W(j,i,1)=B_individual_T.women.(classe{i})(j).K3_K4(3);
            tmisto_g3W(j,i,2)=B_individual_T.women.(classe{i})(j).K6_K7(3);
            tmisto_g4W(j,i,1)=B_individual_T.women.(classe{i})(j).K3_K4(4);
```

```
            tmisto_g4W(j,i,2)=B_individual_T.women.(classe{i})(j).K6_K7(4);
            tmisto_g5W(j,i,1)=B_individual_T.women.(classe{i})(j).K3_K4(5);
            tmisto_g5W(j,i,2)=B_individual_T.women.(classe{i})(j).K6_K7(5);
        end
    end
end

for m=1:length(lmisto)

B_individual_T.women.confronto.MEAN.tmisto_g1(m,:)=nanmean(tmisto_g1W(:,:,m
));

B_individual_T.women.confronto.MEAN.tmisto_g2(m,:)=nanmean(tmisto_g2W(:,:,m
));

B_individual_T.women.confronto.MEAN.tmisto_g3(m,:)=nanmean(tmisto_g3W(:,:,m
));

B_individual_T.women.confronto.MEAN.tmisto_g4(m,:)=nanmean(tmisto_g4W(:,:,m
));

B_individual_T.women.confronto.MEAN.tmisto_g5(m,:)=nanmean(tmisto_g5W(:,:,m
));

B_individual_T.women.confronto.STD.tmisto_g1(m,:)=nanstd(tmisto_g1W(:,:,m))
;

B_individual_T.women.confronto.STD.tmisto_g2(m,:)=nanstd(tmisto_g2W(:,:,m))
;

B_individual_T.women.confronto.STD.tmisto_g3(m,:)=nanstd(tmisto_g3W(:,:,m))
;

B_individual_T.women.confronto.STD.tmisto_g4(m,:)=nanstd(tmisto_g4W(:,:,m))
;

B_individual_T.women.confronto.STD.tmisto_g5(m,:)=nanstd(tmisto_g5W(:,:,m))
;
end
B_individual_T.women.confronto.K3K4.tmisto_gm=(B_individual_T.women.confron
to.MEAN.tmisto_g1(1,:)+B_individual_T.women.confronto.MEAN.tmisto_g2(1,:)+B
_individual_T.women.confronto.MEAN.tmisto_g3(1,:)+B_individual_T.women.conf
ronto.MEAN.tmisto_g4(1,:)+B_individual_T.women.confronto.MEAN.tmisto_g5(1,:
))/5;
B_individual_T.women.confronto.K6K7.tmisto_gm=(B_individual_T.women.confron
to.MEAN.tmisto_g1(2,:)+B_individual_T.women.confronto.MEAN.tmisto_g2(2,:)+B
_individual_T.women.confronto.MEAN.tmisto_g3(2,:)+B_individual_T.women.conf
ronto.MEAN.tmisto_g4(2,:)+B_individual_T.women.confronto.MEAN.tmisto_g5(2,:
))/5;

% UOMINI
tmisto_g1M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g2M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g3M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g4M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g5M=NaN(max(atletiM_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(B_individual_T.men.(classe{i}),1)
            tmisto_g1M(j,i,1)=B_individual_T.men.(classe{i})(j).K3_K4(1);
```

```
            tmisto_g1M(j,i,2)=B_individual_T.men.(classe{i})(j).K6_K7(1);
            tmisto_g2M(j,i,1)=B_individual_T.men.(classe{i})(j).K3_K4(2);
            tmisto_g2M(j,i,2)=B_individual_T.men.(classe{i})(j).K6_K7(2);
            tmisto_g3M(j,i,1)=B_individual_T.men.(classe{i})(j).K3_K4(3);
            tmisto_g3M(j,i,2)=B_individual_T.men.(classe{i})(j).K6_K7(3);
            tmisto_g4M(j,i,1)=B_individual_T.men.(classe{i})(j).K3_K4(4);
            tmisto_g4M(j,i,2)=B_individual_T.men.(classe{i})(j).K6_K7(4);
            tmisto_g5M(j,i,1)=B_individual_T.men.(classe{i})(j).K3_K4(5);
            tmisto_g5M(j,i,2)=B_individual_T.men.(classe{i})(j).K6_K7(5);
        end
    end
end

for m=1:length(lmisto)

B_individual_T.men.confronto.MEAN.tmisto_g1(m,:)=nanmean(tmisto_g1M(:,:,m))
;

B_individual_T.men.confronto.MEAN.tmisto_g2(m,:)=nanmean(tmisto_g2M(:,:,m))
;

B_individual_T.men.confronto.MEAN.tmisto_g3(m,:)=nanmean(tmisto_g3M(:,:,m))
;

B_individual_T.men.confronto.MEAN.tmisto_g4(m,:)=nanmean(tmisto_g4M(:,:,m))
;

B_individual_T.men.confronto.MEAN.tmisto_g5(m,:)=nanmean(tmisto_g5M(:,:,m))
;

B_individual_T.men.confronto.STD.tmisto_g1(m,:)=nanstd(tmisto_g1M(:,:,m));

B_individual_T.men.confronto.STD.tmisto_g2(m,:)=nanstd(tmisto_g2M(:,:,m));

B_individual_T.men.confronto.STD.tmisto_g3(m,:)=nanstd(tmisto_g3M(:,:,m));

B_individual_T.men.confronto.STD.tmisto_g4(m,:)=nanstd(tmisto_g4M(:,:,m));

B_individual_T.men.confronto.STD.tmisto_g5(m,:)=nanstd(tmisto_g5M(:,:,m));
end
B_individual_T.men.confronto.K3K4.tmisto_gm=(B_individual_T.men.confronto.M
EAN.tmisto_g1(1,:)+B_individual_T.men.confronto.MEAN.tmisto_g2(1,:)+B_indiv
idual_T.men.confronto.MEAN.tmisto_g3(1,:)+B_individual_T.men.confronto.MEAN
.tmisto_g4(1,:)+B_individual_T.men.confronto.MEAN.tmisto_g5(1,:))/5;
B_individual_T.men.confronto.K6K7.tmisto_gm=(B_individual_T.men.confronto.M
EAN.tmisto_g1(2,:)+B_individual_T.men.confronto.MEAN.tmisto_g2(2,:)+B_indiv
idual_T.men.confronto.MEAN.tmisto_g3(2,:)+B_individual_T.men.confronto.MEAN
.tmisto_g4(2,:)+B_individual_T.men.confronto.MEAN.tmisto_g5(2,:))/5;

%%

%uso i coeff dell'IPC stagione 2017-2018
IPC17_18=[0.86 0.90 0.94 0.96 1.00];

B_individual_T.women.confronto.K3K4.tmisto_IPC17_18=B_individual_T.women.co
nfronto.K3K4.tmisto_gm(5)./IPC17_18;
B_individual_T.women.confronto.K6K7.tmisto_IPC17_18=B_individual_T.women.co
nfronto.K6K7.tmisto_gm(5)./IPC17_18;
```

```
B_individual_T.men.confronto.K3K4.tmisto_IPC17_18=B_individual_T.men.confro
nto.K3K4.tmisto_gm(5)./IPC17_18;
B_individual_T.men.confronto.K6K7.tmisto_IPC17_18=B_individual_T.men.confro
nto.K6K7.tmisto_gm(5)./IPC17_18;

%uso i coeff dell'IPC stagione 2019-2020
IPC19_20=[0.86 0.88 0.93 0.95 1.00];

B_individual_T.women.confronto.K3K4.tmisto_IPC19_20=B_individual_T.women.co
nfronto.K3K4.tmisto_gm(5)./IPC19_20;
B_individual_T.women.confronto.K6K7.tmisto_IPC19_20=B_individual_T.women.co
nfronto.K6K7.tmisto_gm(5)./IPC19_20;

B_individual_T.men.confronto.K3K4.tmisto_IPC19_20=B_individual_T.men.confro
nto.K3K4.tmisto_gm(5)./IPC19_20;
B_individual_T.men.confronto.K6K7.tmisto_IPC19_20=B_individual_T.men.confro
nto.K6K7.tmisto_gm(5)./IPC19_20;

% confronto 0: calcolo il tempo del segmento misto utilizzando il coeff
% correttivo dei tratti misti trovati. --> METODO 0
B_individual_T.women.confronto.K3K4.tmisto_met0=B_individual_T.women.confro
nto.K3K4.tmisto_gm(5)./coeff_mistoW(1,:);
B_individual_T.women.confronto.K6K7.tmisto_met0=B_individual_T.women.confro
nto.K6K7.tmisto_gm(5)./coeff_mistoW(2,:);

B_individual_T.men.confronto.K3K4.tmisto_met0=B_individual_T.men.confronto.
K3K4.tmisto_gm(5)./coeff_mistoM(1,:);
B_individual_T.men.confronto.K6K7.tmisto_met0=B_individual_T.men.confronto.
K6K7.tmisto_gm(5)./coeff_mistoM(2,:);

% CONFRONTO 1: UTILIZZO I COEFFICIENTI DI GARA TROVATI UTILIZZANDO IL TEMPO
% TOTALE DI GARA --> uso il METODO 1
B_individual_T.women.confronto.K3K4.tmisto_met1=B_individual_T.women.confro
nto.K3K4.tmisto_gm(5)./coeff_garaW(1,:);
B_individual_T.women.confronto.K6K7.tmisto_met1=B_individual_T.women.confro
nto.K6K7.tmisto_gm(5)./coeff_garaW(1,:);

B_individual_T.men.confronto.K3K4.tmisto_met1=B_individual_T.men.confronto.
K3K4.tmisto_gm(5)./coeff_garaM(1,:);
B_individual_T.men.confronto.K6K7.tmisto_met1=B_individual_T.men.confronto.
K6K7.tmisto_gm(5)./coeff_garaM(1,:);

% CONFRONTO 2: METODO 2
B_individual_T.women.confronto.K3K4.tmisto_met2=B_individual_T.women.confro
nto.K3K4.tmisto_gm(5)./(B_individual_V.women.coeff_perc_gara_medio/100);
B_individual_T.women.confronto.K6K7.tmisto_met2=B_individual_T.women.confro
nto.K6K7.tmisto_gm(5)./(B_individual_V.women.coeff_perc_gara_medio/100);

B_individual_T.men.confronto.K3K4.tmisto_met2=B_individual_T.men.confronto.
K3K4.tmisto_gm(5)./(B_individual_V.men.coeff_perc_gara_medio/100);
B_individual_T.men.confronto.K6K7.tmisto_met2=B_individual_T.men.confronto.
K6K7.tmisto_gm(5)./(B_individual_V.men.coeff_perc_gara_medio/100);

% CONFRONTO 3: uso il METODO 3
B_individual_T.women.confronto.K3K4.tmisto_met3=B_individual_T.women.confro
nto.K3K4.tmisto_gm(5)./(B_individual_V.women.coeff_perc_gara_pesato/100);
B_individual_T.women.confronto.K6K7.tmisto_met3=B_individual_T.women.confro
nto.K6K7.tmisto_gm(5)./(B_individual_V.women.coeff_perc_gara_pesato/100);
```

```
B_individual_T.men.confronto.K3K4.tmisto_met3=B_individual_T.men.confronto.
K3K4.tmisto_gm(5)./(B_individual_V.men.coeff_perc_gara_pesato/100);
B_individual_T.men.confronto.K6K7.tmisto_met3=B_individual_T.men.confronto.
K6K7.tmisto_gm(5)./(B_individual_V.men.coeff_perc_gara_pesato/100);

% confronto 4: suddivido i segmenti misti in sottosegmenti ed utilizzo le
% velocità calcolate dai segmenti di riferimento per ottenere il valore di
% tempo dell'intero segmento per ogni classe  ---> METODO 4

% K3 = pto 52 e K4 = pto 75
% suddivido il tratto misto K3-K4 in 5 sottosegmenti in relazione
% all'altitudine dei tratti; la suddivisione è la seguetne:
% 1) K3 (52) al pto 52+7; 2) pto 59 al pto 52+11; 3) pto 63 al pto 52+12;
% 4) pto 64 al pto 52+17; 5) pto 69 al pto 52+23 (75), cioè K4

sottosegK3K4_l=[122.1-0 264.5-122.1 293.3-264.5 356.9-293.3 493.8-356.9];
sottosegK3K4_h=[6.03-0 -0.379-6.03 -0.445+0.379 5.259+0.445 0.944-5.259];
sottopendK3K4=sottosegK3K4_h./sottosegK3K4_l;
sottopendK3K4_perc=sottopendK3K4*100;
peso_sottosegK3K4=sottosegK3K4_l/lmisto(1);

% utilizzo le velocità medie calcolate nei tratti di riferimento in base
% alla pendenza dei sottosegmenti trovati: uphill middle - downhill - flat
% - uphill steep - downhill, pesati per la lunghezza dei tratti analizzati:

% DONNE
frazv_prevW=[B_individual_V.women.MEAN.vseg_gm(1,:)*peso_sottosegK3K4(1);
B_individual_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(2);
B_individual_V.women.MEAN.vseg_gm(4,:)*peso_sottosegK3K4(3);
B_individual_V.women.MEAN.vseg_gm(2,:)*peso_sottosegK3K4(4);
B_individual_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(5)];
B_individual_V.women.v_prevK3K4=sum(frazv_prevW);
matr_temp=3.6*[sottosegK3K4_l(1)./B_individual_V.women.MEAN.vseg_gm(1,:);
sottosegK3K4_l(2)./B_individual_V.women.MEAN.vseg_gm(6,:);
sottosegK3K4_l(3)./B_individual_V.women.MEAN.vseg_gm(4,:);
sottosegK3K4_l(4)./B_individual_V.women.MEAN.vseg_gm(2,:);
sottosegK3K4_l(5)./B_individual_V.women.MEAN.vseg_gm(6,:)];
B_individual_T.women.confronto.K3K4.tmisto_met4=sum(matr_temp);

% UOMINI
frazv_prevM=[B_individual_V.men.MEAN.vseg_gm(1,:)*peso_sottosegK3K4(1);
B_individual_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(2);
B_individual_V.men.MEAN.vseg_gm(4,:)*peso_sottosegK3K4(3);
B_individual_V.men.MEAN.vseg_gm(2,:)*peso_sottosegK3K4(4);
B_individual_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(5)];
B_individual_V.men.v_prevK3K4=sum(frazv_prevM);
matr_temp=3.6*[sottosegK3K4_l(1)./B_individual_V.men.MEAN.vseg_gm(1,:);
sottosegK3K4_l(2)./B_individual_V.men.MEAN.vseg_gm(6,:);
sottosegK3K4_l(3)./B_individual_V.men.MEAN.vseg_gm(4,:);
sottosegK3K4_l(4)./B_individual_V.men.MEAN.vseg_gm(2,:);
sottosegK3K4_l(5)./B_individual_V.men.MEAN.vseg_gm(6,:)];
B_individual_T.men.confronto.K3K4.tmisto_met4=sum(matr_temp);

% K6 = pto 84 e K/ = pto 98
% suddivido il tratto misto K6-K7 in 6 sottosegmenti in relazione
% all'altitudine dei tratti; la suddivisione è la seguetne:
% 1) K6 (84) al pto 84+2; 2) pto 86 al pto 84+3; 3) pto 87 al pto 84+6;
% 4) pto 90 al pto 84+9; 5) pto 93 al pto 84+13; 6) pto 97 al pto 98 (K6)
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```
sottosegK6K7_l=[56.14-0 65.36-54.14 95.54-65.36 139.8-95.54 191.5-139.8
198.8-191.5];
sottosegK6K7_h=[-2.923-0 -2.957+2.923 -1.553+2.957 -6.978+1.553 -
3.663+6.978 -4.017+3.663];
sottopendK6K7=sottosegK6K7_h./sottosegK6K7_l;
sottopendK6K7_perc=sottopendK6K7*100;
peso_sottosegK6K7=sottosegK6K7_l/lmisto(2);

% utilizzo le velocità medie calcolate nei tratti di riferimento in base
% alla pendenza dei sottosegmenti trovati: downhill - flat - uphill middle
% - downhill - uphill steep - downhill


% DONNE
frazv_prevW=[B_individual_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(1);
B_individual_V.women.MEAN.vseg_gm(4,:)*peso_sottosegK6K7(2);
B_individual_V.women.MEAN.vseg_gm(1,:)*peso_sottosegK6K7(3);
B_individual_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(4);
B_individual_V.women.MEAN.vseg_gm(2,:)*peso_sottosegK6K7(5);
B_individual_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(6)];
B_individual_V.women.v_prevK6K7=sum(frazv_prevW);
matr_temp=3.6*[sottosegK6K7_l(1)./B_individual_V.women.MEAN.vseg_gm(6,:);
sottosegK6K7_l(2)./B_individual_V.women.MEAN.vseg_gm(4,:);
sottosegK6K7_l(3)./B_individual_V.women.MEAN.vseg_gm(1,:);
sottosegK6K7_l(4)./B_individual_V.women.MEAN.vseg_gm(6,:);
sottosegK6K7_l(5)./B_individual_V.women.MEAN.vseg_gm(2,:);
sottosegK6K7_l(6)./B_individual_V.women.MEAN.vseg_gm(6,:)];
B_individual_T.women.confronto.K6K7.tmisto_met4=sum(matr_temp);

% UOMINI
frazv_prevM=[B_individual_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(1);
B_individual_V.men.MEAN.vseg_gm(4,:)*peso_sottosegK6K7(2);
B_individual_V.men.MEAN.vseg_gm(1,:)*peso_sottosegK6K7(3);
B_individual_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(4);
B_individual_V.men.MEAN.vseg_gm(2,:)*peso_sottosegK6K7(5);
B_individual_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(6)];
B_individual_V.men.v_prevK6K7=sum(frazv_prevM);
matr_temp=3.6*[sottosegK6K7_l(1)./B_individual_V.men.MEAN.vseg_gm(6,:);
sottosegK6K7_l(2)./B_individual_V.men.MEAN.vseg_gm(4,:);
sottosegK6K7_l(3)./B_individual_V.men.MEAN.vseg_gm(1,:);
sottosegK6K7_l(4)./B_individual_V.men.MEAN.vseg_gm(6,:);
sottosegK6K7_l(5)./B_individual_V.men.MEAN.vseg_gm(2,:);
sottosegK6K7_l(6)./B_individual_V.men.MEAN.vseg_gm(6,:)];
B_individual_T.men.confronto.K6K7.tmisto_met4=sum(matr_temp);

%% CALCOLO DEGLI ERRORI PERCENTUALI
% DONNE
B_individual_T.women.confronto.K3K4.e_IPC17_18=abs((B_individual_T.women.co
nfronto.K3K4.tmisto_gm-
B_individual_T.women.confronto.K3K4.tmisto_IPC17_18)./B_individual_T.women.
confronto.K3K4.tmisto_gm)*100;
B_individual_T.women.confronto.K3K4.e_IPC19_20=abs((B_individual_T.women.co
nfronto.K3K4.tmisto_gm-
B_individual_T.women.confronto.K3K4.tmisto_IPC19_20)./B_individual_T.women.
confronto.K3K4.tmisto_gm)*100;
B_individual_T.women.confronto.K3K4.e_met0=abs((B_individual_T.women.confro
nto.K3K4.tmisto_gm-
B_individual_T.women.confronto.K3K4.tmisto_met0)./B_individual_T.women.conf
ronto.K3K4.tmisto_gm)*100;
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B_individual_T.women.confronto.K3K4.e_met1=abs((B_individual_T.women.confro
nto.K3K4.tmisto_gm-
B_individual_T.women.confronto.K3K4.tmisto_met1)./B_individual_T.women.conf
ronto.K3K4.tmisto_gm)*100;
B_individual_T.women.confronto.K3K4.e_met2=abs((B_individual_T.women.confro
nto.K3K4.tmisto_gm-
B_individual_T.women.confronto.K3K4.tmisto_met2)./B_individual_T.women.conf
ronto.K3K4.tmisto_gm)*100;
B_individual_T.women.confronto.K3K4.e_met3=abs((B_individual_T.women.confro
nto.K3K4.tmisto_gm-
B_individual_T.women.confronto.K3K4.tmisto_met3)./B_individual_T.women.conf
ronto.K3K4.tmisto_gm)*100;
B_individual_T.women.confronto.K3K4.e_met4=abs((B_individual_T.women.confro
nto.K3K4.tmisto_gm-
B_individual_T.women.confronto.K3K4.tmisto_met4)./B_individual_T.women.conf
ronto.K3K4.tmisto_gm)*100;

B_individual_T.women.confronto.K6K7.e_IPC17_18=abs((B_individual_T.women.co
nfronto.K6K7.tmisto_gm-
B_individual_T.women.confronto.K6K7.tmisto_IPC17_18)./B_individual_T.women.
confronto.K6K7.tmisto_gm)*100;
B_individual_T.women.confronto.K6K7.e_IPC19_20=abs((B_individual_T.women.co
nfronto.K6K7.tmisto_gm-
B_individual_T.women.confronto.K6K7.tmisto_IPC19_20)./B_individual_T.women.
confronto.K6K7.tmisto_gm)*100;
B_individual_T.women.confronto.K6K7.e_met0=abs((B_individual_T.women.confro
nto.K6K7.tmisto_gm-
B_individual_T.women.confronto.K6K7.tmisto_met0)./B_individual_T.women.conf
ronto.K6K7.tmisto_gm)*100;
B_individual_T.women.confronto.K6K7.e_met1=abs((B_individual_T.women.confro
nto.K6K7.tmisto_gm-
B_individual_T.women.confronto.K6K7.tmisto_met1)./B_individual_T.women.conf
ronto.K6K7.tmisto_gm)*100;
B_individual_T.women.confronto.K6K7.e_met2=abs((B_individual_T.women.confro
nto.K6K7.tmisto_gm-
B_individual_T.women.confronto.K6K7.tmisto_met2)./B_individual_T.women.conf
ronto.K6K7.tmisto_gm)*100;
B_individual_T.women.confronto.K6K7.e_met3=abs((B_individual_T.women.confro
nto.K6K7.tmisto_gm-
B_individual_T.women.confronto.K6K7.tmisto_met3)./B_individual_T.women.conf
ronto.K6K7.tmisto_gm)*100;
B_individual_T.women.confronto.K6K7.e_met4=abs((B_individual_T.women.confro
nto.K6K7.tmisto_gm-
B_individual_T.women.confronto.K6K7.tmisto_met4)./B_individual_T.women.conf
ronto.K6K7.tmisto_gm)*100;

% UOMINI
B_individual_T.men.confronto.K3K4.e_IPC17_18=abs((B_individual_T.men.confro
nto.K3K4.tmisto_gm-
B_individual_T.men.confronto.K3K4.tmisto_IPC17_18)./B_individual_T.men.conf
ronto.K3K4.tmisto_gm)*100;
B_individual_T.men.confronto.K3K4.e_IPC19_20=abs((B_individual_T.men.confro
nto.K3K4.tmisto_gm-
B_individual_T.men.confronto.K3K4.tmisto_IPC19_20)./B_individual_T.men.conf
ronto.K3K4.tmisto_gm)*100;
B_individual_T.men.confronto.K3K4.e_met0=abs((B_individual_T.men.confronto.
K3K4.tmisto_gm-
B_individual_T.men.confronto.K3K4.tmisto_met0)./B_individual_T.men.confront
o.K3K4.tmisto_gm)*100;
B_individual_T.men.confronto.K3K4.e_met1=abs((B_individual_T.men.confronto.
K3K4.tmisto_gm-
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B_individual_T.men.confronto.K3K4.tmisto_met1)./B_individual_T.men.confront
o.K3K4.tmisto_gm)*100;
B_individual_T.men.confronto.K3K4.e_met2=abs((B_individual_T.men.confronto.
K3K4.tmisto_gm-
B_individual_T.men.confronto.K3K4.tmisto_met2)./B_individual_T.men.confront
o.K3K4.tmisto_gm)*100;
B_individual_T.men.confronto.K3K4.e_met3=abs((B_individual_T.men.confronto.
K3K4.tmisto_gm-
B_individual_T.men.confronto.K3K4.tmisto_met3)./B_individual_T.men.confront
o.K3K4.tmisto_gm)*100;
B_individual_T.men.confronto.K3K4.e_met4=abs((B_individual_T.men.confronto.
K3K4.tmisto_gm-
B_individual_T.men.confronto.K3K4.tmisto_met4)./B_individual_T.men.confront
o.K3K4.tmisto_gm)*100;

B_individual_T.men.confronto.K6K7.e_IPC17_18=abs((B_individual_T.men.confro
nto.K6K7.tmisto_gm-
B_individual_T.men.confronto.K6K7.tmisto_IPC17_18)./B_individual_T.men.conf
ronto.K6K7.tmisto_gm)*100;
B_individual_T.men.confronto.K6K7.e_IPC19_20=abs((B_individual_T.men.confro
nto.K6K7.tmisto_gm-
B_individual_T.men.confronto.K6K7.tmisto_IPC19_20)./B_individual_T.men.conf
ronto.K6K7.tmisto_gm)*100;
B_individual_T.men.confronto.K6K7.e_met0=abs((B_individual_T.men.confronto.
K6K7.tmisto_gm-
B_individual_T.men.confronto.K6K7.tmisto_met0)./B_individual_T.men.confront
o.K6K7.tmisto_gm)*100;
B_individual_T.men.confronto.K6K7.e_met1=abs((B_individual_T.men.confronto.
K6K7.tmisto_gm-
B_individual_T.men.confronto.K6K7.tmisto_met1)./B_individual_T.men.confront
o.K6K7.tmisto_gm)*100;
B_individual_T.men.confronto.K6K7.e_met2=abs((B_individual_T.men.confronto.
K6K7.tmisto_gm-
B_individual_T.men.confronto.K6K7.tmisto_met2)./B_individual_T.men.confront
o.K6K7.tmisto_gm)*100;
B_individual_T.men.confronto.K6K7.e_met3=abs((B_individual_T.men.confronto.
K6K7.tmisto_gm-
B_individual_T.men.confronto.K6K7.tmisto_met3)./B_individual_T.men.confront
o.K6K7.tmisto_gm)*100;
B_individual_T.men.confronto.K6K7.e_met4=abs((B_individual_T.men.confronto.
K6K7.tmisto_gm-
B_individual_T.men.confronto.K6K7.tmisto_met4)./B_individual_T.men.confront
o.K6K7.tmisto_gm)*100;

%% SALVATAGGIO STRUTTURA DELLE VELOCITà

save([filepath_save '\B_individual_velocita.mat'],'-
struct','B_individual_V');
save([filepath_save '\B_individual_tempo.mat'],'-struct','B_individual_T');
```

f.3) Cross country middle

```
%% CROSS COUNTRY MIDDLE DISTANCE
clc
clear all
close all

nome_gara='\Cross_country_middle';
filepath= [cd nome_gara];
```

```
filepath_save=[cd nome_gara];
filepath_save2=[cd nome_gara '\STEP2_GRAFICI'];
XC_middle_T=load([filepath '\XC_middle_finale.mat']);
load([cd '\dati' '\l_segmenti3D.mat']);
load([cd '\dati' '\l_segmentoK1K33D.mat']);

% Creazione del vettore classi
c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
nsegmentiW=length(XC_middle_T.women.MEAN.intertempi_giro1);
nsegmentiM=length(XC_middle_T.men.MEAN.intertempi_giro1);
nclassi=5;
classe={'LW10' 'LW10_5' 'LW11' 'LW11_5' 'LW12'};

%% DATI NOTI E CALCOLATI SULLE DISTANZE
% dall'IPC:
l_XC_middleW=5000;  % metri
l_XC_middleM=7500;

% Per i segmenti K1-K2, K2-K3, K1-K3, K4-K5, K5-K6 e K7-K8 devo considerare
% le lunghezze:

lseg=[l_KK3D(2) l_KK3D(3) l_KK3D(2)+l_KK3D(3) l_KK3D(5) l_KK3D(6)
l_KK3D(8)];

%% CALCOLO DELLE VELOCITà PER OGNI ATLETA
% Inverto tutti i valori all'interno dei campi delle struct e li moltiplico
% per il corretto valore della distanza --> in questo modo ottengo i valori
% di velocità in m/s --> moltiplicando anche per 3.6 ottengo i valori delle
% velocità in km/h.

% DONNE
for i=1:nclassi
    if isempty(XC_middle_T.women.(classe{i}))==0
        for j=1:length(XC_middle_T.women.(classe{i}))

XC_middle_V.women.(classe{i})(j).first_name=XC_middle_T.women.(classe{i})(j
).first_name;

XC_middle_V.women.(classe{i})(j).last_name=XC_middle_T.women.(classe{i})(j)
.last_name;

XC_middle_V.women.(classe{i})(j).v_gara=l_XC_middleW*3.6/XC_middle_T.women.
(classe{i})(j).finish_time;
            for k=1:length(lseg)

XC_middle_V.women.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/XC_middle_T.women.(
classe{i})(j).intertempi_giro1(k);

XC_middle_V.women.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/XC_middle_T.women.(
classe{i})(j).intertempi_giro2(k);
            end
        end
    else
        XC_middle_V.women.(classe{i}).v_gara=[];
        XC_middle_V.women.(classe{i}).vseg_g1=[];
        XC_middle_V.women.(classe{i}).vseg_g2=[];
    end
end

% UOMINI
```

```
for i=1:nclassi
    if isempty(XC_middle_T.men.(classe{i}))==0
        for j=1:length(XC_middle_T.men.(classe{i}))

XC_middle_V.men.(classe{i})(j).first_name=XC_middle_T.men.(classe{i})(j).fi
rst_name;

XC_middle_V.men.(classe{i})(j).last_name=XC_middle_T.men.(classe{i})(j).las
t_name;

XC_middle_V.men.(classe{i})(j).v_gara=l_XC_middleM*3.6/XC_middle_T.men.(cla
sse{i})(j).finish_time;
            for k=1:length(lseg)

XC_middle_V.men.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/XC_middle_T.men.(clas
se{i})(j).intertempi_giro1(k);

XC_middle_V.men.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/XC_middle_T.men.(clas
se{i})(j).intertempi_giro2(k);

XC_middle_V.men.(classe{i})(j).vseg_g3(k)=3.6*lseg(k)/XC_middle_T.men.(clas
se{i})(j).intertempi_giro3(k);
            end
        end
    else
        XC_middle_V.men.(classe{i}).v_gara=[];
        XC_middle_V.men.(classe{i}).vseg_g1=[];
        XC_middle_V.men.(classe{i}).vseg_g2=[];
        XC_middle_V.men.(classe{i}).vseg_g3=[];
    end
end

%% CALCOLO DELLE VELOCITà MEDIE E STD PER CLASSI

% DONNE
atletiW_classi=[0 4 2 0 7];
vgaraW=NaN(max(atletiW_classi),nclassi);
vseg_g1W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g2W=NaN(max(atletiW_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiW_classi(i)~=0
         for j=1:size(XC_middle_V.women.(classe{i}),2)
            vgaraW(j,i)=XC_middle_V.women.(classe{i})(j).v_gara;
            for m=1:length(lseg)

vseg_g1W(j,i,m)=XC_middle_V.women.(classe{i})(j).vseg_g1(m);

vseg_g2W(j,i,m)=XC_middle_V.women.(classe{i})(j).vseg_g2(m);
            end
         end
    end
end

for i=1:nclassi
    XC_middle_V.women.MEAN.v_gara=nanmean(vgaraW);
    XC_middle_V.women.STD.v_gara=nanstd(vgaraW);
end

for m=1:length(lseg)
```

```
    XC_middle_V.women.MEAN.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    XC_middle_V.women.MEAN.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
    XC_middle_V.women.STD.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    XC_middle_V.women.STD.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
end


% UOMINI
atletiM_classi=[2 0 3 2 14];
vgaraM=NaN(max(atletiM_classi),nclassi);
vseg_g1M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g2M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g3M=NaN(max(atletiM_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(XC_middle_V.men.(classe{i}),2)
            vgaraM(j,i)=XC_middle_V.men.(classe{i})(j).v_gara;
            for m=1:length(lseg)
                vseg_g1M(j,i,m)=XC_middle_V.men.(classe{i})(j).vseg_g1(m);
                vseg_g2M(j,i,m)=XC_middle_V.men.(classe{i})(j).vseg_g2(m);
                vseg_g3M(j,i,m)=XC_middle_V.men.(classe{i})(j).vseg_g3(m);
            end
        end
    end
end

for i=1:nclassi
    XC_middle_V.men.MEAN.v_gara=nanmean(vgaraM);
    XC_middle_V.men.STD.v_gara=nanstd(vgaraM);
end

for m=1:length(lseg)
    XC_middle_V.men.MEAN.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    XC_middle_V.men.MEAN.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    XC_middle_V.men.MEAN.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
    XC_middle_V.men.STD.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    XC_middle_V.men.STD.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    XC_middle_V.men.STD.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
end

%% CALCOLO DEI COEFFICIENTI CORRETTIVI:

% calcolo del coeff correttivo medio in base al tempo totale di gara (anche
% se avessi utilizzato la velocità media di gara il risultato non sarebbe
% cambiato)

%DONNE
t_gW=[XC_middle_T.women.MEAN.t_finale(1) XC_middle_T.women.MEAN.t_finale(2)
XC_middle_T.women.MEAN.t_finale(3) XC_middle_T.women.MEAN.t_finale(4)
XC_middle_T.women.MEAN.t_finale(5)]/XC_middle_T.women.MEAN.t_finale(5);
XC_middle_V.women.t_perc_gara=t_gW*100;
coeff_garaW=1./t_gW;
XC_middle_V.women.coeff_perc_gara=coeff_garaW*100;

% UOMINI
t_gM=[XC_middle_T.men.MEAN.t_finale(1) XC_middle_T.men.MEAN.t_finale(2)
XC_middle_T.men.MEAN.t_finale(3) XC_middle_T.men.MEAN.t_finale(4)
XC_middle_T.men.MEAN.t_finale(5)]/XC_middle_T.men.MEAN.t_finale(5);
XC_middle_V.men.t_perc_gara=t_gM*100;
```

```
coeff_garaM=1./t_gM;
XC_middle_V.men.coeff_perc_gara=coeff_garaM*100;


% calcolo dei coeff correttivi in base ai singoli segmenti che si sono
% valutati: in questo caso devo utilizzare la velocità media di ogni
% segmento per avere una congruenza tra i coefficienti dei vari segmenti
% (tengo in considerazione la variazione di lunghezza dei diversi segmenti)


lseg_tot=sum(lseg([1 2 4 5 6]));    % lunghezza totale dei segmenti
valutati
peso_seg=lseg/lseg_tot; % da non considerare il 3° valore

% DONNE
XC_middle_V.women.MEAN.vseg_gm=(XC_middle_V.women.MEAN.vseg_g1+XC_middle_V.
women.MEAN.vseg_g2)/2;
coeff_segW=[XC_middle_V.women.MEAN.vseg_gm(:,1)
XC_middle_V.women.MEAN.vseg_gm(:,2) XC_middle_V.women.MEAN.vseg_gm(:,3)
XC_middle_V.women.MEAN.vseg_gm(:,4)
XC_middle_V.women.MEAN.vseg_gm(:,5)]./XC_middle_V.women.MEAN.vseg_gm(:,5);
XC_middle_V.women.coeff_perc_seg=100*coeff_segW;
XC_middle_V.women.coeff_perc_gara_medio=[nanmean(XC_middle_V.women.coeff_pe
rc_seg([1 2 4 5 6],1)) nanmean(XC_middle_V.women.coeff_perc_seg([1 2 4 5
6],2)) nanmean(XC_middle_V.women.coeff_perc_seg([1 2 4 5 6],3))
nanmean(XC_middle_V.women.coeff_perc_seg([1 2 4 5 6],4))
nanmean(XC_middle_V.women.coeff_perc_seg([1 2 4 5 6],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempW(i,j)=XC_middle_V.women.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
XC_middle_V.women.coeff_perc_gara_pesato=[sum(tempW([1 2 4 5 6],1))
sum(tempW([1 2 4 5 6],2)) sum(tempW([1 2 4 5 6],3)) sum(tempW([1 2 4 5
6],4)) sum(tempW([1 2 4 5 6],5))];



% UOMINI
XC_middle_V.men.MEAN.vseg_gm=(XC_middle_V.men.MEAN.vseg_g1+XC_middle_V.men.
MEAN.vseg_g2+XC_middle_V.men.MEAN.vseg_g3)/3;
coeff_segM=[XC_middle_V.men.MEAN.vseg_gm(:,1)
XC_middle_V.men.MEAN.vseg_gm(:,2) XC_middle_V.men.MEAN.vseg_gm(:,3)
XC_middle_V.men.MEAN.vseg_gm(:,4)
XC_middle_V.men.MEAN.vseg_gm(:,5)]./XC_middle_V.men.MEAN.vseg_gm(:,5);
XC_middle_V.men.coeff_perc_seg=100*coeff_segM;
XC_middle_V.men.coeff_perc_gara_medio=[nanmean(XC_middle_V.men.coeff_perc_s
eg([1 2 4 5 6],1)) nanmean(XC_middle_V.men.coeff_perc_seg([1 2 4 5 6],2))
nanmean(XC_middle_V.men.coeff_perc_seg([1 2 4 5 6],3))
nanmean(XC_middle_V.men.coeff_perc_seg([1 2 4 5 6],4))
nanmean(XC_middle_V.men.coeff_perc_seg([1 2 4 5 6],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempM(i,j)=XC_middle_V.men.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
XC_middle_V.men.coeff_perc_gara_pesato=[sum(tempM([1 2 4 5 6],1))
sum(tempM([1 2 4 5 6],2)) sum(tempM([1 2 4 5 6],3)) sum(tempM([1 2 4 5
6],4)) sum(tempM([1 2 4 5 6],5))];
```

```
%% CREAZIONE TRATTI MISTI:
% a) START-K1 (non analizzato nel seguito)
% b) K3-K4
% c) K6-K7

% lSTARTK1=l_KK3D(1);
lmisto=[l_KK3D(4) l_KK3D(7)];

% DONNE
for i=1:length(classe)
    if isempty(XC_middle_T.women.(classe{i}))==0
        for j=1:length(XC_middle_T.women.(classe{i}))
            % calcolo START-K1
%
XC_middle_T.women.(classe{i})(j).START_K1(1)=XC_middle_T.women.(classe{i})(
j).split_time_giro1(1);
%
XC_middle_T.women.(classe{i})(j).START_K1(2)=XC_middle_T.women.(classe{i})(
j).split_time_giro2(1)-
XC_middle_T.women.(classe{i})(j).split_time_giro1(11);
            % calcolo K3-K4

XC_middle_T.women.(classe{i})(j).K3_K4(1)=XC_middle_T.women.(classe{i})(j).
split_time_giro1(4)-XC_middle_T.women.(classe{i})(j).split_time_giro1(3);

XC_middle_T.women.(classe{i})(j).K3_K4(2)=XC_middle_T.women.(classe{i})(j).
split_time_giro2(4)-XC_middle_T.women.(classe{i})(j).split_time_giro2(3);


XC_middle_V.women.(classe{i})(j).K3_K4(1)=3.6*lmisto(1)/XC_middle_T.women.(
classe{i})(j).K3_K4(1);

XC_middle_V.women.(classe{i})(j).K3_K4(2)=3.6*lmisto(1)/XC_middle_T.women.(
classe{i})(j).K3_K4(2);
            % calcolo K6-K7

XC_middle_T.women.(classe{i})(j).K6_K7(1)=XC_middle_T.women.(classe{i})(j).
split_time_giro1(7)-XC_middle_T.women.(classe{i})(j).split_time_giro1(6);

XC_middle_T.women.(classe{i})(j).K6_K7(2)=XC_middle_T.women.(classe{i})(j).
split_time_giro2(7)-XC_middle_T.women.(classe{i})(j).split_time_giro2(6);


XC_middle_V.women.(classe{i})(j).K6_K7(1)=3.6*lmisto(2)/XC_middle_T.women.(
classe{i})(j).K6_K7(1);

XC_middle_V.women.(classe{i})(j).K6_K7(2)=3.6*lmisto(2)/XC_middle_T.women.(
classe{i})(j).K6_K7(2);
        end
    else
        XC_middle_V.women.(classe{i}).K3_K4=[];
        XC_middle_V.women.(classe{i}).K6_K7=[];
    end
end

% fare la media E LA STD dei valori K3K4 E K6K7 per ogni classe (creare una
% matrice per il g1 ed un altro per il g2 (avrò 2 matrici 2x5
% righe=segmenti misti; colonne=classi) --> mediare quindi i valori di
% velocità sui giri --> avrò una matrice 2x5
```

```
vmisto_g1W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g2W=NaN(max(atletiW_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiW_classi(i)~=0
        for j=1:size(XC_middle_V.women.(classe{i}),2)
            vmisto_g1W(j,i,1)=XC_middle_V.women.(classe{i})(j).K3_K4(1);
            vmisto_g1W(j,i,2)=XC_middle_V.women.(classe{i})(j).K6_K7(1);
            vmisto_g2W(j,i,1)=XC_middle_V.women.(classe{i})(j).K3_K4(2);
            vmisto_g2W(j,i,2)=XC_middle_V.women.(classe{i})(j).K6_K7(2);
        end
    end
end

for m=1:length(lmisto)
    XC_middle_V.women.MEAN.vmisto_g1(m,:)=nanmean(vmisto_g1W(:,:,m));
    XC_middle_V.women.MEAN.vmisto_g2(m,:)=nanmean(vmisto_g2W(:,:,m));
    XC_middle_V.women.STD.vmisto_g1(m,:)=nanstd(vmisto_g1W(:,:,m));
    XC_middle_V.women.STD.vmisto_g2(m,:)=nanstd(vmisto_g2W(:,:,m));
end


% UOMINI
for i=1:length(classe)
    if isempty(XC_middle_T.men.(classe{i}))==0
        for j=1:length(XC_middle_T.men.(classe{i}))
            % calcolo START-K1
%
XC_middle_T.women.(classe{i})(j).START_K1(1)=XC_middle_T.women.(classe{i})(
j).split_time_giro1(1);
%
XC_middle_T.women.(classe{i})(j).START_K1(2)=XC_middle_T.women.(classe{i})(
j).split_time_giro2(1)-
XC_middle_T.women.(classe{i})(j).split_time_giro1(11);
            % calcolo K3-K4

XC_middle_T.men.(classe{i})(j).K3_K4(1)=XC_middle_T.men.(classe{i})(j).spli
t_time_giro1(4)-XC_middle_T.men.(classe{i})(j).split_time_giro1(3);

XC_middle_T.men.(classe{i})(j).K3_K4(2)=XC_middle_T.men.(classe{i})(j).spli
t_time_giro2(4)-XC_middle_T.men.(classe{i})(j).split_time_giro2(3);

XC_middle_T.men.(classe{i})(j).K3_K4(3)=XC_middle_T.men.(classe{i})(j).spli
t_time_giro3(4)-XC_middle_T.men.(classe{i})(j).split_time_giro3(3);


XC_middle_V.men.(classe{i})(j).K3_K4(1)=3.6*lmisto(1)/XC_middle_T.men.(clas
se{i})(j).K3_K4(1);

XC_middle_V.men.(classe{i})(j).K3_K4(2)=3.6*lmisto(1)/XC_middle_T.men.(clas
se{i})(j).K3_K4(2);

XC_middle_V.men.(classe{i})(j).K3_K4(3)=3.6*lmisto(1)/XC_middle_T.men.(clas
se{i})(j).K3_K4(3);
            % calcolo K6-K7

XC_middle_T.men.(classe{i})(j).K6_K7(1)=XC_middle_T.men.(classe{i})(j).spli
t_time_giro1(7)-XC_middle_T.men.(classe{i})(j).split_time_giro1(6);
```

```
XC_middle_T.men.(classe{i})(j).K6_K7(2)=XC_middle_T.men.(classe{i})(j).spli
t_time_giro2(7)-XC_middle_T.men.(classe{i})(j).split_time_giro2(6);

XC_middle_T.men.(classe{i})(j).K6_K7(3)=XC_middle_T.men.(classe{i})(j).spli
t_time_giro3(7)-XC_middle_T.men.(classe{i})(j).split_time_giro3(6);


XC_middle_V.men.(classe{i})(j).K6_K7(1)=3.6*lmisto(2)/XC_middle_T.men.(clas
se{i})(j).K6_K7(1);

XC_middle_V.men.(classe{i})(j).K6_K7(2)=3.6*lmisto(2)/XC_middle_T.men.(clas
se{i})(j).K6_K7(2);

XC_middle_V.men.(classe{i})(j).K6_K7(3)=3.6*lmisto(2)/XC_middle_T.men.(clas
se{i})(j).K6_K7(3);
        end
    else
        XC_middle_V.men.(classe{i}).K3_K4=[];
        XC_middle_V.men.(classe{i}).K6_K7=[];
    end
end

vmisto_g1M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g2M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g3M=NaN(max(atletiM_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(XC_middle_V.men.(classe{i}),2)
            vmisto_g1M(j,i,1)=XC_middle_V.men.(classe{i})(j).K3_K4(1);
            vmisto_g1M(j,i,2)=XC_middle_V.men.(classe{i})(j).K6_K7(1);
            vmisto_g2M(j,i,1)=XC_middle_V.men.(classe{i})(j).K3_K4(2);
            vmisto_g2M(j,i,2)=XC_middle_V.men.(classe{i})(j).K6_K7(2);
            vmisto_g3M(j,i,1)=XC_middle_V.men.(classe{i})(j).K3_K4(3);
            vmisto_g3M(j,i,2)=XC_middle_V.men.(classe{i})(j).K6_K7(3);
        end
    end
end

for m=1:length(lmisto)
    XC_middle_V.men.MEAN.vmisto_g1(m,:)=nanmean(vmisto_g1M(:,:,m));
    XC_middle_V.men.MEAN.vmisto_g2(m,:)=nanmean(vmisto_g2M(:,:,m));
    XC_middle_V.men.MEAN.vmisto_g3(m,:)=nanmean(vmisto_g3M(:,:,m));
    XC_middle_V.men.STD.vmisto_g1(m,:)=nanstd(vmisto_g1M(:,:,m));
    XC_middle_V.men.STD.vmisto_g2(m,:)=nanstd(vmisto_g2M(:,:,m));
    XC_middle_V.men.STD.vmisto_g3(m,:)=nanstd(vmisto_g3M(:,:,m));
end

%% PREVISIONE E CONFRONTO TRATTI MISTI

% Sono andata a considerare tutta la lunghezza dei tratti misti e la
% velocità media di tutto il tratto, senza considerare parti di salita e
% parti di pianura/discesa.
% DONNE
XC_middle_V.women.MEAN.vmisto_gm=(XC_middle_V.women.MEAN.vmisto_g1+XC_middl
e_V.women.MEAN.vmisto_g2)/2;
coeff_mistoW=[XC_middle_V.women.MEAN.vmisto_gm(:,1)
XC_middle_V.women.MEAN.vmisto_gm(:,2) XC_middle_V.women.MEAN.vmisto_gm(:,3)
XC_middle_V.women.MEAN.vmisto_gm(:,4)
```

```
XC_middle_V.women.MEAN.vmisto_gm(:,5)]./XC_middle_V.women.MEAN.vmisto_gm(:,
5);
XC_middle_V.women.coeff_perc_misto=100*coeff_mistoW;

% UOMINI
XC_middle_V.men.MEAN.vmisto_gm=(XC_middle_V.men.MEAN.vmisto_g1+XC_middle_V.
men.MEAN.vmisto_g2+XC_middle_V.men.MEAN.vmisto_g3)/3;
coeff_mistoM=[XC_middle_V.men.MEAN.vmisto_gm(:,1)
XC_middle_V.men.MEAN.vmisto_gm(:,2) XC_middle_V.men.MEAN.vmisto_gm(:,3)
XC_middle_V.men.MEAN.vmisto_gm(:,4)
XC_middle_V.men.MEAN.vmisto_gm(:,5)]./XC_middle_V.men.MEAN.vmisto_gm(:,5);
XC_middle_V.men.coeff_perc_misto=100*coeff_mistoM;

% tempo REALE segmento K3-K4 e K6-K7:
% DONNE
tmisto_g1W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g2W=NaN(max(atletiW_classi),nclassi,length(lmisto));
for i=1:nclassi
    if atletiW_classi(i)~=0
        for j=1:size(XC_middle_T.women.(classe{i}),1)
            tmisto_g1W(j,i,1)=XC_middle_T.women.(classe{i})(j).K3_K4(1);
            tmisto_g1W(j,i,2)=XC_middle_T.women.(classe{i})(j).K6_K7(1);
            tmisto_g2W(j,i,1)=XC_middle_T.women.(classe{i})(j).K3_K4(2);
            tmisto_g2W(j,i,2)=XC_middle_T.women.(classe{i})(j).K6_K7(2);
        end
    end
end

for m=1:length(lmisto)

XC_middle_T.women.confronto.MEAN.tmisto_g1(m,:)=nanmean(tmisto_g1W(:,:,m));

XC_middle_T.women.confronto.MEAN.tmisto_g2(m,:)=nanmean(tmisto_g2W(:,:,m));

XC_middle_T.women.confronto.STD.tmisto_g1(m,:)=nanstd(tmisto_g1W(:,:,m));

XC_middle_T.women.confronto.STD.tmisto_g2(m,:)=nanstd(tmisto_g2W(:,:,m));
end
XC_middle_T.women.confronto.K3K4.tmisto_gm=(XC_middle_T.women.confronto.MEA
N.tmisto_g1(1,:)+XC_middle_T.women.confronto.MEAN.tmisto_g2(1,:))/2;
XC_middle_T.women.confronto.K6K7.tmisto_gm=(XC_middle_T.women.confronto.MEA
N.tmisto_g1(2,:)+XC_middle_T.women.confronto.MEAN.tmisto_g2(2,:))/2;

% UOMINI
tmisto_g1M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g2M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g3M=NaN(max(atletiM_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(XC_middle_T.men.(classe{i}),1)
            tmisto_g1M(j,i,1)=XC_middle_T.men.(classe{i})(j).K3_K4(1);
            tmisto_g1M(j,i,2)=XC_middle_T.men.(classe{i})(j).K6_K7(1);
            tmisto_g2M(j,i,1)=XC_middle_T.men.(classe{i})(j).K3_K4(2);
            tmisto_g2M(j,i,2)=XC_middle_T.men.(classe{i})(j).K6_K7(2);
            tmisto_g3M(j,i,1)=XC_middle_T.men.(classe{i})(j).K3_K4(3);
            tmisto_g3M(j,i,2)=XC_middle_T.men.(classe{i})(j).K6_K7(3);
        end
    end
end
```

```
for m=1:length(lmisto)

XC_middle_T.men.confronto.MEAN.tmisto_g1(m,:)=nanmean(tmisto_g1M(:,:,m));

XC_middle_T.men.confronto.MEAN.tmisto_g2(m,:)=nanmean(tmisto_g2M(:,:,m));

XC_middle_T.men.confronto.MEAN.tmisto_g3(m,:)=nanmean(tmisto_g3M(:,:,m));
    XC_middle_T.men.confronto.STD.tmisto_g1(m,:)=nanstd(tmisto_g1M(:,:,m));
    XC_middle_T.men.confronto.STD.tmisto_g2(m,:)=nanstd(tmisto_g2M(:,:,m));
    XC_middle_T.men.confronto.STD.tmisto_g3(m,:)=nanstd(tmisto_g3M(:,:,m));
end
XC_middle_T.men.confronto.K3K4.tmisto_gm=(XC_middle_T.men.confronto.MEAN.tm
isto_g1(1,:)+XC_middle_T.men.confronto.MEAN.tmisto_g2(1,:)+XC_middle_T.men.
confronto.MEAN.tmisto_g3(1,:))/3;
XC_middle_T.men.confronto.K6K7.tmisto_gm=(XC_middle_T.men.confronto.MEAN.tm
isto_g1(2,:)+XC_middle_T.men.confronto.MEAN.tmisto_g2(2,:)+XC_middle_T.men.
confronto.MEAN.tmisto_g3(2,:))/3;

%%

%uso i coeff dell'IPC stagione 2017-2018
IPC17_18=[0.86 0.90 0.94 0.96 1.00];

XC_middle_T.women.confronto.K3K4.tmisto_IPC17_18=XC_middle_T.women.confront
o.K3K4.tmisto_gm(5)./IPC17_18;
XC_middle_T.women.confronto.K6K7.tmisto_IPC17_18=XC_middle_T.women.confront
o.K6K7.tmisto_gm(5)./IPC17_18;

XC_middle_T.men.confronto.K3K4.tmisto_IPC17_18=XC_middle_T.men.confronto.K3
K4.tmisto_gm(5)./IPC17_18;
XC_middle_T.men.confronto.K6K7.tmisto_IPC17_18=XC_middle_T.men.confronto.K6
K7.tmisto_gm(5)./IPC17_18;

%uso i coeff dell'IPC stagione 2019-2020
IPC19_20=[0.86 0.88 0.93 0.95 1.00];

XC_middle_T.women.confronto.K3K4.tmisto_IPC19_20=XC_middle_T.women.confront
o.K3K4.tmisto_gm(5)./IPC19_20;
XC_middle_T.women.confronto.K6K7.tmisto_IPC19_20=XC_middle_T.women.confront
o.K6K7.tmisto_gm(5)./IPC19_20;

XC_middle_T.men.confronto.K3K4.tmisto_IPC19_20=XC_middle_T.men.confronto.K3
K4.tmisto_gm(5)./IPC19_20;
XC_middle_T.men.confronto.K6K7.tmisto_IPC19_20=XC_middle_T.men.confronto.K6
K7.tmisto_gm(5)./IPC19_20;

% confronto 0: calcolo il tempo del segmento misto utilizzando il coeff
% correttivo dei tratti misti trovati. --> METODO 0
XC_middle_T.women.confronto.K3K4.tmisto_met0=XC_middle_T.women.confronto.K3
K4.tmisto_gm(5)./coeff_mistoW(1,:);
XC_middle_T.women.confronto.K6K7.tmisto_met0=XC_middle_T.women.confronto.K6
K7.tmisto_gm(5)./coeff_mistoW(2,:);

XC_middle_T.men.confronto.K3K4.tmisto_met0=XC_middle_T.men.confronto.K3K4.t
misto_gm(5)./coeff_mistoM(1,:);
XC_middle_T.men.confronto.K6K7.tmisto_met0=XC_middle_T.men.confronto.K6K7.t
misto_gm(5)./coeff_mistoM(2,:);
```

```
% CONFRONTO 1: UTILIZZO I COEFFICIENTI DI GARA TROVATI UTILIZZANDO IL TEMPO
% TOTALE DI GARA --> uso il METODO 1
XC_middle_T.women.confronto.K3K4.tmisto_met1=XC_middle_T.women.confronto.K3
K4.tmisto_gm(5)./coeff_garaW(1,:);
XC_middle_T.women.confronto.K6K7.tmisto_met1=XC_middle_T.women.confronto.K6
K7.tmisto_gm(5)./coeff_garaW(1,:);

XC_middle_T.men.confronto.K3K4.tmisto_met1=XC_middle_T.men.confronto.K3K4.t
misto_gm(5)./coeff_garaM(1,:);
XC_middle_T.men.confronto.K6K7.tmisto_met1=XC_middle_T.men.confronto.K6K7.t
misto_gm(5)./coeff_garaM(1,:);

% CONFRONTO 2: METODO 2
XC_middle_T.women.confronto.K3K4.tmisto_met2=XC_middle_T.women.confronto.K3
K4.tmisto_gm(5)./(XC_middle_V.women.coeff_perc_gara_medio/100);
XC_middle_T.women.confronto.K6K7.tmisto_met2=XC_middle_T.women.confronto.K6
K7.tmisto_gm(5)./(XC_middle_V.women.coeff_perc_gara_medio/100);

XC_middle_T.men.confronto.K3K4.tmisto_met2=XC_middle_T.men.confronto.K3K4.t
misto_gm(5)./(XC_middle_V.men.coeff_perc_gara_medio/100);
XC_middle_T.men.confronto.K6K7.tmisto_met2=XC_middle_T.men.confronto.K6K7.t
misto_gm(5)./(XC_middle_V.men.coeff_perc_gara_medio/100);

% CONFRONTO 3: uso il METODO 3
XC_middle_T.women.confronto.K3K4.tmisto_met3=XC_middle_T.women.confronto.K3
K4.tmisto_gm(5)./(XC_middle_V.women.coeff_perc_gara_pesato/100);
XC_middle_T.women.confronto.K6K7.tmisto_met3=XC_middle_T.women.confronto.K6
K7.tmisto_gm(5)./(XC_middle_V.women.coeff_perc_gara_pesato/100);

XC_middle_T.men.confronto.K3K4.tmisto_met3=XC_middle_T.men.confronto.K3K4.t
misto_gm(5)./(XC_middle_V.men.coeff_perc_gara_pesato/100);
XC_middle_T.men.confronto.K6K7.tmisto_met3=XC_middle_T.men.confronto.K6K7.t
misto_gm(5)./(XC_middle_V.men.coeff_perc_gara_pesato/100);

% confronto 4: suddivido i segmenti misti in sottosegmenti ed utilizzo le
% velocità calcolate dai segmenti di riferimento per ottenere il valore di
% tempo dell'intero segmento per ogni classe  ---> METODO 4

% K3 = pto 52 e K4 = pto 75
% suddivido il tratto misto K3-K4 in 5 sottosegmenti in relazione
% all'altitudine dei tratti; la suddivisione è la seguetne:
% 1) K3 (52) al pto 52+7; 2) pto 59 al pto 52+11; 3) pto 63 al pto 52+12;
% 4) pto 64 al pto 52+17; 5) pto 69 al pto 52+23 (75), cioè K4

sottosegK3K4_l=[122.1-0 264.5-122.1 293.3-264.5 356.9-293.3 493.8-356.9];
sottosegK3K4_h=[6.03-0 -0.379-6.03 -0.445+0.379 5.259+0.445 0.944-5.259];
sottopendK3K4=sottosegK3K4_h./sottosegK3K4_l;
sottopendK3K4_perc=sottopendK3K4*100;
peso_sottosegK3K4=sottosegK3K4_l/lmisto(1);

% utilizzo le velocità medie calcolate nei tratti di riferimento in base
% alla pendenza dei sottosegmenti trovati: uphill middle - downhill - flat
% - uphill steep - downhill, pesati per la lunghezza dei tratti analizzati:

% DONNE
frazv_prevW=[XC_middle_V.women.MEAN.vseg_gm(1,:)*peso_sottosegK3K4(1);
XC_middle_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(2);
XC_middle_V.women.MEAN.vseg_gm(4,:)*peso_sottosegK3K4(3);
```

```
XC_middle_V.women.MEAN.vseg_gm(2,:)*peso_sottosegK3K4(4);
XC_middle_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(5)];
XC_middle_V.women.v_prevK3K4=sum(frazv_prevW);
matr_temp=3.6*[sottosegK3K4_l(1)./XC_middle_V.women.MEAN.vseg_gm(1,:);
sottosegK3K4_l(2)./XC_middle_V.women.MEAN.vseg_gm(6,:);
sottosegK3K4_l(3)./XC_middle_V.women.MEAN.vseg_gm(4,:);
sottosegK3K4_l(4)./XC_middle_V.women.MEAN.vseg_gm(2,:);
sottosegK3K4_l(5)./XC_middle_V.women.MEAN.vseg_gm(6,:)];
XC_middle_T.women.confronto.K3K4.tmisto_met4=sum(matr_temp);

% UOMINI
frazv_prevM=[XC_middle_V.men.MEAN.vseg_gm(1,:)*peso_sottosegK3K4(1);
XC_middle_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(2);
XC_middle_V.men.MEAN.vseg_gm(4,:)*peso_sottosegK3K4(3);
XC_middle_V.men.MEAN.vseg_gm(2,:)*peso_sottosegK3K4(4);
XC_middle_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(5)];
XC_middle_V.men.v_prevK3K4=sum(frazv_prevM);
matr_temp=3.6*[sottosegK3K4_l(1)./XC_middle_V.men.MEAN.vseg_gm(1,:);
sottosegK3K4_l(2)./XC_middle_V.men.MEAN.vseg_gm(6,:);
sottosegK3K4_l(3)./XC_middle_V.men.MEAN.vseg_gm(4,:);
sottosegK3K4_l(4)./XC_middle_V.men.MEAN.vseg_gm(2,:);
sottosegK3K4_l(5)./XC_middle_V.men.MEAN.vseg_gm(6,:)];
XC_middle_T.men.confronto.K3K4.tmisto_met4=sum(matr_temp);

% K6 = pto 84 e K/ = pto 98
% suddivido il tratto misto K6-K7 in 6 sottosegmenti in relazione
% all'altitudine dei tratti; la suddivisione è la seguetne:
% 1) K6 (84) al pto 84+2; 2) pto 86 al pto 84+3; 3) pto 87 al pto 84+6;
% 4) pto 90 al pto 84+9; 5) pto 93 al pto 84+13; 6) pto 97 al pto 98 (K6)

sottosegK6K7_l=[56.14-0 65.36-54.14 95.54-65.36 139.8-95.54 191.5-139.8
198.8-191.5];
sottosegK6K7_h=[-2.923-0 -2.957+2.923 -1.553+2.957 -6.978+1.553 -
3.663+6.978 -4.017+3.663];
sottopendK6K7=sottosegK6K7_h./sottosegK6K7_l;
sottopendK6K7_perc=sottopendK6K7*100;
peso_sottosegK6K7=sottosegK6K7_l/lmisto(2);

% utilizzo le velocità medie calcolate nei tratti di riferimento in base
% alla pendenza dei sottosegmenti trovati: downhill - flat - uphill middle
% - downhill - uphill steep - downhill


% DONNE
frazv_prevW=[XC_middle_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(1);
XC_middle_V.women.MEAN.vseg_gm(4,:)*peso_sottosegK6K7(2);
XC_middle_V.women.MEAN.vseg_gm(1,:)*peso_sottosegK6K7(3);
XC_middle_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(4);
XC_middle_V.women.MEAN.vseg_gm(2,:)*peso_sottosegK6K7(5);
XC_middle_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(6)];
XC_middle_V.women.v_prevK6K7=sum(frazv_prevW);
matr_temp=3.6*[sottosegK6K7_l(1)./XC_middle_V.women.MEAN.vseg_gm(6,:);
sottosegK6K7_l(2)./XC_middle_V.women.MEAN.vseg_gm(4,:);
sottosegK6K7_l(3)./XC_middle_V.women.MEAN.vseg_gm(1,:);
sottosegK6K7_l(4)./XC_middle_V.women.MEAN.vseg_gm(6,:);
sottosegK6K7_l(5)./XC_middle_V.women.MEAN.vseg_gm(2,:);
sottosegK6K7_l(6)./XC_middle_V.women.MEAN.vseg_gm(6,:)];
XC_middle_T.women.confronto.K6K7.tmisto_met4=sum(matr_temp);

% UOMINI
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frazv_prevM=[XC_middle_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(1);
XC_middle_V.men.MEAN.vseg_gm(4,:)*peso_sottosegK6K7(2);
XC_middle_V.men.MEAN.vseg_gm(1,:)*peso_sottosegK6K7(3);
XC_middle_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(4);
XC_middle_V.men.MEAN.vseg_gm(2,:)*peso_sottosegK6K7(5);
XC_middle_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(6)];
XC_middle_V.men.v_prevK6K7=sum(frazv_prevM);
matr_temp=3.6*[sottosegK6K7_l(1)./XC_middle_V.men.MEAN.vseg_gm(6,:);
sottosegK6K7_l(2)./XC_middle_V.men.MEAN.vseg_gm(4,:);
sottosegK6K7_l(3)./XC_middle_V.men.MEAN.vseg_gm(1,:);
sottosegK6K7_l(4)./XC_middle_V.men.MEAN.vseg_gm(6,:);
sottosegK6K7_l(5)./XC_middle_V.men.MEAN.vseg_gm(2,:);
sottosegK6K7_l(6)./XC_middle_V.men.MEAN.vseg_gm(6,:)];
XC_middle_T.men.confronto.K6K7.tmisto_met4=sum(matr_temp);

%% CALCOLO DEGLI ERRORI PERCENTUALI
% DONNE
XC_middle_T.women.confronto.K3K4.e_IPC17_18=abs((XC_middle_T.women.confront
o.K3K4.tmisto_gm-
XC_middle_T.women.confronto.K3K4.tmisto_IPC17_18)./XC_middle_T.women.confro
nto.K3K4.tmisto_gm)*100;
XC_middle_T.women.confronto.K3K4.e_IPC19_20=abs((XC_middle_T.women.confront
o.K3K4.tmisto_gm-
XC_middle_T.women.confronto.K3K4.tmisto_IPC19_20)./XC_middle_T.women.confro
nto.K3K4.tmisto_gm)*100;
XC_middle_T.women.confronto.K3K4.e_met0=abs((XC_middle_T.women.confronto.K3
K4.tmisto_gm-
XC_middle_T.women.confronto.K3K4.tmisto_met0)./XC_middle_T.women.confronto.
K3K4.tmisto_gm)*100;
XC_middle_T.women.confronto.K3K4.e_met1=abs((XC_middle_T.women.confronto.K3
K4.tmisto_gm-
XC_middle_T.women.confronto.K3K4.tmisto_met1)./XC_middle_T.women.confronto.
K3K4.tmisto_gm)*100;
XC_middle_T.women.confronto.K3K4.e_met2=abs((XC_middle_T.women.confronto.K3
K4.tmisto_gm-
XC_middle_T.women.confronto.K3K4.tmisto_met2)./XC_middle_T.women.confronto.
K3K4.tmisto_gm)*100;
XC_middle_T.women.confronto.K3K4.e_met3=abs((XC_middle_T.women.confronto.K3
K4.tmisto_gm-
XC_middle_T.women.confronto.K3K4.tmisto_met3)./XC_middle_T.women.confronto.
K3K4.tmisto_gm)*100;
XC_middle_T.women.confronto.K3K4.e_met4=abs((XC_middle_T.women.confronto.K3
K4.tmisto_gm-
XC_middle_T.women.confronto.K3K4.tmisto_met4)./XC_middle_T.women.confronto.
K3K4.tmisto_gm)*100;

XC_middle_T.women.confronto.K6K7.e_IPC17_18=abs((XC_middle_T.women.confront
o.K6K7.tmisto_gm-
XC_middle_T.women.confronto.K6K7.tmisto_IPC17_18)./XC_middle_T.women.confro
nto.K6K7.tmisto_gm)*100;
XC_middle_T.women.confronto.K6K7.e_IPC19_20=abs((XC_middle_T.women.confront
o.K6K7.tmisto_gm-
XC_middle_T.women.confronto.K6K7.tmisto_IPC19_20)./XC_middle_T.women.confro
nto.K6K7.tmisto_gm)*100;
XC_middle_T.women.confronto.K6K7.e_met0=abs((XC_middle_T.women.confronto.K6
K7.tmisto_gm-
XC_middle_T.women.confronto.K6K7.tmisto_met0)./XC_middle_T.women.confronto.
K6K7.tmisto_gm)*100;
XC_middle_T.women.confronto.K6K7.e_met1=abs((XC_middle_T.women.confronto.K6
K7.tmisto_gm-
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XC_middle_T.women.confronto.K6K7.tmisto_met1)./XC_middle_T.women.confronto.
K6K7.tmisto_gm)*100;
XC_middle_T.women.confronto.K6K7.e_met2=abs((XC_middle_T.women.confronto.K6
K7.tmisto_gm-
XC_middle_T.women.confronto.K6K7.tmisto_met2)./XC_middle_T.women.confronto.
K6K7.tmisto_gm)*100;
XC_middle_T.women.confronto.K6K7.e_met3=abs((XC_middle_T.women.confronto.K6
K7.tmisto_gm-
XC_middle_T.women.confronto.K6K7.tmisto_met3)./XC_middle_T.women.confronto.
K6K7.tmisto_gm)*100;
XC_middle_T.women.confronto.K6K7.e_met4=abs((XC_middle_T.women.confronto.K6
K7.tmisto_gm-
XC_middle_T.women.confronto.K6K7.tmisto_met4)./XC_middle_T.women.confronto.
K6K7.tmisto_gm)*100;

% UOMINI
XC_middle_T.men.confronto.K3K4.e_IPC17_18=abs((XC_middle_T.men.confronto.K3
K4.tmisto_gm-
XC_middle_T.men.confronto.K3K4.tmisto_IPC17_18)./XC_middle_T.men.confronto.
K3K4.tmisto_gm)*100;
XC_middle_T.men.confronto.K3K4.e_IPC19_20=abs((XC_middle_T.men.confronto.K3
K4.tmisto_gm-
XC_middle_T.men.confronto.K3K4.tmisto_IPC19_20)./XC_middle_T.men.confronto.
K3K4.tmisto_gm)*100;
XC_middle_T.men.confronto.K3K4.e_met0=abs((XC_middle_T.men.confronto.K3K4.t
misto_gm-
XC_middle_T.men.confronto.K3K4.tmisto_met0)./XC_middle_T.men.confronto.K3K4
.tmisto_gm)*100;
XC_middle_T.men.confronto.K3K4.e_met1=abs((XC_middle_T.men.confronto.K3K4.t
misto_gm-
XC_middle_T.men.confronto.K3K4.tmisto_met1)./XC_middle_T.men.confronto.K3K4
.tmisto_gm)*100;
XC_middle_T.men.confronto.K3K4.e_met2=abs((XC_middle_T.men.confronto.K3K4.t
misto_gm-
XC_middle_T.men.confronto.K3K4.tmisto_met2)./XC_middle_T.men.confronto.K3K4
.tmisto_gm)*100;
XC_middle_T.men.confronto.K3K4.e_met3=abs((XC_middle_T.men.confronto.K3K4.t
misto_gm-
XC_middle_T.men.confronto.K3K4.tmisto_met3)./XC_middle_T.men.confronto.K3K4
.tmisto_gm)*100;
XC_middle_T.men.confronto.K3K4.e_met4=abs((XC_middle_T.men.confronto.K3K4.t
misto_gm-
XC_middle_T.men.confronto.K3K4.tmisto_met4)./XC_middle_T.men.confronto.K3K4
.tmisto_gm)*100;

XC_middle_T.men.confronto.K6K7.e_IPC17_18=abs((XC_middle_T.men.confronto.K6
K7.tmisto_gm-
XC_middle_T.men.confronto.K6K7.tmisto_IPC17_18)./XC_middle_T.men.confronto.
K6K7.tmisto_gm)*100;
XC_middle_T.men.confronto.K6K7.e_IPC19_20=abs((XC_middle_T.men.confronto.K6
K7.tmisto_gm-
XC_middle_T.men.confronto.K6K7.tmisto_IPC19_20)./XC_middle_T.men.confronto.
K6K7.tmisto_gm)*100;
XC_middle_T.men.confronto.K6K7.e_met0=abs((XC_middle_T.men.confronto.K6K7.t
misto_gm-
XC_middle_T.men.confronto.K6K7.tmisto_met0)./XC_middle_T.men.confronto.K6K7
.tmisto_gm)*100;
XC_middle_T.men.confronto.K6K7.e_met1=abs((XC_middle_T.men.confronto.K6K7.t
misto_gm-
XC_middle_T.men.confronto.K6K7.tmisto_met1)./XC_middle_T.men.confronto.K6K7
.tmisto_gm)*100;
```

```
XC_middle_T.men.confronto.K6K7.e_met2=abs((XC_middle_T.men.confronto.K6K7.t
misto_gm-
XC_middle_T.men.confronto.K6K7.tmisto_met2)./XC_middle_T.men.confronto.K6K7
.tmisto_gm)*100;
XC_middle_T.men.confronto.K6K7.e_met3=abs((XC_middle_T.men.confronto.K6K7.t
misto_gm-
XC_middle_T.men.confronto.K6K7.tmisto_met3)./XC_middle_T.men.confronto.K6K7
.tmisto_gm)*100;
XC_middle_T.men.confronto.K6K7.e_met4=abs((XC_middle_T.men.confronto.K6K7.t
misto_gm-
XC_middle_T.men.confronto.K6K7.tmisto_met4)./XC_middle_T.men.confronto.K6K7
.tmisto_gm)*100;

%% SALVATAGGIO STRUTTURA DELLE VELOCITà

save([filepath_save '\XC_middle_velocita.mat'],'-struct','XC_middle_V');
save([filepath_save '\XC_middle_tempo.mat'],'-struct','XC_middle_T');
```

f.4) Cross country long

```
%% CROSS COUNTRY LONG DISTANCE
clc
clear all
close all

nome_gara='\Cross_country_long';
filepath= [cd nome_gara];
filepath_save=[cd nome_gara];
filepath_save2=[cd nome_gara '\STEP2_GRAFICI'];
XC_long_T=load([filepath '\XC_long_finale.mat']);
load([cd '\dati' '\l_segmenti3D.mat']);
load([cd '\dati' '\l_segmentoK1K33D.mat']);

% Creazione del vettore classi
c=categorical({'LW10','LW10.5','LW11','LW11.5','LW12'});
nsegmentiW=length(XC_long_T.women.MEAN.intertempi_giro1);
nsegmentiM=length(XC_long_T.men.MEAN.intertempi_giro1);
nclassi=5;
classe={'LW10' 'LW10_5' 'LW11' 'LW11_5' 'LW12'};

%% DATI NOTI E CALCOLATI SULLE DISTANZE
% dall'IPC:
l_XC_longW=12000;  % metri
l_XC_longM=15000;

% Per i segmenti K1-K2, K2-K3, K1-K3, K4-K5, K5-K6 e K7-K8 devo considerare
% le lunghezze:

lseg=[l_KK3D(2) l_KK3D(3) l_KK3D(2)+l_KK3D(3) l_KK3D(5) l_KK3D(6)
l_KK3D(8)];
% segmenti intermedi misti
lSTARTK1=l_KK3D(1);
lK3K4=l_KK3D(4);
lK6K7=l_KK3D(7);
%% CALCOLO DELLE VELOCITà PER OGNI ATLETA
% Inverto tutti i valori all'interno dei campi delle struct e li moltiplico
% per il corretto valore della distanza --> in questo modo ottengo i valori
% di velocità in m/s --> moltiplicando anche per 3.6 ottengo i valori delle
% velocità in km/h.
```

```
% DONNE
for i=1:nclassi
    if isempty(XC_long_T.women.(classe{i}))==0
        for j=1:length(XC_long_T.women.(classe{i}))

XC_long_V.women.(classe{i})(j).first_name=XC_long_T.women.(classe{i})(j).fi
rst_name;

XC_long_V.women.(classe{i})(j).last_name=XC_long_T.women.(classe{i})(j).las
t_name;

XC_long_V.women.(classe{i})(j).v_gara=l_XC_longW*3.6/XC_long_T.women.(class
e{i})(j).finish_time;
            for k=1:length(lseg)

XC_long_V.women.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/XC_long_T.women.(clas
se{i})(j).intertempi_giro1(k);

XC_long_V.women.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/XC_long_T.women.(clas
se{i})(j).intertempi_giro2(k);

XC_long_V.women.(classe{i})(j).vseg_g3(k)=3.6*lseg(k)/XC_long_T.women.(clas
se{i})(j).intertempi_giro3(k);

XC_long_V.women.(classe{i})(j).vseg_g4(k)=3.6*lseg(k)/XC_long_T.women.(clas
se{i})(j).intertempi_giro4(k);
            end
        end
    else
        XC_long_V.women.(classe{i}).v_gara=[];
        XC_long_V.women.(classe{i}).vseg_g1=[];
        XC_long_V.women.(classe{i}).vseg_g2=[];
        XC_long_V.women.(classe{i}).vseg_g3=[];
        XC_long_V.women.(classe{i}).vseg_g4=[];
    end
end

% UOMINI
for i=1:nclassi
    if isempty(XC_long_T.men.(classe{i}))==0
        for j=1:length(XC_long_T.men.(classe{i}))

XC_long_V.men.(classe{i})(j).first_name=XC_long_T.men.(classe{i})(j).first_
name;

XC_long_V.men.(classe{i})(j).last_name=XC_long_T.men.(classe{i})(j).last_na
me;

XC_long_V.men.(classe{i})(j).v_gara=l_XC_longM*3.6/XC_long_T.men.(classe{i}
)(j).tempo_finale;
            for k=1:length(lseg)

XC_long_V.men.(classe{i})(j).vseg_g1(k)=3.6*lseg(k)/XC_long_T.men.(classe{i
})(j).intertempi_giro1(k);

XC_long_V.men.(classe{i})(j).vseg_g2(k)=3.6*lseg(k)/XC_long_T.men.(classe{i
})(j).intertempi_giro2(k);

XC_long_V.men.(classe{i})(j).vseg_g3(k)=3.6*lseg(k)/XC_long_T.men.(classe{i
})(j).intertempi_giro3(k);
```

```
XC_long_V.men.(classe{i})(j).vseg_g4(k)=3.6*lseg(k)/XC_long_T.men.(classe{i
})(j).intertempi_giro4(k);

XC_long_V.men.(classe{i})(j).vseg_g5(k)=3.6*lseg(k)/XC_long_T.men.(classe{i
})(j).intertempi_giro5(k);
            end
        end
    else
        XC_long_V.men.(classe{i}).v_gara=[];
        XC_long_V.men.(classe{i}).vseg_g1=[];
        XC_long_V.men.(classe{i}).vseg_g2=[];
        XC_long_V.men.(classe{i}).vseg_g3=[];
        XC_long_V.men.(classe{i}).vseg_g4=[];
        XC_long_V.men.(classe{i}).vseg_g5=[];
    end
end

%% CALCOLO DELLE VELOCITà MEDIE E STD PER CLASSI

% DONNE
atletiW_classi=[0 2 2 0 6];
vgaraW=NaN(max(atletiW_classi),nclassi);
vseg_g1W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g2W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g3W=NaN(max(atletiW_classi),nclassi,length(lseg));
vseg_g4W=NaN(max(atletiW_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiW_classi(i)~=0
         for j=1:size(XC_long_V.women.(classe{i}),2)
            vgaraW(j,i)=XC_long_V.women.(classe{i})(j).v_gara;
            for m=1:length(lseg)
                vseg_g1W(j,i,m)=XC_long_V.women.(classe{i})(j).vseg_g1(m);
                vseg_g2W(j,i,m)=XC_long_V.women.(classe{i})(j).vseg_g2(m);
                vseg_g3W(j,i,m)=XC_long_V.women.(classe{i})(j).vseg_g3(m);
                vseg_g4W(j,i,m)=XC_long_V.women.(classe{i})(j).vseg_g4(m);
            end
         end
    end
end

for i=1:nclassi
    XC_long_V.women.MEAN.v_gara=nanmean(vgaraW);
    XC_long_V.women.STD.v_gara=nanstd(vgaraW);
end

for m=1:length(lseg)
    XC_long_V.women.MEAN.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    XC_long_V.women.MEAN.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
    XC_long_V.women.MEAN.vseg_g3(m,:)=nanmean(vseg_g3W(:,:,m));
    XC_long_V.women.MEAN.vseg_g4(m,:)=nanmean(vseg_g4W(:,:,m));
    XC_long_V.women.STD.vseg_g1(m,:)=nanmean(vseg_g1W(:,:,m));
    XC_long_V.women.STD.vseg_g2(m,:)=nanmean(vseg_g2W(:,:,m));
    XC_long_V.women.STD.vseg_g3(m,:)=nanmean(vseg_g3W(:,:,m));
    XC_long_V.women.STD.vseg_g4(m,:)=nanmean(vseg_g4W(:,:,m));
end


% UOMINI
```

```
atletiM_classi=[2 0 3 2 13];
vgaraM=NaN(max(atletiM_classi),nclassi);
vseg_g1M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g2M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g3M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g4M=NaN(max(atletiM_classi),nclassi,length(lseg));
vseg_g5M=NaN(max(atletiM_classi),nclassi,length(lseg));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(XC_long_V.men.(classe{i}),2)
            vgaraM(j,i)=XC_long_V.men.(classe{i})(j).v_gara;
            for m=1:length(lseg)
                vseg_g1M(j,i,m)=XC_long_V.men.(classe{i})(j).vseg_g1(m);
                vseg_g2M(j,i,m)=XC_long_V.men.(classe{i})(j).vseg_g2(m);
                vseg_g3M(j,i,m)=XC_long_V.men.(classe{i})(j).vseg_g3(m);
                vseg_g4M(j,i,m)=XC_long_V.men.(classe{i})(j).vseg_g4(m);
                vseg_g5M(j,i,m)=XC_long_V.men.(classe{i})(j).vseg_g5(m);
            end
        end
    end
end

for i=1:nclassi
    XC_long_V.men.MEAN.v_gara=nanmean(vgaraM);
    XC_long_V.men.STD.v_gara=nanstd(vgaraM);
end

for m=1:length(lseg)
    XC_long_V.men.MEAN.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    XC_long_V.men.MEAN.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    XC_long_V.men.MEAN.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
    XC_long_V.men.MEAN.vseg_g4(m,:)=nanmean(vseg_g4M(:,:,m));
    XC_long_V.men.MEAN.vseg_g5(m,:)=nanmean(vseg_g5M(:,:,m));
    XC_long_V.men.STD.vseg_g1(m,:)=nanmean(vseg_g1M(:,:,m));
    XC_long_V.men.STD.vseg_g2(m,:)=nanmean(vseg_g2M(:,:,m));
    XC_long_V.men.STD.vseg_g3(m,:)=nanmean(vseg_g3M(:,:,m));
    XC_long_V.men.STD.vseg_g4(m,:)=nanmean(vseg_g4M(:,:,m));
    XC_long_V.men.STD.vseg_g5(m,:)=nanmean(vseg_g5M(:,:,m));
end

%% CALCOLO DEI COEFFICIENTI CORRETTIVI:

% calcolo del coeff correttivo medio in base al tempo totale di gara (anche
% se avessi utilizzato la velocità media di gara il risultato non sarebbe
% cambiato)

%DONNE
t_gW=[XC_long_T.women.MEAN.t_finale(1) XC_long_T.women.MEAN.t_finale(2)
XC_long_T.women.MEAN.t_finale(3) XC_long_T.women.MEAN.t_finale(4)
XC_long_T.women.MEAN.t_finale(5)]/XC_long_T.women.MEAN.t_finale(5);
XC_long_V.women.t_perc_gara=t_gW*100;
coeff_garaW=1./t_gW;
XC_long_V.women.coeff_perc_gara=coeff_garaW*100;

% UOMINI
t_gM=[XC_long_T.men.MEAN.t_finale(1) XC_long_T.men.MEAN.t_finale(2)
XC_long_T.men.MEAN.t_finale(3) XC_long_T.men.MEAN.t_finale(4)
XC_long_T.men.MEAN.t_finale(5)]/XC_long_T.men.MEAN.t_finale(5);
XC_long_V.men.t_perc_gara=t_gM*100;
```

```
coeff_garaM=1./t_gM;
XC_long_V.men.coeff_perc_gara=coeff_garaM*100;


% calcolo dei coeff correttivi in base ai singoli segmenti che si sono
% valutati: in questo caso devo utilizzare la velocità media di ogni
% segmento per avere una congruenza tra i coefficienti dei vari segmenti
% (tengo in considerazione la variazione di lunghezza dei diversi segmenti)


lseg_tot=sum(lseg([1 2 4 5 6]));    % lunghezza totale dei segmenti
valutati
peso_seg=lseg/lseg_tot; % da non considerare il 3° valore

% DONNE
XC_long_V.women.MEAN.vseg_gm=(XC_long_V.women.MEAN.vseg_g1+XC_long_V.women.
MEAN.vseg_g2+XC_long_V.women.MEAN.vseg_g3+XC_long_V.women.MEAN.vseg_g4)/4;
coeff_segW=[XC_long_V.women.MEAN.vseg_gm(:,1)
XC_long_V.women.MEAN.vseg_gm(:,2) XC_long_V.women.MEAN.vseg_gm(:,3)
XC_long_V.women.MEAN.vseg_gm(:,4)
XC_long_V.women.MEAN.vseg_gm(:,5)]./XC_long_V.women.MEAN.vseg_gm(:,5);
XC_long_V.women.coeff_perc_seg=100*coeff_segW;
XC_long_V.women.coeff_perc_gara_medio=[nanmean(XC_long_V.women.coeff_perc_s
eg([1 2 4 5 6],1)) nanmean(XC_long_V.women.coeff_perc_seg([1 2 4 5 6],2))
nanmean(XC_long_V.women.coeff_perc_seg([1 2 4 5 6],3))
nanmean(XC_long_V.women.coeff_perc_seg([1 2 4 5 6],4))
nanmean(XC_long_V.women.coeff_perc_seg([1 2 4 5 6],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempW(i,j)=XC_long_V.women.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
XC_long_V.women.coeff_perc_gara_pesato=[sum(tempW([1 2 4 5 6],1))
sum(tempW([1 2 4 5 6],2)) sum(tempW([1 2 4 5 6],3)) sum(tempW([1 2 4 5
6],4)) sum(tempW([1 2 4 5 6],5))];



% UOMINI
XC_long_V.men.MEAN.vseg_gm=(XC_long_V.men.MEAN.vseg_g1+XC_long_V.men.MEAN.v
seg_g2+XC_long_V.men.MEAN.vseg_g3+XC_long_V.men.MEAN.vseg_g4+XC_long_V.men.
MEAN.vseg_g5)/5;
coeff_segM=[XC_long_V.men.MEAN.vseg_gm(:,1) XC_long_V.men.MEAN.vseg_gm(:,2)
XC_long_V.men.MEAN.vseg_gm(:,3) XC_long_V.men.MEAN.vseg_gm(:,4)
XC_long_V.men.MEAN.vseg_gm(:,5)]./XC_long_V.men.MEAN.vseg_gm(:,5);
XC_long_V.men.coeff_perc_seg=100*coeff_segM;
XC_long_V.men.coeff_perc_gara_medio=[nanmean(XC_long_V.men.coeff_perc_seg([
1 2 4 5 6],1)) nanmean(XC_long_V.men.coeff_perc_seg([1 2 4 5 6],2))
nanmean(XC_long_V.men.coeff_perc_seg([1 2 4 5 6],3))
nanmean(XC_long_V.men.coeff_perc_seg([1 2 4 5 6],4))
nanmean(XC_long_V.men.coeff_perc_seg([1 2 4 5 6],5))];

for j=1:nclassi
    for i=1:length(lseg)
        tempM(i,j)=XC_long_V.men.coeff_perc_seg(i,j)*peso_seg(i);
    end
end
XC_long_V.men.coeff_perc_gara_pesato=[sum(tempM([1 2 4 5 6],1))
sum(tempM([1 2 4 5 6],2)) sum(tempM([1 2 4 5 6],3)) sum(tempM([1 2 4 5
6],4)) sum(tempM([1 2 4 5 6],5))];
```

```
%% CREAZIONE TRATTI MISTI:
% a) START-K1
% b) K3-K4
% c) K6-K7

% lSTARTK1=l_KK3D(1);
lmisto=[l_KK3D(4) l_KK3D(7)];

% DONNE
for i=1:length(classe)
    if isempty(XC_long_T.women.(classe{i}))==0
        for j=1:length(XC_long_T.women.(classe{i}))
            % calcolo START-K1
%
XC_long_T.women.(classe{i})(j).START_K1(1)=XC_long_T.women.(classe{i})(j).s
plit_time_giro1(1);
%
XC_long_T.women.(classe{i})(j).START_K1(2)=XC_long_T.women.(classe{i})(j).s
plit_time_giro2(1)-XC_long_T.women.(classe{i})(j).split_time_giro1(11);
            % calcolo K3-K4

XC_long_T.women.(classe{i})(j).K3_K4(1)=XC_long_T.women.(classe{i})(j).spli
t_time_giro1(4)-XC_long_T.women.(classe{i})(j).split_time_giro1(3);

XC_long_T.women.(classe{i})(j).K3_K4(2)=XC_long_T.women.(classe{i})(j).spli
t_time_giro2(4)-XC_long_T.women.(classe{i})(j).split_time_giro2(3);

XC_long_T.women.(classe{i})(j).K3_K4(3)=XC_long_T.women.(classe{i})(j).spli
t_time_giro3(4)-XC_long_T.women.(classe{i})(j).split_time_giro3(3);

XC_long_T.women.(classe{i})(j).K3_K4(4)=XC_long_T.women.(classe{i})(j).spli
t_time_giro4(4)-XC_long_T.women.(classe{i})(j).split_time_giro4(3);


XC_long_V.women.(classe{i})(j).K3_K4(1)=3.6*lmisto(1)/XC_long_T.women.(clas
se{i})(j).K3_K4(1);

XC_long_V.women.(classe{i})(j).K3_K4(2)=3.6*lmisto(1)/XC_long_T.women.(clas
se{i})(j).K3_K4(2);

XC_long_V.women.(classe{i})(j).K3_K4(3)=3.6*lmisto(1)/XC_long_T.women.(clas
se{i})(j).K3_K4(3);

XC_long_V.women.(classe{i})(j).K3_K4(4)=3.6*lmisto(1)/XC_long_T.women.(clas
se{i})(j).K3_K4(4);
            % calcolo K6-K7
```

```
XC_long_T.women.(classe{i})(j).K6_K7(1)=XC_long_T.women.(classe{i})(j).spli
t_time_giro1(7)-XC_long_T.women.(classe{i})(j).split_time_giro1(6);

XC_long_T.women.(classe{i})(j).K6_K7(2)=XC_long_T.women.(classe{i})(j).spli
t_time_giro2(7)-XC_long_T.women.(classe{i})(j).split_time_giro2(6);

XC_long_T.women.(classe{i})(j).K6_K7(3)=XC_long_T.women.(classe{i})(j).spli
t_time_giro3(7)-XC_long_T.women.(classe{i})(j).split_time_giro3(6);

XC_long_T.women.(classe{i})(j).K6_K7(4)=XC_long_T.women.(classe{i})(j).spli
t_time_giro4(7)-XC_long_T.women.(classe{i})(j).split_time_giro4(6);


XC_long_V.women.(classe{i})(j).K6_K7(1)=3.6*lmisto(2)/XC_long_T.women.(clas
se{i})(j).K6_K7(1);

XC_long_V.women.(classe{i})(j).K6_K7(2)=3.6*lmisto(2)/XC_long_T.women.(clas
se{i})(j).K6_K7(2);

XC_long_V.women.(classe{i})(j).K6_K7(3)=3.6*lmisto(2)/XC_long_T.women.(clas
se{i})(j).K6_K7(3);

XC_long_V.women.(classe{i})(j).K6_K7(4)=3.6*lmisto(2)/XC_long_T.women.(clas
se{i})(j).K6_K7(4);
        end
    else
        XC_long_V.women.(classe{i}).K3_K4=[];
        XC_long_V.women.(classe{i}).K6_K7=[];
    end
end

% fare la media E LA STD dei valori K3K4 E K6K7 per ogni classe (creare una
% matrice per il g1 ed un altro per il g2 (avrò 2 matrici 2x5
% righe=segmenti misti; colonne=classi) --> mediare quindi i valori di
% velocità sui giri --> avrò una matrice 2x5

vmisto_g1W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g2W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g3W=NaN(max(atletiW_classi),nclassi,length(lmisto));
vmisto_g4W=NaN(max(atletiW_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiW_classi(i)~=0
        for j=1:size(XC_long_V.women.(classe{i}),2)
            vmisto_g1W(j,i,1)=XC_long_V.women.(classe{i})(j).K3_K4(1);
            vmisto_g1W(j,i,2)=XC_long_V.women.(classe{i})(j).K6_K7(1);
            vmisto_g2W(j,i,1)=XC_long_V.women.(classe{i})(j).K3_K4(2);
            vmisto_g2W(j,i,2)=XC_long_V.women.(classe{i})(j).K6_K7(2);
            vmisto_g3W(j,i,1)=XC_long_V.women.(classe{i})(j).K3_K4(3);
            vmisto_g3W(j,i,2)=XC_long_V.women.(classe{i})(j).K6_K7(3);
            vmisto_g4W(j,i,1)=XC_long_V.women.(classe{i})(j).K3_K4(4);
            vmisto_g4W(j,i,2)=XC_long_V.women.(classe{i})(j).K6_K7(4);
        end
    end
end

for m=1:length(lmisto)
    XC_long_V.women.MEAN.vmisto_g1(m,:)=nanmean(vmisto_g1W(:,:,m));
    XC_long_V.women.MEAN.vmisto_g2(m,:)=nanmean(vmisto_g2W(:,:,m));
```

```
    XC_long_V.women.MEAN.vmisto_g3(m,:)=nanmean(vmisto_g3W(:,:,m));
    XC_long_V.women.MEAN.vmisto_g4(m,:)=nanmean(vmisto_g4W(:,:,m));
    XC_long_V.women.STD.vmisto_g1(m,:)=nanstd(vmisto_g1W(:,:,m));
    XC_long_V.women.STD.vmisto_g2(m,:)=nanstd(vmisto_g2W(:,:,m));
    XC_long_V.women.STD.vmisto_g3(m,:)=nanstd(vmisto_g3W(:,:,m));
    XC_long_V.women.STD.vmisto_g4(m,:)=nanstd(vmisto_g4W(:,:,m));
end


% UOMINI
for i=1:length(classe)
    if isempty(XC_long_T.men.(classe{i}))==0
        for j=1:length(XC_long_T.men.(classe{i}))
            % calcolo START-K1
%
XC_long_T.women.(classe{i})(j).START_K1(1)=XC_long_T.women.(classe{i})(j).s
plit_time_giro1(1);
%
XC_long_T.women.(classe{i})(j).START_K1(2)=XC_long_T.women.(classe{i})(j).s
plit_time_giro2(1)-XC_long_T.women.(classe{i})(j).split_time_giro1(11);
            % calcolo K3-K4

XC_long_T.men.(classe{i})(j).K3_K4(1)=XC_long_T.men.(classe{i})(j).split_ti
me_giro1(4)-XC_long_T.men.(classe{i})(j).split_time_giro1(3);

XC_long_T.men.(classe{i})(j).K3_K4(2)=XC_long_T.men.(classe{i})(j).split_ti
me_giro2(4)-XC_long_T.men.(classe{i})(j).split_time_giro2(3);

XC_long_T.men.(classe{i})(j).K3_K4(3)=XC_long_T.men.(classe{i})(j).split_ti
me_giro3(4)-XC_long_T.men.(classe{i})(j).split_time_giro3(3);

XC_long_T.men.(classe{i})(j).K3_K4(4)=XC_long_T.men.(classe{i})(j).split_ti
me_giro4(4)-XC_long_T.men.(classe{i})(j).split_time_giro4(3);

XC_long_T.men.(classe{i})(j).K3_K4(5)=XC_long_T.men.(classe{i})(j).split_ti
me_giro5(4)-XC_long_T.men.(classe{i})(j).split_time_giro5(3);


XC_long_V.men.(classe{i})(j).K3_K4(1)=3.6*lmisto(1)/XC_long_T.men.(classe{i
})(j).K3_K4(1);

XC_long_V.men.(classe{i})(j).K3_K4(2)=3.6*lmisto(1)/XC_long_T.men.(classe{i
})(j).K3_K4(2);

XC_long_V.men.(classe{i})(j).K3_K4(3)=3.6*lmisto(1)/XC_long_T.men.(classe{i
})(j).K3_K4(3);

XC_long_V.men.(classe{i})(j).K3_K4(4)=3.6*lmisto(1)/XC_long_T.men.(classe{i
})(j).K3_K4(4);

XC_long_V.men.(classe{i})(j).K3_K4(5)=3.6*lmisto(1)/XC_long_T.men.(classe{i
})(j).K3_K4(5);
            % calcolo K6-K7

XC_long_T.men.(classe{i})(j).K6_K7(1)=XC_long_T.men.(classe{i})(j).split_ti
me_giro1(7)-XC_long_T.men.(classe{i})(j).split_time_giro1(6);

XC_long_T.men.(classe{i})(j).K6_K7(2)=XC_long_T.men.(classe{i})(j).split_ti
me_giro2(7)-XC_long_T.men.(classe{i})(j).split_time_giro2(6);
```

```
XC_long_T.men.(classe{i})(j).K6_K7(3)=XC_long_T.men.(classe{i})(j).split_ti
me_giro3(7)-XC_long_T.men.(classe{i})(j).split_time_giro3(6);

XC_long_T.men.(classe{i})(j).K6_K7(4)=XC_long_T.men.(classe{i})(j).split_ti
me_giro4(7)-XC_long_T.men.(classe{i})(j).split_time_giro4(6);

XC_long_T.men.(classe{i})(j).K6_K7(5)=XC_long_T.men.(classe{i})(j).split_ti
me_giro5(7)-XC_long_T.men.(classe{i})(j).split_time_giro5(6);


XC_long_V.men.(classe{i})(j).K6_K7(1)=3.6*lmisto(2)/XC_long_T.men.(classe{i
})(j).K6_K7(1);

XC_long_V.men.(classe{i})(j).K6_K7(2)=3.6*lmisto(2)/XC_long_T.men.(classe{i
})(j).K6_K7(2);

XC_long_V.men.(classe{i})(j).K6_K7(3)=3.6*lmisto(2)/XC_long_T.men.(classe{i
})(j).K6_K7(3);

XC_long_V.men.(classe{i})(j).K6_K7(4)=3.6*lmisto(2)/XC_long_T.men.(classe{i
})(j).K6_K7(4);

XC_long_V.men.(classe{i})(j).K6_K7(5)=3.6*lmisto(2)/XC_long_T.men.(classe{i
})(j).K6_K7(5);
        end
    else
        XC_long_V.men.(classe{i}).K3_K4=[];
        XC_long_V.men.(classe{i}).K6_K7=[];
    end
end

vmisto_g1M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g2M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g3M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g4M=NaN(max(atletiM_classi),nclassi,length(lmisto));
vmisto_g5M=NaN(max(atletiM_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(XC_long_V.men.(classe{i}),2)
            vmisto_g1M(j,i,1)=XC_long_V.men.(classe{i})(j).K3_K4(1);
            vmisto_g1M(j,i,2)=XC_long_V.men.(classe{i})(j).K6_K7(1);
            vmisto_g2M(j,i,1)=XC_long_V.men.(classe{i})(j).K3_K4(2);
            vmisto_g2M(j,i,2)=XC_long_V.men.(classe{i})(j).K6_K7(2);
            vmisto_g3M(j,i,1)=XC_long_V.men.(classe{i})(j).K3_K4(3);
            vmisto_g3M(j,i,2)=XC_long_V.men.(classe{i})(j).K6_K7(3);
            vmisto_g4M(j,i,1)=XC_long_V.men.(classe{i})(j).K3_K4(4);
            vmisto_g4M(j,i,2)=XC_long_V.men.(classe{i})(j).K6_K7(4);
            vmisto_g5M(j,i,1)=XC_long_V.men.(classe{i})(j).K3_K4(5);
            vmisto_g5M(j,i,2)=XC_long_V.men.(classe{i})(j).K6_K7(5);
        end
    end
end

for m=1:length(lmisto)
    XC_long_V.men.MEAN.vmisto_g1(m,:)=nanmean(vmisto_g1M(:,:,m));
    XC_long_V.men.MEAN.vmisto_g2(m,:)=nanmean(vmisto_g2M(:,:,m));
    XC_long_V.men.MEAN.vmisto_g3(m,:)=nanmean(vmisto_g3M(:,:,m));
    XC_long_V.men.MEAN.vmisto_g4(m,:)=nanmean(vmisto_g4M(:,:,m));
    XC_long_V.men.MEAN.vmisto_g5(m,:)=nanmean(vmisto_g5M(:,:,m));
```

```
    XC_long_V.men.STD.vmisto_g1(m,:)=nanstd(vmisto_g1M(:,:,m));
    XC_long_V.men.STD.vmisto_g2(m,:)=nanstd(vmisto_g2M(:,:,m));
    XC_long_V.men.STD.vmisto_g3(m,:)=nanstd(vmisto_g3M(:,:,m));
    XC_long_V.men.STD.vmisto_g4(m,:)=nanstd(vmisto_g4M(:,:,m));
    XC_long_V.men.STD.vmisto_g5(m,:)=nanstd(vmisto_g5M(:,:,m));
end

%% PREVISIONE E CONFRONTO TRATTI MISTI

% Sono andata a considerare tutta la lunghezza dei tratti misti e la
% velocità media di tutto il tratto, senza considerare parti di salita e
% parti di pianura/discesa.
% DONNE
XC_long_V.women.MEAN.vmisto_gm=(XC_long_V.women.MEAN.vmisto_g1+XC_long_V.wo
men.MEAN.vmisto_g2+XC_long_V.women.MEAN.vmisto_g3+XC_long_V.women.MEAN.vmis
to_g4)/4;
coeff_mistoW=[XC_long_V.women.MEAN.vmisto_gm(:,1)
XC_long_V.women.MEAN.vmisto_gm(:,2) XC_long_V.women.MEAN.vmisto_gm(:,3)
XC_long_V.women.MEAN.vmisto_gm(:,4)
XC_long_V.women.MEAN.vmisto_gm(:,5)]./XC_long_V.women.MEAN.vmisto_gm(:,5);
XC_long_V.women.coeff_perc_misto=100*coeff_mistoW;

% UOMINI
XC_long_V.men.MEAN.vmisto_gm=(XC_long_V.men.MEAN.vmisto_g1+XC_long_V.men.ME
AN.vmisto_g2+XC_long_V.men.MEAN.vmisto_g3+XC_long_V.men.MEAN.vmisto_g4+XC_l
ong_V.men.MEAN.vmisto_g5)/5;
coeff_mistoM=[XC_long_V.men.MEAN.vmisto_gm(:,1)
XC_long_V.men.MEAN.vmisto_gm(:,2) XC_long_V.men.MEAN.vmisto_gm(:,3)
XC_long_V.men.MEAN.vmisto_gm(:,4)
XC_long_V.men.MEAN.vmisto_gm(:,5)]./XC_long_V.men.MEAN.vmisto_gm(:,5);
XC_long_V.men.coeff_perc_misto=100*coeff_mistoM;

% tempo REALE segmento K3-K4 e K6-K7:
% DONNE
tmisto_g1W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g2W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g3W=NaN(max(atletiW_classi),nclassi,length(lmisto));
tmisto_g4W=NaN(max(atletiW_classi),nclassi,length(lmisto));
for i=1:nclassi
    if atletiW_classi(i)~=0
        for j=1:size(XC_long_T.women.(classe{i}),1)
            tmisto_g1W(j,i,1)=XC_long_T.women.(classe{i})(j).K3_K4(1);
            tmisto_g1W(j,i,2)=XC_long_T.women.(classe{i})(j).K6_K7(1);
            tmisto_g2W(j,i,1)=XC_long_T.women.(classe{i})(j).K3_K4(2);
            tmisto_g2W(j,i,2)=XC_long_T.women.(classe{i})(j).K6_K7(2);
            tmisto_g3W(j,i,1)=XC_long_T.women.(classe{i})(j).K3_K4(3);
            tmisto_g3W(j,i,2)=XC_long_T.women.(classe{i})(j).K6_K7(3);
            tmisto_g4W(j,i,1)=XC_long_T.women.(classe{i})(j).K3_K4(4);
            tmisto_g4W(j,i,2)=XC_long_T.women.(classe{i})(j).K6_K7(4);
        end
    end
end

for m=1:length(lmisto)

XC_long_T.women.confronto.MEAN.tmisto_g1(m,:)=nanmean(tmisto_g1W(:,:,m));

XC_long_T.women.confronto.MEAN.tmisto_g2(m,:)=nanmean(tmisto_g2W(:,:,m));

XC_long_T.women.confronto.MEAN.tmisto_g3(m,:)=nanmean(tmisto_g3W(:,:,m));
```

```
XC_long_T.women.confronto.MEAN.tmisto_g4(m,:)=nanmean(tmisto_g4W(:,:,m));
    XC_long_T.women.confronto.STD.tmisto_g1(m,:)=nanstd(tmisto_g1W(:,:,m));
    XC_long_T.women.confronto.STD.tmisto_g2(m,:)=nanstd(tmisto_g2W(:,:,m));
    XC_long_T.women.confronto.STD.tmisto_g3(m,:)=nanstd(tmisto_g3W(:,:,m));
    XC_long_T.women.confronto.STD.tmisto_g4(m,:)=nanstd(tmisto_g4W(:,:,m));
end
XC_long_T.women.confronto.K3K4.tmisto_gm=(XC_long_T.women.confronto.MEAN.tm
isto_g1(1,:)+XC_long_T.women.confronto.MEAN.tmisto_g2(1,:)+XC_long_T.women.
confronto.MEAN.tmisto_g3(1,:)+XC_long_T.women.confronto.MEAN.tmisto_g4(1,:)
)/4;
XC_long_T.women.confronto.K6K7.tmisto_gm=(XC_long_T.women.confronto.MEAN.tm
isto_g1(2,:)+XC_long_T.women.confronto.MEAN.tmisto_g2(2,:)+XC_long_T.women.
confronto.MEAN.tmisto_g3(2,:)+XC_long_T.women.confronto.MEAN.tmisto_g4(2,:)
)/4;

% UOMINI
tmisto_g1M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g2M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g3M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g4M=NaN(max(atletiM_classi),nclassi,length(lmisto));
tmisto_g5M=NaN(max(atletiM_classi),nclassi,length(lmisto));

for i=1:nclassi
    if atletiM_classi(i)~=0
        for j=1:size(XC_long_T.men.(classe{i}),1)
            tmisto_g1M(j,i,1)=XC_long_T.men.(classe{i})(j).K3_K4(1);
            tmisto_g1M(j,i,2)=XC_long_T.men.(classe{i})(j).K6_K7(1);
            tmisto_g2M(j,i,1)=XC_long_T.men.(classe{i})(j).K3_K4(2);
            tmisto_g2M(j,i,2)=XC_long_T.men.(classe{i})(j).K6_K7(2);
            tmisto_g3M(j,i,1)=XC_long_T.men.(classe{i})(j).K3_K4(3);
            tmisto_g3M(j,i,2)=XC_long_T.men.(classe{i})(j).K6_K7(3);
            tmisto_g4M(j,i,1)=XC_long_T.men.(classe{i})(j).K3_K4(4);
            tmisto_g4M(j,i,2)=XC_long_T.men.(classe{i})(j).K6_K7(4);
            tmisto_g5M(j,i,1)=XC_long_T.men.(classe{i})(j).K3_K4(5);
            tmisto_g5M(j,i,2)=XC_long_T.men.(classe{i})(j).K6_K7(5);
        end
    end
end

for m=1:length(lmisto)
    XC_long_T.men.confronto.MEAN.tmisto_g1(m,:)=nanmean(tmisto_g1M(:,:,m));
    XC_long_T.men.confronto.MEAN.tmisto_g2(m,:)=nanmean(tmisto_g2M(:,:,m));
    XC_long_T.men.confronto.MEAN.tmisto_g3(m,:)=nanmean(tmisto_g3M(:,:,m));
    XC_long_T.men.confronto.MEAN.tmisto_g4(m,:)=nanmean(tmisto_g4M(:,:,m));
    XC_long_T.men.confronto.MEAN.tmisto_g5(m,:)=nanmean(tmisto_g5M(:,:,m));
    XC_long_T.men.confronto.STD.tmisto_g1(m,:)=nanstd(tmisto_g1M(:,:,m));
    XC_long_T.men.confronto.STD.tmisto_g2(m,:)=nanstd(tmisto_g2M(:,:,m));
    XC_long_T.men.confronto.STD.tmisto_g3(m,:)=nanstd(tmisto_g3M(:,:,m));
    XC_long_T.men.confronto.STD.tmisto_g4(m,:)=nanstd(tmisto_g4M(:,:,m));
    XC_long_T.men.confronto.STD.tmisto_g5(m,:)=nanstd(tmisto_g5M(:,:,m));
end
XC_long_T.men.confronto.K3K4.tmisto_gm=(XC_long_T.men.confronto.MEAN.tmisto
_g1(1,:)+XC_long_T.men.confronto.MEAN.tmisto_g2(1,:)+XC_long_T.men.confront
o.MEAN.tmisto_g3(1,:)+XC_long_T.men.confronto.MEAN.tmisto_g4(1,:)+XC_long_T
.men.confronto.MEAN.tmisto_g5(1,:))/5;
XC_long_T.men.confronto.K6K7.tmisto_gm=(XC_long_T.men.confronto.MEAN.tmisto
_g1(2,:)+XC_long_T.men.confronto.MEAN.tmisto_g2(2,:)+XC_long_T.men.confront
o.MEAN.tmisto_g3(2,:)+XC_long_T.men.confronto.MEAN.tmisto_g4(2,:)+XC_long_T
.men.confronto.MEAN.tmisto_g5(2,:))/5;
```

```
%%
%uso i coeff dell'IPC stagione 2017-2018
IPC17_18=[0.86 0.90 0.94 0.96 1.00];

XC_long_T.women.confronto.K3K4.tmisto_IPC17_18=XC_long_T.women.confronto.K3
K4.tmisto_gm(5)./IPC17_18;
XC_long_T.women.confronto.K6K7.tmisto_IPC17_18=XC_long_T.women.confronto.K6
K7.tmisto_gm(5)./IPC17_18;

XC_long_T.men.confronto.K3K4.tmisto_IPC17_18=XC_long_T.men.confronto.K3K4.t
misto_gm(5)./IPC17_18;
XC_long_T.men.confronto.K6K7.tmisto_IPC17_18=XC_long_T.men.confronto.K6K7.t
misto_gm(5)./IPC17_18;

%uso i coeff dell'IPC stagione 2019-2020
IPC19_20=[0.86 0.88 0.93 0.95 1.00];

XC_long_T.women.confronto.K3K4.tmisto_IPC19_20=XC_long_T.women.confronto.K3
K4.tmisto_gm(5)./IPC19_20;
XC_long_T.women.confronto.K6K7.tmisto_IPC19_20=XC_long_T.women.confronto.K6
K7.tmisto_gm(5)./IPC19_20;

XC_long_T.men.confronto.K3K4.tmisto_IPC19_20=XC_long_T.men.confronto.K3K4.t
misto_gm(5)./IPC19_20;
XC_long_T.men.confronto.K6K7.tmisto_IPC19_20=XC_long_T.men.confronto.K6K7.t
misto_gm(5)./IPC19_20;

% confronto 0: calcolo il tempo del segmento misto utilizzando il coeff
% correttivo dei tratti misti trovati. --> METODO 0
XC_long_T.women.confronto.K3K4.tmisto_met0=XC_long_T.women.confronto.K3K4.t
misto_gm(5)./coeff_mistoW(1,:);
XC_long_T.women.confronto.K6K7.tmisto_met0=XC_long_T.women.confronto.K6K7.t
misto_gm(5)./coeff_mistoW(2,:);

XC_long_T.men.confronto.K3K4.tmisto_met0=XC_long_T.men.confronto.K3K4.tmist
o_gm(5)./coeff_mistoM(1,:);
XC_long_T.men.confronto.K6K7.tmisto_met0=XC_long_T.men.confronto.K6K7.tmist
o_gm(5)./coeff_mistoM(2,:);

% CONFRONTO 1: UTILIZZO I COEFFICIENTI DI GARA TROVATI UTILIZZANDO IL TEMPO
% TOTALE DI GARA --> uso il METODO 1
XC_long_T.women.confronto.K3K4.tmisto_met1=XC_long_T.women.confronto.K3K4.t
misto_gm(5)./coeff_garaW(1,:);
XC_long_T.women.confronto.K6K7.tmisto_met1=XC_long_T.women.confronto.K6K7.t
misto_gm(5)./coeff_garaW(1,:);

XC_long_T.men.confronto.K3K4.tmisto_met1=XC_long_T.men.confronto.K3K4.tmist
o_gm(5)./coeff_garaM(1,:);
XC_long_T.men.confronto.K6K7.tmisto_met1=XC_long_T.men.confronto.K6K7.tmist
o_gm(5)./coeff_garaM(1,:);

% CONFRONTO 2: METODO 2
XC_long_T.women.confronto.K3K4.tmisto_met2=XC_long_T.women.confronto.K3K4.t
misto_gm(5)./(XC_long_V.women.coeff_perc_gara_medio/100);
XC_long_T.women.confronto.K6K7.tmisto_met2=XC_long_T.women.confronto.K6K7.t
misto_gm(5)./(XC_long_V.women.coeff_perc_gara_medio/100);

XC_long_T.men.confronto.K3K4.tmisto_met2=XC_long_T.men.confronto.K3K4.tmist
o_gm(5)./(XC_long_V.men.coeff_perc_gara_medio/100);
```

```
XC_long_T.men.confronto.K6K7.tmisto_met2=XC_long_T.men.confronto.K6K7.tmist
o_gm(5)./(XC_long_V.men.coeff_perc_gara_medio/100);

% CONFRONTO 3: uso il METODO 3
XC_long_T.women.confronto.K3K4.tmisto_met3=XC_long_T.women.confronto.K3K4.t
misto_gm(5)./(XC_long_V.women.coeff_perc_gara_pesato/100);
XC_long_T.women.confronto.K6K7.tmisto_met3=XC_long_T.women.confronto.K6K7.t
misto_gm(5)./(XC_long_V.women.coeff_perc_gara_pesato/100);

XC_long_T.men.confronto.K3K4.tmisto_met3=XC_long_T.men.confronto.K3K4.tmist
o_gm(5)./(XC_long_V.men.coeff_perc_gara_pesato/100);
XC_long_T.men.confronto.K6K7.tmisto_met3=XC_long_T.men.confronto.K6K7.tmist
o_gm(5)./(XC_long_V.men.coeff_perc_gara_pesato/100);

% confronto 4: suddivido i segmenti misti in sottosegmenti ed utilizzo le
% velocità calcolate dai segmenti di riferimento per ottenere il valore di
% tempo dell'intero segmento per ogni classe  ---> METODO 4

% K3 = pto 52 e K4 = pto 75
% suddivido il tratto misto K3-K4 in 5 sottosegmenti in relazione
% all'altitudine dei tratti; la suddivisione è la seguetne:
% 1) K3 (52) al pto 52+7; 2) pto 59 al pto 52+11; 3) pto 63 al pto 52+12;
% 4) pto 64 al pto 52+17; 5) pto 69 al pto 52+23 (75), cioè K4

sottosegK3K4_l=[122.1-0 264.5-122.1 293.3-264.5 356.9-293.3 493.8-356.9];
sottosegK3K4_h=[6.03-0 -0.379-6.03 -0.445+0.379 5.259+0.445 0.944-5.259];
sottopendK3K4=sottosegK3K4_h./sottosegK3K4_l;
sottopendK3K4_perc=sottopendK3K4*100;
peso_sottosegK3K4=sottosegK3K4_l/lmisto(1);

% utilizzo le velocità medie calcolate nei tratti di riferimento in base
% alla pendenza dei sottosegmenti trovati: uphill middle - downhill - flat
% - uphill steep - downhill, pesati per la lunghezza dei tratti analizzati:

% DONNE
frazv_prevW=[XC_long_V.women.MEAN.vseg_gm(1,:)*peso_sottosegK3K4(1);
XC_long_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(2);
XC_long_V.women.MEAN.vseg_gm(4,:)*peso_sottosegK3K4(3);
XC_long_V.women.MEAN.vseg_gm(2,:)*peso_sottosegK3K4(4);
XC_long_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(5)];
XC_long_V.women.v_prevK3K4=sum(frazv_prevW);
matr_temp=3.6*[sottosegK3K4_l(1)./XC_long_V.women.MEAN.vseg_gm(1,:);
sottosegK3K4_l(2)./XC_long_V.women.MEAN.vseg_gm(6,:);
sottosegK3K4_l(3)./XC_long_V.women.MEAN.vseg_gm(4,:);
sottosegK3K4_l(4)./XC_long_V.women.MEAN.vseg_gm(2,:);
sottosegK3K4_l(5)./XC_long_V.women.MEAN.vseg_gm(6,:)];
XC_long_T.women.confronto.K3K4.tmisto_met4=sum(matr_temp);

% UOMINI
frazv_prevM=[XC_long_V.men.MEAN.vseg_gm(1,:)*peso_sottosegK3K4(1);
XC_long_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(2);
XC_long_V.men.MEAN.vseg_gm(4,:)*peso_sottosegK3K4(3);
XC_long_V.men.MEAN.vseg_gm(2,:)*peso_sottosegK3K4(4);
XC_long_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK3K4(5)];
XC_long_V.men.v_prevK3K4=sum(frazv_prevM);
matr_temp=3.6*[sottosegK3K4_l(1)./XC_long_V.men.MEAN.vseg_gm(1,:);
sottosegK3K4_l(2)./XC_long_V.men.MEAN.vseg_gm(6,:);
sottosegK3K4_l(3)./XC_long_V.men.MEAN.vseg_gm(4,:);
sottosegK3K4_l(4)./XC_long_V.men.MEAN.vseg_gm(2,:);
sottosegK3K4_l(5)./XC_long_V.men.MEAN.vseg_gm(6,:)];
```

```
XC_long_T.men.confronto.K3K4.tmisto_met4=sum(matr_temp);

% K6 = pto 84 e K/ = pto 98
% suddivido il tratto misto K6-K7 in 6 sottosegmenti in relazione
% all'altitudine dei tratti; la suddivisione è la seguetne:
% 1) K6 (84) al pto 84+2; 2) pto 86 al pto 84+3; 3) pto 87 al pto 84+6;
% 4) pto 90 al pto 84+9; 5) pto 93 al pto 84+13; 6) pto 97 al pto 98 (K6)

sottosegK6K7_l=[56.14-0 65.36-54.14 95.54-65.36 139.8-95.54 191.5-139.8
198.8-191.5];
sottosegK6K7_h=[-2.923-0 -2.957+2.923 -1.553+2.957 -6.978+1.553 -
3.663+6.978 -4.017+3.663];
sottopendK6K7=sottosegK6K7_h./sottosegK6K7_l;
sottopendK6K7_perc=sottopendK6K7*100;
peso_sottosegK6K7=sottosegK6K7_l/lmisto(2);

% utilizzo le velocità medie calcolate nei tratti di riferimento in base
% alla pendenza dei sottosegmenti trovati: downhill - flat - uphill middle
% - downhill - uphill steep - downhill


% DONNE
frazv_prevW=[XC_long_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(1);
XC_long_V.women.MEAN.vseg_gm(4,:)*peso_sottosegK6K7(2);
XC_long_V.women.MEAN.vseg_gm(1,:)*peso_sottosegK6K7(3);
XC_long_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(4);
XC_long_V.women.MEAN.vseg_gm(2,:)*peso_sottosegK6K7(5);
XC_long_V.women.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(6)];
XC_long_V.women.v_prevK6K7=sum(frazv_prevW);
matr_temp=3.6*[sottosegK6K7_l(1)./XC_long_V.women.MEAN.vseg_gm(6,:);
sottosegK6K7_l(2)./XC_long_V.women.MEAN.vseg_gm(4,:);
sottosegK6K7_l(3)./XC_long_V.women.MEAN.vseg_gm(1,:);
sottosegK6K7_l(4)./XC_long_V.women.MEAN.vseg_gm(6,:);
sottosegK6K7_l(5)./XC_long_V.women.MEAN.vseg_gm(2,:);
sottosegK6K7_l(6)./XC_long_V.women.MEAN.vseg_gm(6,:)];
XC_long_T.women.confronto.K6K7.tmisto_met4=sum(matr_temp);

% UOMINI
frazv_prevM=[XC_long_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(1);
XC_long_V.men.MEAN.vseg_gm(4,:)*peso_sottosegK6K7(2);
XC_long_V.men.MEAN.vseg_gm(1,:)*peso_sottosegK6K7(3);
XC_long_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(4);
XC_long_V.men.MEAN.vseg_gm(2,:)*peso_sottosegK6K7(5);
XC_long_V.men.MEAN.vseg_gm(6,:)*peso_sottosegK6K7(6)];
XC_long_V.men.v_prevK6K7=sum(frazv_prevM);
matr_temp=3.6*[sottosegK6K7_l(1)./XC_long_V.men.MEAN.vseg_gm(6,:);
sottosegK6K7_l(2)./XC_long_V.men.MEAN.vseg_gm(4,:);
sottosegK6K7_l(3)./XC_long_V.men.MEAN.vseg_gm(1,:);
sottosegK6K7_l(4)./XC_long_V.men.MEAN.vseg_gm(6,:);
sottosegK6K7_l(5)./XC_long_V.men.MEAN.vseg_gm(2,:);
sottosegK6K7_l(6)./XC_long_V.men.MEAN.vseg_gm(6,:)];
XC_long_T.men.confronto.K6K7.tmisto_met4=sum(matr_temp);

%% CALCOLO DEGLI ERRORI PERCENTUALI
% DONNE
XC_long_T.women.confronto.K3K4.e_IPC17_18=abs((XC_long_T.women.confronto.K3
K4.tmisto_gm-
XC_long_T.women.confronto.K3K4.tmisto_IPC17_18)./XC_long_T.women.confronto.
K3K4.tmisto_gm)*100;
```

```
XC_long_T.women.confronto.K3K4.e_IPC19_20=abs((XC_long_T.women.confronto.K3
K4.tmisto_gm-
XC_long_T.women.confronto.K3K4.tmisto_IPC19_20)./XC_long_T.women.confronto.
K3K4.tmisto_gm)*100;
XC_long_T.women.confronto.K3K4.e_met0=abs((XC_long_T.women.confronto.K3K4.t
misto_gm-
XC_long_T.women.confronto.K3K4.tmisto_met0)./XC_long_T.women.confronto.K3K4
.tmisto_gm)*100;
XC_long_T.women.confronto.K3K4.e_met1=abs((XC_long_T.women.confronto.K3K4.t
misto_gm-
XC_long_T.women.confronto.K3K4.tmisto_met1)./XC_long_T.women.confronto.K3K4
.tmisto_gm)*100;
XC_long_T.women.confronto.K3K4.e_met2=abs((XC_long_T.women.confronto.K3K4.t
misto_gm-
XC_long_T.women.confronto.K3K4.tmisto_met2)./XC_long_T.women.confronto.K3K4
.tmisto_gm)*100;
XC_long_T.women.confronto.K3K4.e_met3=abs((XC_long_T.women.confronto.K3K4.t
misto_gm-
XC_long_T.women.confronto.K3K4.tmisto_met3)./XC_long_T.women.confronto.K3K4
.tmisto_gm)*100;
XC_long_T.women.confronto.K3K4.e_met4=abs((XC_long_T.women.confronto.K3K4.t
misto_gm-
XC_long_T.women.confronto.K3K4.tmisto_met4)./XC_long_T.women.confronto.K3K4
.tmisto_gm)*100;

XC_long_T.women.confronto.K6K7.e_IPC17_18=abs((XC_long_T.women.confronto.K6
K7.tmisto_gm-
XC_long_T.women.confronto.K6K7.tmisto_IPC17_18)./XC_long_T.women.confronto.
K6K7.tmisto_gm)*100;
XC_long_T.women.confronto.K6K7.e_IPC19_20=abs((XC_long_T.women.confronto.K6
K7.tmisto_gm-
XC_long_T.women.confronto.K6K7.tmisto_IPC19_20)./XC_long_T.women.confronto.
K6K7.tmisto_gm)*100;
XC_long_T.women.confronto.K6K7.e_met0=abs((XC_long_T.women.confronto.K6K7.t
misto_gm-
XC_long_T.women.confronto.K6K7.tmisto_met0)./XC_long_T.women.confronto.K6K7
.tmisto_gm)*100;
XC_long_T.women.confronto.K6K7.e_met1=abs((XC_long_T.women.confronto.K6K7.t
misto_gm-
XC_long_T.women.confronto.K6K7.tmisto_met1)./XC_long_T.women.confronto.K6K7
.tmisto_gm)*100;
XC_long_T.women.confronto.K6K7.e_met2=abs((XC_long_T.women.confronto.K6K7.t
misto_gm-
XC_long_T.women.confronto.K6K7.tmisto_met2)./XC_long_T.women.confronto.K6K7
.tmisto_gm)*100;
XC_long_T.women.confronto.K6K7.e_met3=abs((XC_long_T.women.confronto.K6K7.t
misto_gm-
XC_long_T.women.confronto.K6K7.tmisto_met3)./XC_long_T.women.confronto.K6K7
.tmisto_gm)*100;
XC_long_T.women.confronto.K6K7.e_met4=abs((XC_long_T.women.confronto.K6K7.t
misto_gm-
XC_long_T.women.confronto.K6K7.tmisto_met4)./XC_long_T.women.confronto.K6K7
.tmisto_gm)*100;

% UOMINI
XC_long_T.men.confronto.K3K4.e_IPC17_18=abs((XC_long_T.men.confronto.K3K4.t
misto_gm-
XC_long_T.men.confronto.K3K4.tmisto_IPC17_18)./XC_long_T.men.confronto.K3K4
.tmisto_gm)*100;
XC_long_T.men.confronto.K3K4.e_IPC19_20=abs((XC_long_T.men.confronto.K3K4.t
misto_gm-
```

```
XC_long_T.men.confronto.K3K4.tmisto_IPC19_20)./XC_long_T.men.confronto.K3K4
.tmisto_gm)*100;
XC_long_T.men.confronto.K3K4.e_met0=abs((XC_long_T.men.confronto.K3K4.tmist
o_gm-
XC_long_T.men.confronto.K3K4.tmisto_met0)./XC_long_T.men.confronto.K3K4.tmi
sto_gm)*100;
XC_long_T.men.confronto.K3K4.e_met1=abs((XC_long_T.men.confronto.K3K4.tmist
o_gm-
XC_long_T.men.confronto.K3K4.tmisto_met1)./XC_long_T.men.confronto.K3K4.tmi
sto_gm)*100;
XC_long_T.men.confronto.K3K4.e_met2=abs((XC_long_T.men.confronto.K3K4.tmist
o_gm-
XC_long_T.men.confronto.K3K4.tmisto_met2)./XC_long_T.men.confronto.K3K4.tmi
sto_gm)*100;
XC_long_T.men.confronto.K3K4.e_met3=abs((XC_long_T.men.confronto.K3K4.tmist
o_gm-
XC_long_T.men.confronto.K3K4.tmisto_met3)./XC_long_T.men.confronto.K3K4.tmi
sto_gm)*100;
XC_long_T.men.confronto.K3K4.e_met4=abs((XC_long_T.men.confronto.K3K4.tmist
o_gm-
XC_long_T.men.confronto.K3K4.tmisto_met4)./XC_long_T.men.confronto.K3K4.tmi
sto_gm)*100;

XC_long_T.men.confronto.K6K7.e_IPC17_18=abs((XC_long_T.men.confronto.K6K7.t
misto_gm-
XC_long_T.men.confronto.K6K7.tmisto_IPC17_18)./XC_long_T.men.confronto.K6K7
.tmisto_gm)*100;
XC_long_T.men.confronto.K6K7.e_IPC19_20=abs((XC_long_T.men.confronto.K6K7.t
misto_gm-
XC_long_T.men.confronto.K6K7.tmisto_IPC19_20)./XC_long_T.men.confronto.K6K7
.tmisto_gm)*100;
XC_long_T.men.confronto.K6K7.e_met0=abs((XC_long_T.men.confronto.K6K7.tmist
o_gm-
XC_long_T.men.confronto.K6K7.tmisto_met0)./XC_long_T.men.confronto.K6K7.tmi
sto_gm)*100;
XC_long_T.men.confronto.K6K7.e_met1=abs((XC_long_T.men.confronto.K6K7.tmist
o_gm-
XC_long_T.men.confronto.K6K7.tmisto_met1)./XC_long_T.men.confronto.K6K7.tmi
sto_gm)*100;
XC_long_T.men.confronto.K6K7.e_met2=abs((XC_long_T.men.confronto.K6K7.tmist
o_gm-
XC_long_T.men.confronto.K6K7.tmisto_met2)./XC_long_T.men.confronto.K6K7.tmi
sto_gm)*100;
XC_long_T.men.confronto.K6K7.e_met3=abs((XC_long_T.men.confronto.K6K7.tmist
o_gm-
XC_long_T.men.confronto.K6K7.tmisto_met3)./XC_long_T.men.confronto.K6K7.tmi
sto_gm)*100;
XC_long_T.men.confronto.K6K7.e_met4=abs((XC_long_T.men.confronto.K6K7.tmist
o_gm-
XC_long_T.men.confronto.K6K7.tmisto_met4)./XC_long_T.men.confronto.K6K7.tmi
sto_gm)*100;

%% SALVATAGGIO STRUTTURA DELLE VELOCITà

save([filepath_save '\XC_long_velocita.mat'],'-struct','XC_long_V');
save([filepath_save '\XC_long_tempo.mat'],'-struct','XC_long_T');
```

APPENDICE G

g.0) Acquisizione dei dati IMU

```
% Codice lettura dati sensori inerziali
% (script matlab passato dalla prof.ssa Laura Gastaldi)
clear all
close all
clc

freq=100; %frequenza di acquisizione in HZ

% definizione percorsi
dati_imuPath = cd('.');          % Identify the script path


%_/_/_/_/_/_/_/_/_/_/_/_/Data READING_/_/_/_/_/_/_/_/_/_/_/_/
%   vado nella directory CSV e faccio una lista, assegno un nome a ogni
file
% 7 sensori --> 7 nomi
LIST=dir('*.csv');                           % leggo i file csv in un'unica
cartella
%  LIST=dir([dati_imuPath,'\*.csv']);              % leggo i file in
un'unica cartella

trial1name=char(LIST(1).name);    % assegno nome per trial(camminata)

%leggo i dati di trial con la function readsensor
%ho una matrice con [time acc_x acc_y acc_z omega_x omega_y omega_z mag_x
mag_y mag_z]
[trial01raw]=readsensor_new_lg(fullfile(dati_imuPath,trial1name));

%   leggo la colonna dei tempi
trialtime01=trial01raw(:,1)*0.1; % moltiplico per 0.1 in modo da avere un
numero con la virgola

trialtime01ini=trialtime01(1,1);
trialtimeini01=round(trialtime01ini); % prendo l'intero più vicino così ho
la successione temporale
trialtime01=round(trialtime01);
trialini=cat(2,trialtimeini01);
%,trialtimeini02,trialtimeini03,trialtimeini04,trialtimeini05,trialtimeini0
6,trialtimeini07); %concatena tutti gli istanti iniziali
trialtimeini=max(trialini); %trova il valore più grande e lo assegna come
valore iniziale

%ciclo while per fissare l'istante inizale e sincronizzare i sensori tra di
loro
flag=0;
while flag==0

    [trial01detx]=find(trialtime01==trialtimeini); %ottengo le coordinate
per fissare l' istante iniziale

    if (isempty(trial01detx)==1) % || isempty(trial02detx)==1 ||
isempty(trial03detx)==1 || isempty(trial04detx)==1 ||
isempty(trial05detx)==1 || isempty(trial06detx)==1 ||
isempty(trial07detx)==1)
        trialtimeini=trialtimeini+1;
```

```
    else
        flag=1;
    end
end
trial01rawl=trial01raw(trial01detx:end, 2:end);

trial01_end=size(trial01rawl,1);
trial_end=cat(2, trial01_end) %, trial02_end, trial03_end, trial04_end,
trial05_end, trial06_end, trial07_end);
trialend=min(trial_end);

%   salvo su trialraw tutti i dati a aprtire da uno stesso istante
iniziale[acc_x acc_y acc_z omega_x omega_y omega_z mag_x mag_y mag_z]

trial01raw=trial01rawl(1:trialend,:);
t=(1:trial_end)/freq;

for j=1:trial_end
MAG(j)=sqrt(trial01raw(j,7)^2+trial01raw(j,8)^2+trial01raw(j,9)^2);
end

acc=[trial01raw(:,1) trial01raw(:,2) trial01raw(:,3)];
omega=[trial01raw(:,4) trial01raw(:,5) trial01raw(:,6)];
mag=[trial01raw(:,7) trial01raw(:,8) trial01raw(:,9)];

filepath_save=[cd '\dati'];
save([filepath_save '\accelerazione.mat'],'acc');
save([filepath_save '\velocita_angolare.mat'],'omega');
save([filepath_save '\mag.mat'],'mag');
save([filepath_save '\tempo.mat'],'t')
```

g.1) Cross country middle uomini

g.1.1) Atleta 8 – classe LW11.5

```
%%
clc
clear all
close all

% Caricamento dei dati estratti al passaggio precedente dai file excel
nome_atleta='\Golubkov_Ivan_42';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_middle=load([filepath2 '\XC_middle_finale']);

% individuo l'atleta di interesse e lo "prelevo" dalla struttura principale
atleta=XC_middle.men.LW11_5(2);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3];

%%
```

```
% filtro il modulo del segnale MAG e lo confronto col segnale originale -->
% vedo quanto il rumore influenza il segnale rilevato e se è necessario il
% filtraggio
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
saveas(gcf,[cd '\figure' '\mag.fig']);

% --> uso il SEGNALE ORIGINALE
%% INDIVIDUAZIONE DEI PICCHI
% Individuo i picchi nel segnale MAG sfruttando le soglie temporali e sul
% modulo per non intercettare quelli legati al rumore o picchi doppi. I
% picchi sono assocciati al passaggio dell'atleta ai K
mPD=3;
MPH=100;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
% [PKS2
LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro con MAG non filtrato
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company

% Shifto il segnale MAG in modo da renderlo coerente con quello della TC
% (pongo a zero il primo picco rappresentante il passaggio al cancelletto
% dello start)
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1:8) splittime(2,1:8) splittime(3,1:8)];
LOC11=[LOC1shift(2:3) LOC1shift(5:10) LOC1shift(12:19) LOC1shift(21:28)];
diff1=TC1-LOC11;
```

```
vett=1:24;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (3);
KK=[LOC11(2)-LOC11(1) LOC11(10)-LOC11(9) LOC11(18)-LOC11(17); LOC11(3)-
LOC11(2) LOC11(11)-LOC11(10) LOC11(19)-LOC11(18); LOC11(3)-LOC11(1)
LOC11(11)-LOC11(9) LOC11(19)-LOC11(17); LOC11(5)-LOC11(4) LOC11(13)-
LOC11(12) LOC11(21)-LOC11(20); LOC11(6)-LOC11(5) LOC11(14)-LOC11(13)
LOC11(22)-LOC11(21); LOC11(8)-LOC11(7) LOC11(16)-LOC11(15) LOC11(24)-
LOC11(23)]
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
% salvo i dati dell'atleta per usarli successivamente in un altro script
% insieme a quelli degli altri atleti partecipanti alla gara di XCM
save err_Golubkov.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(9):pos_t(10),1);
accx_K1K2_g3=acc(pos_t(17):pos_t(18),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(9):pos_t(10),2);
accy_K1K2_g3=acc(pos_t(17):pos_t(18),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
```

```
accz_K1K2_g2=-acc(pos_t(9):pos_t(10),3);
accz_K1K2_g3=-acc(pos_t(17):pos_t(18),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=acc(pos_t(10):pos_t(11),1);
accx_K2K3_g3=acc(pos_t(18):pos_t(19),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=acc(pos_t(10):pos_t(11),2);
accy_K2K3_g3=acc(pos_t(18):pos_t(19),2);
accz_K2K3_g1=-acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=-acc(pos_t(10):pos_t(11),3);
accz_K2K3_g3=-acc(pos_t(18):pos_t(19),3);
% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(5):pos_t(6),1);
accx_K5K6_g2=acc(pos_t(13):pos_t(14),1);
accx_K5K6_g3=acc(pos_t(21):pos_t(22),1);
accy_K5K6_g1=acc(pos_t(5):pos_t(6),2);
accy_K5K6_g2=acc(pos_t(13):pos_t(14),2);
accy_K5K6_g3=acc(pos_t(21):pos_t(22),2);
accz_K5K6_g1=-acc(pos_t(5):pos_t(6),3);
accz_K5K6_g2=-acc(pos_t(13):pos_t(14),3);
accz_K5K6_g3=-acc(pos_t(21):pos_t(22),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(7):pos_t(8),1);
accx_K7K8_g2=acc(pos_t(15):pos_t(16),1);
accx_K7K8_g3=acc(pos_t(23):pos_t(24),1);
accy_K7K8_g1=acc(pos_t(7):pos_t(8),2);
accy_K7K8_g2=acc(pos_t(15):pos_t(16),2);
accy_K7K8_g3=acc(pos_t(23):pos_t(24),2);
accz_K7K8_g1=-acc(pos_t(7):pos_t(8),3);
accz_K7K8_g2=-acc(pos_t(15):pos_t(16),3);
accz_K7K8_g3=-acc(pos_t(23):pos_t(24),3);

%% grafici accelerazione lineare K1K2
% Grafico le accelerazioni lineari di ogni segmento d'interesse per tutti i
% giri (3) percorsi lungo le tre coordinate x, y e z. --> valuto
% l'orientamento del sensore posto sullo slittino osservando i segnali
lungo i 3 assi.

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K1K2_g1)
```

```
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
```

```
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
```

```
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all

% --> asse principale : asse z
acc_K1K2_g1=accz_K1K2_g1;
acc_K1K2_g2=accz_K1K2_g2;
acc_K1K2_g3=accz_K1K2_g3;

acc_K2K3_g1=accz_K2K3_g1;
acc_K2K3_g2=accz_K2K3_g2;
acc_K2K3_g3=accz_K2K3_g3;

acc_K5K6_g1=accz_K5K6_g1;
acc_K5K6_g2=accz_K5K6_g2;
acc_K5K6_g3=accz_K5K6_g3;
```

```
acc_K7K8_g1=accz_K7K8_g1;
acc_K7K8_g2=accz_K7K8_g2;
acc_K7K8_g3=accz_K7K8_g3;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=3;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;

save acc_Golubkov.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
% grafico i segnali delle accelerazioni lineari SOLO lungo l'asse
% principale per tutti i giri fatti per ogni segmento. per ogni segnale
% evidenzio i picchi presenti (idealmente dovrei ottenere 1 picco a ciclo
% nel momento di massima accelerazione, corrispondente alla fase di spinta
% dell'atleta. I parametri di minima distanza tra i picchi (mPDmax) e di
% valore minimo (MPHmax) sono gli stessi per ogni giro di un segmento, ma
% possono variare per i segmenti successivi. Il loro valore è scelto dopo
% aver osservato i grafici stessi delle accelerazioni lineari.
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=2;
```

```
[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

% Calcolo la distanza tra picchi successivi per tutti i giri della gara.
% Questi valori verranno poi salvati per processarli successivamente.
for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=2;

[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
```

```
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=2;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
```

```
subplot(3,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=2;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
```

```
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) length(distK2K3_g2) length(distK2K3_g3)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)];
max_righe=max(n_righe);
```

```
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;

save dist_Golubkov.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) length(P_K2K3_g2) length(P_K2K3_g3)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;

% SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;

save picchi_Golubkov.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.1.2) Atleta 9 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Zhang_Chenyang_27';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_middle=load([filepath2 '\XC_middle_finale']);
```

```
atleta=XC_middle.men.LW12(4);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=100;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
[PKS2 LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1:8) splittime(2,1) splittime(2,3:5) splittime(2,7:8)
splittime(3,1:5) splittime(3,7:8)];
LOC11=[LOC1shift(2:9) LOC1shift(12) LOC1shift(14:16) LOC1shift(17:18)
LOC1shift(21:25) LOC1shift(26:27)];
diff1=TC1-LOC11;
vett=1:length(TC1);

[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
```

```
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (3);
KK=[LOC11(2)-LOC11(1) NaN LOC11(16)-LOC11(15); LOC11(3)-LOC11(2) NaN
LOC11(17)-LOC11(16);  LOC11(3)-LOC11(1) LOC11(10)-LOC11(9) LOC11(17)-
LOC11(15); LOC11(5)-LOC11(4) LOC11(12)-LOC11(11) LOC11(19)-
LOC11(18);LOC11(6)-LOC11(5) NaN NaN; LOC11(8)-LOC11(7) LOC11(14)-LOC11(13)
LOC11(21)-LOC11(20)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Zhang.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=NaN;
accx_K1K2_g3=acc(pos_t(15):pos_t(16),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=NaN;
accy_K1K2_g3=acc(pos_t(15):pos_t(16),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=NaN;
accz_K1K2_g3=-acc(pos_t(15):pos_t(16),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=NaN;
accx_K2K3_g3=acc(pos_t(16):pos_t(17),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
```

```
accy_K2K3_g2=NaN;
accy_K2K3_g3=acc(pos_t(16):pos_t(17),2);
accz_K2K3_g1=-acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=NaN;
accz_K2K3_g3=-acc(pos_t(16):pos_t(17),3);

% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(5):pos_t(6),1);
accx_K5K6_g2=NaN;
accx_K5K6_g3=NaN;
accy_K5K6_g1=acc(pos_t(5):pos_t(6),2);
accy_K5K6_g2=NaN;
accy_K5K6_g3=NaN;
accz_K5K6_g1=-acc(pos_t(5):pos_t(6),3);
accz_K5K6_g2=NaN;
accz_K5K6_g3=NaN;
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(7):pos_t(8),1);
accx_K7K8_g2=acc(pos_t(13):pos_t(14),1);
accx_K7K8_g3=acc(pos_t(20):pos_t(21),1);
accy_K7K8_g1=acc(pos_t(7):pos_t(8),2);
accy_K7K8_g2=acc(pos_t(13):pos_t(14),2);
accy_K7K8_g3=acc(pos_t(20):pos_t(21),2);
accz_K7K8_g1=-acc(pos_t(7):pos_t(8),3);
accz_K7K8_g2=-acc(pos_t(13):pos_t(14),3);
accz_K7K8_g3=-acc(pos_t(20):pos_t(21),3);

%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,3)
```

```
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);
```

```
figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all
%%
% Da adesso lavoro solo sulla coordinata z poiché è quella che contiene il
% mio segnale di interesse.
```

```
% Individuo picchi positivi nell'andamento dell'accelerazione e
% valuto la distanza tra 2 massimi successivi

% --> asse principale : asse Y
acc_K1K2_g1=accz_K1K2_g1;
acc_K1K2_g2=accz_K1K2_g2;
acc_K1K2_g3=accz_K1K2_g3;

acc_K2K3_g1=accz_K2K3_g1;
acc_K2K3_g2=accz_K2K3_g2;
acc_K2K3_g3=accz_K2K3_g3;

acc_K5K6_g1=accz_K5K6_g1;
acc_K5K6_g2=accz_K5K6_g2;
acc_K5K6_g3=accz_K5K6_g3;

acc_K7K8_g1=accz_K7K8_g1;
acc_K7K8_g2=accz_K7K8_g2;
acc_K7K8_g3=accz_K7K8_g3;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=3;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;

save acc_Zhang.mat accK1K2 accK2K3 accK5K6 accK7K8;
```

```
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);

mPDmax12=0.7;
MPHmax12=2;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end

pause
close all

%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);

mPDmax23=0.6;
MPHmax23=2;

[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
```

```
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
grid
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);

mPDmax56=0.7;
MPHmax56=2;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);

mPDmax78=0.7;
MPHmax78=2;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
```

```
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end

%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) 0 length(distK1K2_g3)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) 0 length(distK2K3_g3)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) 0 0];
max_righe=max(n_righe);
```

```
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;

save dist_Zhang.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) 0 length(P_K1K2_g3)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) 0 length(P_K2K3_g3)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) 0 0];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;

% SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;

save picchi_Zhang.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.1.3) Atleta 11 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Lee_Jeong_Min_36';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);
```

```
XC_middle=load([filepath2 '\XC_middle_finale']);

atleta=XC_middle.men.LW12(10);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=100;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
[PKS2 LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1:5) splittime(1,7:8) splittime(2,1:2) splittime(2,4:8)
splittime(3,1:8)];
LOC11=[LOC1shift(2:6) LOC1shift(7:8) LOC1shift(11:12) LOC1shift(13:17)
LOC1shift(20:27)];
diff1=TC1-LOC11;
vett=1:length(TC1);
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);
```

```
figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (5), colonne = numero giri (3);
KK=[LOC11(2)-LOC11(1) LOC11(9)-LOC11(8) LOC11(16)-LOC11(15); LOC11(3)-
LOC11(2) NaN LOC11(17)-LOC11(16);  LOC11(3)-LOC11(1) NaN LOC11(17)-
LOC11(15); LOC11(5)-LOC11(4) LOC11(11)-LOC11(10) LOC11(19)-LOC11(18); NaN
LOC11(12)-LOC11(11) LOC11(20)-LOC11(19); LOC11(7)-LOC11(6) LOC11(14)-
LOC11(13) LOC11(22)-LOC11(21)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Lee.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(8):pos_t(9),1);
accx_K1K2_g3=acc(pos_t(15):pos_t(16),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(8):pos_t(9),2);
accy_K1K2_g3=acc(pos_t(15):pos_t(16),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=-acc(pos_t(8):pos_t(9),3);
accz_K1K2_g3=-acc(pos_t(15):pos_t(16),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=NaN;
accx_K2K3_g3=acc(pos_t(16):pos_t(17),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=NaN;
accy_K2K3_g3=acc(pos_t(16):pos_t(17),2);
```

```
accz_K2K3_g1=-acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=NaN;
accz_K2K3_g3=-acc(pos_t(16):pos_t(17),3);
% SEGMENTO K5K6
accx_K5K6_g1=NaN;
accx_K5K6_g2=acc(pos_t(11):pos_t(12),1);
accx_K5K6_g3=acc(pos_t(19):pos_t(20),1);
accy_K5K6_g1=NaN;
accy_K5K6_g2=acc(pos_t(11):pos_t(12),2);
accy_K5K6_g3=acc(pos_t(19):pos_t(20),2);
accz_K5K6_g1=NaN;
accz_K5K6_g2=-acc(pos_t(11):pos_t(12),3);
accz_K5K6_g3=-acc(pos_t(19):pos_t(20),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(6):pos_t(7),1);
accx_K7K8_g2=acc(pos_t(13):pos_t(14),1);
accx_K7K8_g3=acc(pos_t(21):pos_t(22),1);
accy_K7K8_g1=acc(pos_t(6):pos_t(7),2);
accy_K7K8_g2=acc(pos_t(13):pos_t(14),2);
accy_K7K8_g3=acc(pos_t(21):pos_t(22),2);
accz_K7K8_g1=-acc(pos_t(6):pos_t(7),3);
accz_K7K8_g2=-acc(pos_t(13):pos_t(14),3);
accz_K7K8_g3=-acc(pos_t(21):pos_t(22),3);

%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
```

```
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
% v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(3,1,3)
```

```
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
figure()
title('accelerazione lineare x [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
title('accelerazione lineare y [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
```

```
title('accelerazione lineare z [m/s^2]')
hold on
subplot(3,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all


% --> asse principale : asse z
acc_K1K2_g1=accz_K1K2_g1;
acc_K1K2_g2=accz_K1K2_g2;
acc_K1K2_g3=accz_K1K2_g3;

acc_K2K3_g1=accz_K2K3_g1;
acc_K2K3_g2=accz_K2K3_g2;
acc_K2K3_g3=accz_K2K3_g3;

acc_K5K6_g1=accz_K5K6_g1;
acc_K5K6_g2=accz_K5K6_g2;
acc_K5K6_g3=accz_K5K6_g3;

acc_K7K8_g1=accz_K7K8_g1;
acc_K7K8_g2=accz_K7K8_g2;
acc_K7K8_g3=accz_K7K8_g3;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=3;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
```

```
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;

save acc_Lee.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);

mPDmax12=0.7;
MPHmax12=2;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
```

```
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);

mPDmax23=0.559;
MPHmax23=2;

[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
grid
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end

pause
close all

%% K5K6
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);

mPDmax56=0.7;
MPHmax56=2;

[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
```

```
figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);

mPDmax78=0.7;
MPHmax78=2;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(3,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(3,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
```

```
subplot(3,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end

%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) 0 length(distK2K3_g3)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;

%SEGMENTO K5-K6
n_righe=[0 length(distK5K6_g2) length(distK5K6_g3)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;

save dist_Lee.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
```

```
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) 0 length(P_K2K3_g3)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;

% SEGMENTO K5-K6
nrighe=[0 length(P_K5K6_g2) length(P_K5K6_g3)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;

% SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;

save picchi_Lee.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.2) Cross country long donne

g.2.1) Atleta 2 – classe LW10.5

```
%%
clc
clear all
close all

nome_atleta='\Abdikarimova';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.women.LW10_5(2);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);
```

```
MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
%[PKS2
LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)
% --> il MAG ha registrato tutti i checkpoint di Stefan (posso analizzarlo
% dal file excel contando il loro numero e confrontandolo col numero di
% picchi trovati) --> devo andare a considerare solo quelli relativi ai K!

%                        (K4)
%                K1 K2 K3 X K5 K6 K7 K8
% picchi GIRO 1: 10 11 12 x 15 16 17 18
% picchi GIRO 2: 30 31 32 x 35 36 37 38
% picchi GIRO 3: 49 50 51 x 54 55 56 57
% picchi GIRO 4: 68 69 70 x 73 74 75 76

%il K4 non è mai stato rilevato

TC1=[splittime(1,1:3) splittime(1,5:8) splittime(2,1:3) splittime(2,5:8)
splittime(3,1:3) splittime(3,5:8) splittime(4,1:3) splittime(4,5:8)];
LOC11=[LOC1shift(10:12) LOC1shift(15:18) LOC1shift(30:32) LOC1shift(35:38)
LOC1shift(49:51) LOC1shift(54:57) LOC1shift(68:70) LOC1shift(73:76)];
diff1=TC1-LOC11;
vett=1:28;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
```

```
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (4);
KK=[LOC11(2)-LOC11(1) LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(23)-
LOC11(22); LOC11(3)-LOC11(2) LOC11(10)-LOC11(9) LOC11(17)-LOC11(16)
LOC11(24)-LOC11(23); LOC11(3)-LOC11(1) LOC11(10)-LOC11(8) LOC11(17)-
LOC11(15) LOC11(24)-LOC11(22); NaN NaN NaN NaN; LOC11(5)-LOC11(4)
LOC11(12)-LOC11(11) LOC11(19)-LOC11(18) LOC11(26)-LOC11(25); LOC11(7)-
LOC11(6) LOC11(14)-LOC11(13) LOC11(21)-LOC11(20) LOC11(28)-LOC11(27)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Abdikarimova.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(8):pos_t(9),1);
accx_K1K2_g3=acc(pos_t(15):pos_t(16),1);
accx_K1K2_g4=acc(pos_t(22):pos_t(23),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(8):pos_t(9),2);
accy_K1K2_g3=acc(pos_t(15):pos_t(16),2);
accy_K1K2_g4=acc(pos_t(22):pos_t(23),2);
accz_K1K2_g1=acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=acc(pos_t(8):pos_t(9),3);
accz_K1K2_g3=acc(pos_t(15):pos_t(16),3);
accz_K1K2_g4=acc(pos_t(22):pos_t(23),3);
```

```
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=acc(pos_t(9):pos_t(10),1);
accx_K2K3_g3=acc(pos_t(16):pos_t(17),1);
accx_K2K3_g4=acc(pos_t(23):pos_t(24),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=acc(pos_t(9):pos_t(10),2);
accy_K2K3_g3=acc(pos_t(16):pos_t(17),2);
accy_K2K3_g4=acc(pos_t(23):pos_t(24),2);
accz_K2K3_g1=acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=acc(pos_t(9):pos_t(10),3);
accz_K2K3_g3=acc(pos_t(16):pos_t(17),3);
accz_K2K3_g4=acc(pos_t(23):pos_t(24),3);
% SEGMENTO K4K5
% mancano le rilevazioni del MAG a K4 per ogni giro.
% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(4):pos_t(5),1);
accx_K5K6_g2=acc(pos_t(11):pos_t(12),1);
accx_K5K6_g3=acc(pos_t(18):pos_t(19),1);
accx_K5K6_g4=acc(pos_t(25):pos_t(26),1);
accy_K5K6_g1=acc(pos_t(4):pos_t(5),2);
accy_K5K6_g2=acc(pos_t(11):pos_t(12),2);
accy_K5K6_g3=acc(pos_t(18):pos_t(19),2);
accy_K5K6_g4=acc(pos_t(25):pos_t(26),2);
accz_K5K6_g1=acc(pos_t(4):pos_t(5),3);
accz_K5K6_g2=acc(pos_t(11):pos_t(12),3);
accz_K5K6_g3=acc(pos_t(18):pos_t(19),3);
accz_K5K6_g4=acc(pos_t(25):pos_t(26),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(6):pos_t(7),1);
accx_K7K8_g2=acc(pos_t(13):pos_t(14),1);
accx_K7K8_g3=acc(pos_t(20):pos_t(21),1);
accx_K7K8_g4=acc(pos_t(27):pos_t(28),1);
accy_K7K8_g1=acc(pos_t(6):pos_t(7),2);
accy_K7K8_g2=acc(pos_t(13):pos_t(14),2);
accy_K7K8_g3=acc(pos_t(20):pos_t(21),2);
accy_K7K8_g4=acc(pos_t(27):pos_t(28),2);
accz_K7K8_g1=acc(pos_t(6):pos_t(7),3);
accz_K7K8_g2=acc(pos_t(13):pos_t(14),3);
accz_K7K8_g3=acc(pos_t(20):pos_t(21),3);
accz_K7K8_g4=acc(pos_t(27):pos_t(28),3);

close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K1K2_g3)
```

```
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accx_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
```

```
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
```

```
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);
```

```
figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all


% --> asse principale : asse x
acc_K1K2_g1=accx_K1K2_g1;
acc_K1K2_g2=accx_K1K2_g2;
acc_K1K2_g3=accx_K1K2_g3;
acc_K1K2_g4=accx_K1K2_g4;

acc_K2K3_g1=accx_K2K3_g1;
acc_K2K3_g2=accx_K2K3_g2;
acc_K2K3_g3=accx_K2K3_g3;
acc_K2K3_g4=accx_K2K3_g4;

acc_K5K6_g1=accx_K5K6_g1;
acc_K5K6_g2=accx_K5K6_g2;
acc_K5K6_g3=accx_K5K6_g3;
acc_K5K6_g4=accx_K5K6_g4;

acc_K7K8_g1=accx_K7K8_g1;
acc_K7K8_g2=accx_K7K8_g2;
acc_K7K8_g3=accx_K7K8_g3;
acc_K7K8_g4=accx_K7K8_g4;
```

```
%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=4;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;

save acc_Abdikarimova.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=1;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
```

```
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);

%da valutare osservando i segnali
mPDmax23=0.7;
```

```
MPHmax23=0;

[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end

pause
close all
```

```
%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
```

```
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
```

```
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) length(distK2K3_g2) length(distK2K3_g3)
length(distK2K3_g4)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;

save dist_Abdikarimova.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
```

```
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) length(P_K2K3_g2) length(P_K2K3_g3)
length(P_K2K3_g4)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;

% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;

save picchi_Abdikarimova.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.2.2) Atleta 3 – classe LW10.5

```
%%
clc
clear all
close all

nome_atleta='\Skarstein';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);
```

```
atleta=XC_long.women.LW10_5(1);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
%[PKS2
LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)
% --> il MAG ha registrato tutti i checkpoint di Stefan (posso analizzarlo
% dal file excel contando il loro numero e confrontandolo col numero di
% picchi trovati) --> devo andare a considerare solo quelli relativi ai K!

%                        (K4)
%                K1 K2 K3 X K5 K6 K7 K8
% picchi GIRO 1: 11 12 13 x 16 17 18 19
% picchi GIRO 2: 30 31 32 x 35 36 37 38
% picchi GIRO 3: 49 50 51 x 54 55 56 57
% picchi GIRO 4: 68 69 70 x 73 74 75 76

%il K4 non è mai stato rilevato
```

```
TC1=[splittime(1,1:3) splittime(1,5:8) splittime(2,1:3) splittime(2,5:8)
splittime(3,1:3) splittime(3,5:8) splittime(4,1:3) splittime(4,5:8)];
LOC11=[LOC1shift(11:13) LOC1shift(16:19) LOC1shift(30:32) LOC1shift(35:38)
LOC1shift(49:51) LOC1shift(54:57) LOC1shift(68:70) LOC1shift(73:76)];
diff1=TC1-LOC11;
vett=1:28;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (4);
KK=[LOC11(2)-LOC11(1) LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(23)-
LOC11(22); LOC11(3)-LOC11(2) LOC11(10)-LOC11(9) LOC11(17)-LOC11(16)
LOC11(24)-LOC11(23); LOC11(3)-LOC11(1) LOC11(10)-LOC11(8) LOC11(17)-
LOC11(15) LOC11(24)-LOC11(22); NaN NaN NaN NaN; LOC11(5)-LOC11(4)
LOC11(12)-LOC11(11) LOC11(19)-LOC11(18) LOC11(26)-LOC11(25); LOC11(7)-
LOC11(6) LOC11(14)-LOC11(13) LOC11(21)-LOC11(20) LOC11(28)-LOC11(27)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Seo.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(8):pos_t(9),1);
accx_K1K2_g3=acc(pos_t(15):pos_t(16),1);
accx_K1K2_g4=acc(pos_t(22):pos_t(23),1);
```

```
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(8):pos_t(9),2);
accy_K1K2_g3=acc(pos_t(15):pos_t(16),2);
accy_K1K2_g4=acc(pos_t(22):pos_t(23),2);
accz_K1K2_g1=acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=acc(pos_t(8):pos_t(9),3);
accz_K1K2_g3=acc(pos_t(15):pos_t(16),3);
accz_K1K2_g4=acc(pos_t(22):pos_t(23),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=acc(pos_t(9):pos_t(10),1);
accx_K2K3_g3=acc(pos_t(16):pos_t(17),1);
accx_K2K3_g4=acc(pos_t(23):pos_t(24),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=acc(pos_t(9):pos_t(10),2);
accy_K2K3_g3=acc(pos_t(16):pos_t(17),2);
accy_K2K3_g4=acc(pos_t(23):pos_t(24),2);
accz_K2K3_g1=acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=acc(pos_t(9):pos_t(10),3);
accz_K2K3_g3=acc(pos_t(16):pos_t(17),3);
accz_K2K3_g4=acc(pos_t(23):pos_t(24),3);
% SEGMENTO K4K5
% mancano le rilevazioni del MAG a K4 per ogni giro.
% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(4):pos_t(5),1);
accx_K5K6_g2=acc(pos_t(11):pos_t(12),1);
accx_K5K6_g3=acc(pos_t(18):pos_t(19),1);
accx_K5K6_g4=acc(pos_t(25):pos_t(26),1);
accy_K5K6_g1=acc(pos_t(4):pos_t(5),2);
accy_K5K6_g2=acc(pos_t(11):pos_t(12),2);
accy_K5K6_g3=acc(pos_t(18):pos_t(19),2);
accy_K5K6_g4=acc(pos_t(25):pos_t(26),2);
accz_K5K6_g1=acc(pos_t(4):pos_t(5),3);
accz_K5K6_g2=acc(pos_t(11):pos_t(12),3);
accz_K5K6_g3=acc(pos_t(18):pos_t(19),3);
accz_K5K6_g4=acc(pos_t(25):pos_t(26),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(6):pos_t(7),1);
accx_K7K8_g2=acc(pos_t(13):pos_t(14),1);
accx_K7K8_g3=acc(pos_t(20):pos_t(21),1);
accx_K7K8_g4=acc(pos_t(27):pos_t(28),1);
accy_K7K8_g1=acc(pos_t(6):pos_t(7),2);
accy_K7K8_g2=acc(pos_t(13):pos_t(14),2);
accy_K7K8_g3=acc(pos_t(20):pos_t(21),2);
accy_K7K8_g4=acc(pos_t(27):pos_t(28),2);
accz_K7K8_g1=acc(pos_t(6):pos_t(7),3);
accz_K7K8_g2=acc(pos_t(13):pos_t(14),3);
accz_K7K8_g3=acc(pos_t(20):pos_t(21),3);
accz_K7K8_g4=acc(pos_t(27):pos_t(28),3);

close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
```

```
subplot(4,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accx_K2K3_g1)
```

```
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
```

```
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
```

```
subplot(4,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all

% --> asse principale : asse z
acc_K1K2_g1=accz_K1K2_g1;
acc_K1K2_g2=accz_K1K2_g2;
acc_K1K2_g3=accz_K1K2_g3;
acc_K1K2_g4=accz_K1K2_g4;

acc_K2K3_g1=accz_K2K3_g1;
acc_K2K3_g2=accz_K2K3_g2;
acc_K2K3_g3=accz_K2K3_g3;
acc_K2K3_g4=accz_K2K3_g4;

acc_K5K6_g1=accz_K5K6_g1;
acc_K5K6_g2=accz_K5K6_g2;
acc_K5K6_g3=accz_K5K6_g3;
acc_K5K6_g4=accz_K5K6_g4;
```

```
acc_K7K8_g1=accz_K7K8_g1;
acc_K7K8_g2=accz_K7K8_g2;
acc_K7K8_g3=accz_K7K8_g3;
acc_K7K8_g4=accz_K7K8_g4;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=4;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;

save acc_Seo.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);

%da valutare osservando i segnali
mPDmax12=0.7;
```

```
MPHmax12=1;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
```

```
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=0;

[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
```

```
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
```

```
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
```

```
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) length(distK2K3_g2) length(distK2K3_g3)
length(distK2K3_g4)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
```

```
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;

save dist_Seo.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) length(P_K2K3_g2) length(P_K2K3_g3)
length(P_K2K3_g4)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;

% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;

save picchi_Seo.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.2.3) Atleta 6 – classe LW11

```
%%
clc
clear all
close all

nome_atleta='\Dos_santos';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
```

```
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.women.LW11(1);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
% [PKS2
LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)
% --> il MAG ha registrato tutti i checkpoint di Stefan (posso analizzarlo
% dal file excel contando il loro numero e confrontandolo col numero di
% picchi trovati) --> devo andare a considerare solo quelli relativi ai K!

%                        (K4)
%                K1 K2 K3  X K5 K6 K7 K8
% picchi GIRO 1: 10 11 NaN x 15 16 17 18
% picchi GIRO 2: 29 30 31  x 34 35 36 37
```

```
% picchi GIRO 3: 47 48 49  x 52 53 54 55
% picchi GIRO 4: 65 66 67  x 70 71 72 73

%il K4 non è mai stato rilevato

TC1=[splittime(1,1:2) splittime(1,5:8) splittime(2,1:3) splittime(2,5:8)
splittime(3,1:3) splittime(3,5:8) splittime(4,1:3) splittime(4,5:8)];
LOC11=[LOC1shift(10:11) LOC1shift(15:18) LOC1shift(29:31) LOC1shift(34:37)
LOC1shift(47:49) LOC1shift(52:55) LOC1shift(65:67) LOC1shift(70:73)];
diff1=TC1-LOC11;
vett=1:27;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (4);
KK=[LOC11(2)-LOC11(1) LOC11(8)-LOC11(7) LOC11(15)-LOC11(14) LOC11(22)-
LOC11(21); NaN LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(23)-LOC11(22);
NaN LOC11(9)-LOC11(7) LOC11(16)-LOC11(14) LOC11(23)-LOC11(21); NaN NaN NaN
NaN; LOC11(4)-LOC11(3) LOC11(11)-LOC11(10) LOC11(18)-LOC11(17) LOC11(25)-
LOC11(24); LOC11(6)-LOC11(5) LOC11(13)-LOC11(12) LOC11(20)-LOC11(19)
LOC11(27)-LOC11(26)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Dos_Santos.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;
```

```
% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(7):pos_t(8),1);
accx_K1K2_g3=acc(pos_t(14):pos_t(15),1);
accx_K1K2_g4=acc(pos_t(21):pos_t(22),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(7):pos_t(8),2);
accy_K1K2_g3=acc(pos_t(14):pos_t(15),2);
accy_K1K2_g4=acc(pos_t(21):pos_t(22),2);
accz_K1K2_g1=acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=acc(pos_t(7):pos_t(8),3);
accz_K1K2_g3=acc(pos_t(14):pos_t(15),3);
accz_K1K2_g4=acc(pos_t(21):pos_t(22),3);
% segmento K2K3
accx_K2K3_g1=NaN;
accx_K2K3_g2=acc(pos_t(8):pos_t(9),1);
accx_K2K3_g3=acc(pos_t(15):pos_t(16),1);
accx_K2K3_g4=acc(pos_t(22):pos_t(23),1);
accy_K2K3_g1=NaN;
accy_K2K3_g2=acc(pos_t(8):pos_t(9),2);
accy_K2K3_g3=acc(pos_t(15):pos_t(16),2);
accy_K2K3_g4=acc(pos_t(22):pos_t(23),2);
accz_K2K3_g1=NaN;
accz_K2K3_g2=acc(pos_t(8):pos_t(9),3);
accz_K2K3_g3=acc(pos_t(15):pos_t(16),3);
accz_K2K3_g4=acc(pos_t(22):pos_t(23),3);
% SEGMENTO K4K5
% mancano le rilevazioni del MAG a K4 per ogni giro.
% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(3):pos_t(4),1);
accx_K5K6_g2=acc(pos_t(10):pos_t(11),1);
accx_K5K6_g3=acc(pos_t(17):pos_t(18),1);
accx_K5K6_g4=acc(pos_t(24):pos_t(25),1);
accy_K5K6_g1=acc(pos_t(3):pos_t(4),2);
accy_K5K6_g2=acc(pos_t(10):pos_t(11),2);
accy_K5K6_g3=acc(pos_t(17):pos_t(18),2);
accy_K5K6_g4=acc(pos_t(24):pos_t(25),2);
accz_K5K6_g1=acc(pos_t(3):pos_t(4),3);
accz_K5K6_g2=acc(pos_t(10):pos_t(11),3);
accz_K5K6_g3=acc(pos_t(17):pos_t(18),3);
accz_K5K6_g4=acc(pos_t(24):pos_t(25),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(5):pos_t(6),1);
accx_K7K8_g2=acc(pos_t(12):pos_t(13),1);
accx_K7K8_g3=acc(pos_t(19):pos_t(20),1);
accx_K7K8_g4=acc(pos_t(26):pos_t(27),1);
accy_K7K8_g1=acc(pos_t(5):pos_t(6),2);
accy_K7K8_g2=acc(pos_t(12):pos_t(13),2);
accy_K7K8_g3=acc(pos_t(19):pos_t(20),2);
accy_K7K8_g4=acc(pos_t(26):pos_t(27),2);
accz_K7K8_g1=acc(pos_t(5):pos_t(6),3);
accz_K7K8_g2=acc(pos_t(12):pos_t(13),3);
accz_K7K8_g3=acc(pos_t(19):pos_t(20),3);
accz_K7K8_g4=acc(pos_t(26):pos_t(27),3);

close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
```

```
v4=0.01:0.01:0.01*length(accx_K1K2_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);
```

```
figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(4,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(4,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(4,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K5K6_g3)
```

```
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
```

```
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all


% --> asse principale : asse z
acc_K1K2_g1=accz_K1K2_g1;
acc_K1K2_g2=accz_K1K2_g2;
acc_K1K2_g3=accz_K1K2_g3;
acc_K1K2_g4=accz_K1K2_g4;

acc_K2K3_g1=accz_K2K3_g1;
acc_K2K3_g2=accz_K2K3_g2;
acc_K2K3_g3=accz_K2K3_g3;
acc_K2K3_g4=accz_K2K3_g4;

acc_K5K6_g1=accz_K5K6_g1;
acc_K5K6_g2=accz_K5K6_g2;
acc_K5K6_g3=accz_K5K6_g3;
acc_K5K6_g4=accz_K5K6_g4;

acc_K7K8_g1=accz_K7K8_g1;
acc_K7K8_g2=accz_K7K8_g2;
```

```
acc_K7K8_g3=accz_K7K8_g3;
acc_K7K8_g4=accz_K7K8_g4;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=4;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;

save acc_Dos_Santos.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=1;
```

```
[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end

pause
close all
%% K2K3
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);
```

```
%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=0;

[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;
```

```
[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end

pause
close all

%% K7K8
```

```
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
```

```
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;

%SEGMENTO K2-K3
n_righe=[0 length(distK2K3_g2) length(distK2K3_g3) length(distK2K3_g4)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;

save dist_Dos_Santos.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;

% SEGMENTO K2-K3
nrighe=[0 length(P_K2K3_g2) length(P_K2K3_g3) length(P_K2K3_g4)];
```

```
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;

% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;

save picchi_Dos_Santos.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.2.4) Atleta 7 – classe LW11

```
%%
clc
clear all
close all

nome_atleta='\Skarstein';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.women.LW11(2);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);
```

```
MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
%[PKS2
LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)
% --> il MAG ha registrato tutti i checkpoint di Stefan (posso analizzarlo
% dal file excel contando il loro numero e confrontandolo col numero di
% picchi trovati) --> devo andare a considerare solo quelli relativi ai K!

%                         (K4)
%                 K1  K2  K3  X  K5  K6  K7  K8
% picchi GIRO 1:  10  11  12  x  15  16  17  18
% picchi GIRO 2:  30  31  32  x  35  36  37  38
% picchi GIRO 3:  49  50  51  x  54  55  56  57
% picchi GIRO 4:  68  69  70  x  73  74  75  76

%il K4 non è mai stato rilevato

TC1=[splittime(1,1:3) splittime(1,5:8) splittime(2,1:3) splittime(2,5:8)
splittime(3,1:3) splittime(3,5:8) splittime(4,1:3) splittime(4,5:8)];
LOC11=[LOC1shift(10:12) LOC1shift(15:18) LOC1shift(30:32) LOC1shift(35:38)
LOC1shift(49:51) LOC1shift(54:57) LOC1shift(68:70) LOC1shift(73:76)];
diff1=TC1-LOC11;
vett=1:28;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
```

```
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (4);
KK=[LOC11(2)-LOC11(1) LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(23)-
LOC11(22); LOC11(3)-LOC11(2) LOC11(10)-LOC11(9) LOC11(17)-LOC11(16)
LOC11(24)-LOC11(23); LOC11(3)-LOC11(1) LOC11(10)-LOC11(8) LOC11(17)-
LOC11(15) LOC11(24)-LOC11(22); NaN NaN NaN NaN; LOC11(5)-LOC11(4)
LOC11(12)-LOC11(11) LOC11(19)-LOC11(18) LOC11(26)-LOC11(25); LOC11(7)-
LOC11(6) LOC11(14)-LOC11(13) LOC11(21)-LOC11(20) LOC11(28)-LOC11(27)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Skarstein.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(8):pos_t(9),1);
accx_K1K2_g3=acc(pos_t(15):pos_t(16),1);
accx_K1K2_g4=acc(pos_t(22):pos_t(23),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(8):pos_t(9),2);
accy_K1K2_g3=acc(pos_t(15):pos_t(16),2);
accy_K1K2_g4=acc(pos_t(22):pos_t(23),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=-acc(pos_t(8):pos_t(9),3);
accz_K1K2_g3=-acc(pos_t(15):pos_t(16),3);
accz_K1K2_g4=-acc(pos_t(22):pos_t(23),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
```

```
accx_K2K3_g2=acc(pos_t(9):pos_t(10),1);
accx_K2K3_g3=acc(pos_t(16):pos_t(17),1);
accx_K2K3_g4=acc(pos_t(23):pos_t(24),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=acc(pos_t(9):pos_t(10),2);
accy_K2K3_g3=acc(pos_t(16):pos_t(17),2);
accy_K2K3_g4=acc(pos_t(23):pos_t(24),2);
accz_K2K3_g1=-acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=-acc(pos_t(9):pos_t(10),3);
accz_K2K3_g3=-acc(pos_t(16):pos_t(17),3);
accz_K2K3_g4=-acc(pos_t(23):pos_t(24),3);
% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(4):pos_t(5),1);
accx_K5K6_g2=acc(pos_t(11):pos_t(12),1);
accx_K5K6_g3=acc(pos_t(18):pos_t(19),1);
accx_K5K6_g4=acc(pos_t(25):pos_t(26),1);
accy_K5K6_g1=acc(pos_t(4):pos_t(5),2);
accy_K5K6_g2=acc(pos_t(11):pos_t(12),2);
accy_K5K6_g3=acc(pos_t(18):pos_t(19),2);
accy_K5K6_g4=acc(pos_t(25):pos_t(26),2);
accz_K5K6_g1=-acc(pos_t(4):pos_t(5),3);
accz_K5K6_g2=-acc(pos_t(11):pos_t(12),3);
accz_K5K6_g3=-acc(pos_t(18):pos_t(19),3);
accz_K5K6_g4=-acc(pos_t(25):pos_t(26),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(6):pos_t(7),1);
accx_K7K8_g2=acc(pos_t(13):pos_t(14),1);
accx_K7K8_g3=acc(pos_t(20):pos_t(21),1);
accx_K7K8_g4=acc(pos_t(27):pos_t(28),1);
accy_K7K8_g1=acc(pos_t(6):pos_t(7),2);
accy_K7K8_g2=acc(pos_t(13):pos_t(14),2);
accy_K7K8_g3=acc(pos_t(20):pos_t(21),2);
accy_K7K8_g4=acc(pos_t(27):pos_t(28),2);
accz_K7K8_g1=-acc(pos_t(6):pos_t(7),3);
accz_K7K8_g2=-acc(pos_t(13):pos_t(14),3);
accz_K7K8_g3=-acc(pos_t(20):pos_t(21),3);
accz_K7K8_g4=-acc(pos_t(27):pos_t(28),3);

pause
close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K1K2_g4)
```

```
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accx_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);
```

```
figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
```

```
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
```

```
subplot(4,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all


% --> asse principale : asse x
acc_K1K2_g1=accx_K1K2_g1;
acc_K1K2_g2=accx_K1K2_g2;
acc_K1K2_g3=accx_K1K2_g3;
acc_K1K2_g4=accx_K1K2_g4;

acc_K2K3_g1=accx_K2K3_g1;
acc_K2K3_g2=accx_K2K3_g2;
acc_K2K3_g3=accx_K2K3_g3;
acc_K2K3_g4=accx_K2K3_g4;

acc_K5K6_g1=accx_K5K6_g1;
acc_K5K6_g2=accx_K5K6_g2;
acc_K5K6_g3=accx_K5K6_g3;
acc_K5K6_g4=accx_K5K6_g4;

acc_K7K8_g1=accx_K7K8_g1;
acc_K7K8_g2=accx_K7K8_g2;
acc_K7K8_g3=accx_K7K8_g3;
acc_K7K8_g4=accx_K7K8_g4;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=4;
```

```
% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;

save acc_Skarstein.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=1;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
```

```
figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=0;
```

```
[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
```

```
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end
```

```
pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
```

```
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) length(distK2K3_g2) length(distK2K3_g3)
length(distK2K3_g4)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;

save dist_Skarstein.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4)];
maxrighe=max(nrighe);
```

```
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) length(P_K2K3_g2) length(P_K2K3_g3)
length(P_K2K3_g4)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;

% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;

save picchi_Skarstein.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.2.5) Atleta 11 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Zainullina';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.women.LW12(6);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4];
```

```
%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
%[PKS2
LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)
% --> il MAG ha registrato tutti i checkpoint di Stefan (posso analizzarlo
% dal file excel contando il loro numero e confrontandolo col numero di
% picchi trovati) --> devo andare a considerare solo quelli relativi ai K!

%                        (K4)
%                K1  K2  K3  X  K5  K6  K7  K8
% picchi GIRO 1: 10  11  12   x  15  16  17  18
% picchi GIRO 2: 30  31  NaN  x  35  36  37  38
% picchi GIRO 3: 49  50  51   x  54  55  56  57
% picchi GIRO 4: 68  69  70   x  73  74  75  76

%il K4 non è mai stato rilevato
```

```
TC1=[splittime(1,1:3) splittime(1,5:8) splittime(2,1:2) splittime(2,5:8)
splittime(3,1:3) splittime(3,5:8) splittime(4,1:3) splittime(4,5:8)];
LOC11=[LOC1shift(10:12) LOC1shift(15:18) LOC1shift(30:31) LOC1shift(35:38)
LOC1shift(49:51) LOC1shift(54:57) LOC1shift(68:70) LOC1shift(73:76)];
diff1=TC1-LOC11;
vett=1:27;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (4);
KK=[LOC11(2)-LOC11(1) LOC11(9)-LOC11(8) LOC11(15)-LOC11(14) LOC11(22)-
LOC11(21); LOC11(3)-LOC11(2) NaN LOC11(16)-LOC11(15) LOC11(23)-LOC11(22);
LOC11(3)-LOC11(1) NaN LOC11(16)-LOC11(14) LOC11(23)-LOC11(21); NaN NaN NaN
NaN; LOC11(5)-LOC11(4) LOC11(11)-LOC11(10) LOC11(18)-LOC11(17) LOC11(25)-
LOC11(24); LOC11(7)-LOC11(6) LOC11(13)-LOC11(12) LOC11(20)-LOC11(19)
LOC11(27)-LOC11(26)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Zainullina.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(8):pos_t(9),1);
accx_K1K2_g3=acc(pos_t(14):pos_t(15),1);
accx_K1K2_g4=acc(pos_t(21):pos_t(22),1);
```

```
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(8):pos_t(9),2);
accy_K1K2_g3=acc(pos_t(14):pos_t(15),2);
accy_K1K2_g4=acc(pos_t(21):pos_t(22),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=-acc(pos_t(8):pos_t(9),3);
accz_K1K2_g3=-acc(pos_t(14):pos_t(15),3);
accz_K1K2_g4=-acc(pos_t(21):pos_t(22),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=NaN;
accx_K2K3_g3=acc(pos_t(15):pos_t(16),1);
accx_K2K3_g4=acc(pos_t(22):pos_t(23),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=NaN;
accy_K2K3_g3=acc(pos_t(15):pos_t(16),2);
accy_K2K3_g4=acc(pos_t(22):pos_t(23),2);
accz_K2K3_g1=-acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=NaN;
accz_K2K3_g3=-acc(pos_t(15):pos_t(16),3);
accz_K2K3_g4=-acc(pos_t(22):pos_t(23),3);
% SEGMENTO K4K5
% mancano le rilevazioni del MAG a K4 per ogni giro.
% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(4):pos_t(5),1);
accx_K5K6_g2=acc(pos_t(10):pos_t(11),1);
accx_K5K6_g3=acc(pos_t(17):pos_t(18),1);
accx_K5K6_g4=acc(pos_t(24):pos_t(25),1);
accy_K5K6_g1=acc(pos_t(4):pos_t(5),2);
accy_K5K6_g2=acc(pos_t(10):pos_t(11),2);
accy_K5K6_g3=acc(pos_t(17):pos_t(18),2);
accy_K5K6_g4=acc(pos_t(24):pos_t(25),2);
accz_K5K6_g1=-acc(pos_t(4):pos_t(5),3);
accz_K5K6_g2=-acc(pos_t(10):pos_t(11),3);
accz_K5K6_g3=-acc(pos_t(17):pos_t(18),3);
accz_K5K6_g4=-acc(pos_t(24):pos_t(25),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(6):pos_t(7),1);
accx_K7K8_g2=acc(pos_t(12):pos_t(13),1);
accx_K7K8_g3=acc(pos_t(19):pos_t(20),1);
accx_K7K8_g4=acc(pos_t(26):pos_t(27),1);
accy_K7K8_g1=acc(pos_t(6):pos_t(7),2);
accy_K7K8_g2=acc(pos_t(12):pos_t(13),2);
accy_K7K8_g3=acc(pos_t(19):pos_t(20),2);
accy_K7K8_g4=acc(pos_t(26):pos_t(27),2);
accz_K7K8_g1=-acc(pos_t(6):pos_t(7),3);
accz_K7K8_g2=-acc(pos_t(12):pos_t(13),3);
accz_K7K8_g3=-acc(pos_t(19):pos_t(20),3);
accz_K7K8_g4=-acc(pos_t(26):pos_t(27),3);

close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
```

```
subplot(4,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(4,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accx_K2K3_g1)
```

```
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(4,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);
```

```
figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
```

```
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all


% --> asse principale : asse x
acc_K1K2_g1=accx_K1K2_g1;
acc_K1K2_g2=accx_K1K2_g2;
acc_K1K2_g3=accx_K1K2_g3;
acc_K1K2_g4=accx_K1K2_g4;

acc_K2K3_g1=accx_K2K3_g1;
acc_K2K3_g2=accx_K2K3_g2;
acc_K2K3_g3=accx_K2K3_g3;
acc_K2K3_g4=accx_K2K3_g4;

acc_K5K6_g1=accx_K5K6_g1;
acc_K5K6_g2=accx_K5K6_g2;
acc_K5K6_g3=accx_K5K6_g3;
acc_K5K6_g4=accx_K5K6_g4;

acc_K7K8_g1=accx_K7K8_g1;
acc_K7K8_g2=accx_K7K8_g2;
acc_K7K8_g3=accx_K7K8_g3;
acc_K7K8_g4=accx_K7K8_g4;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
```

```
% atleti inseriti
n_giri=4;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;

save acc_Zainullina.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=1;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
```

```
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=0;
```

```
[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
```

```
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);
```

```
%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end

pause
close all
```

```
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) 0 length(distK2K3_g3) length(distK2K3_g4)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;

save dist_Zainullina.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) 0 length(P_K2K3_g3) length(P_K2K3_g4)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;
```

```
% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;

% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;

save picchi_Zainullina.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.2.6) Atleta 12 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Guliaeva';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.women.LW12(5);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
```

```
title('MAG non filtrato')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
%[PKS2
LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)
% --> il MAG ha registrato tutti i checkpoint di Stefan (posso analizzarlo
% dal file excel contando il loro numero e confrontandolo col numero di
% picchi trovati) --> devo andare a considerare solo quelli relativi ai K!

%                        (K4)
%                 K1  K2  K3  X  K5  K6  K7  K8
% picchi GIRO 1: 11  NaN  13  x  16  17  18  19
% picchi GIRO 2: 30  31   32  x  35  36  37  38
% picchi GIRO 3: 49  50   51  x  54  55  56  57
% picchi GIRO 4: 68  69   70  x  73  74  75  76

%il K4 non è mai stato rilevato

TC1=[splittime(1,1) splittime(1,3) splittime(1,5:8) splittime(2,1:3)
splittime(2,5:8) splittime(3,1:3) splittime(3,5:8) splittime(4,1:3)
splittime(4,5:8)];
LOC11=[LOC1shift(11) LOC1shift(13) LOC1shift(16:19) LOC1shift(30:32)
LOC1shift(35:38) LOC1shift(49:51) LOC1shift(54:57) LOC1shift(68:70)
LOC1shift(73:76)];
diff1=TC1-LOC11;
vett=1:27;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
```

```
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (4);
KK=[NaN LOC11(8)-LOC11(7) LOC11(15)-LOC11(14) LOC11(22)-LOC11(21); NaN
LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(23)-LOC11(22); LOC11(2)-
LOC11(1) LOC11(9)-LOC11(7) LOC11(16)-LOC11(14) LOC11(23)-LOC11(21); NaN NaN
NaN NaN; LOC11(4)-LOC11(3) LOC11(11)-LOC11(10) LOC11(18)-LOC11(17)
LOC11(25)-LOC11(24); LOC11(6)-LOC11(5) LOC11(13)-LOC11(12) LOC11(20)-
LOC11(19) LOC11(27)-LOC11(26)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Guliaeva.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=NaN;
accx_K1K2_g2=acc(pos_t(7):pos_t(8),1);
accx_K1K2_g3=acc(pos_t(14):pos_t(15),1);
accx_K1K2_g4=acc(pos_t(21):pos_t(22),1);
accy_K1K2_g1=NaN;
accy_K1K2_g2=acc(pos_t(7):pos_t(8),2);
accy_K1K2_g3=acc(pos_t(14):pos_t(15),2);
accy_K1K2_g4=acc(pos_t(21):pos_t(22),2);
accz_K1K2_g1=NaN;
accz_K1K2_g2=-acc(pos_t(7):pos_t(8),3);
accz_K1K2_g3=-acc(pos_t(14):pos_t(15),3);
accz_K1K2_g4=-acc(pos_t(21):pos_t(22),3);
% segmento K2K3
accx_K2K3_g1=NaN;
accx_K2K3_g2=acc(pos_t(8):pos_t(9),1);
accx_K2K3_g3=acc(pos_t(15):pos_t(16),1);
accx_K2K3_g4=acc(pos_t(22):pos_t(23),1);
accy_K2K3_g1=NaN;
accy_K2K3_g2=acc(pos_t(8):pos_t(9),2);
accy_K2K3_g3=acc(pos_t(15):pos_t(16),2);
accy_K2K3_g4=acc(pos_t(22):pos_t(23),2);
```

```
accz_K2K3_g1=NaN;
accz_K2K3_g2=-acc(pos_t(8):pos_t(9),3);
accz_K2K3_g3=-acc(pos_t(15):pos_t(16),3);
accz_K2K3_g4=-acc(pos_t(22):pos_t(23),3);
% SEGMENTO K4K5
% mancano le rilevazioni del MAG a K4 per ogni giro.
% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(3):pos_t(4),1);
accx_K5K6_g2=acc(pos_t(10):pos_t(11),1);
accx_K5K6_g3=acc(pos_t(17):pos_t(18),1);
accx_K5K6_g4=acc(pos_t(24):pos_t(25),1);
accy_K5K6_g1=acc(pos_t(3):pos_t(4),2);
accy_K5K6_g2=acc(pos_t(10):pos_t(11),2);
accy_K5K6_g3=acc(pos_t(17):pos_t(18),2);
accy_K5K6_g4=acc(pos_t(24):pos_t(25),2);
accz_K5K6_g1=-acc(pos_t(3):pos_t(4),3);
accz_K5K6_g2=-acc(pos_t(10):pos_t(11),3);
accz_K5K6_g3=-acc(pos_t(17):pos_t(18),3);
accz_K5K6_g4=-acc(pos_t(24):pos_t(25),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(5):pos_t(6),1);
accx_K7K8_g2=acc(pos_t(12):pos_t(13),1);
accx_K7K8_g3=acc(pos_t(19):pos_t(20),1);
accx_K7K8_g4=acc(pos_t(26):pos_t(27),1);
accy_K7K8_g1=acc(pos_t(5):pos_t(6),2);
accy_K7K8_g2=acc(pos_t(12):pos_t(13),2);
accy_K7K8_g3=acc(pos_t(19):pos_t(20),2);
accy_K7K8_g4=acc(pos_t(26):pos_t(27),2);
accz_K7K8_g1=-acc(pos_t(5):pos_t(6),3);
accz_K7K8_g2=-acc(pos_t(12):pos_t(13),3);
accz_K7K8_g3=-acc(pos_t(19):pos_t(20),3);
accz_K7K8_g4=-acc(pos_t(26):pos_t(27),3);

close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(4,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(4,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
```

```
subplot(4,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(4,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(4,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(4,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
```

```
subplot(4,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K4K5

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(4,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
```

```
subplot(4,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);

figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(4,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(4,1,2)
plot(v2,accz_K7K8_g2)
```

```
xlabel('tempo [s]')
subplot(4,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(4,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all


% --> asse principale : asse x
acc_K1K2_g1=accx_K1K2_g1;
acc_K1K2_g2=accx_K1K2_g2;
acc_K1K2_g3=accx_K1K2_g3;
acc_K1K2_g4=accx_K1K2_g4;

acc_K2K3_g1=accx_K2K3_g1;
acc_K2K3_g2=accx_K2K3_g2;
acc_K2K3_g3=accx_K2K3_g3;
acc_K2K3_g4=accx_K2K3_g4;

acc_K5K6_g1=accx_K5K6_g1;
acc_K5K6_g2=accx_K5K6_g2;
acc_K5K6_g3=accx_K5K6_g3;
acc_K5K6_g4=accx_K5K6_g4;

acc_K7K8_g1=accx_K7K8_g1;
acc_K7K8_g2=accx_K7K8_g2;
acc_K7K8_g3=accx_K7K8_g3;
acc_K7K8_g4=accx_K7K8_g4;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=4;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;
```

```
%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;

save acc_Guliaeva.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=1;

[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
```

```
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end

pause
close all
%% K2K3
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=0;

[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
```

```
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
```

```
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(4,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(4,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
```

```
subplot(4,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[0 length(distK1K2_g2) length(distK1K2_g3) length(distK1K2_g4)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;

%SEGMENTO K2-K3
n_righe=[0 length(distK2K3_g2) length(distK2K3_g3) length(distK2K3_g4)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
```

```
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;

save dist_Guliaeva.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[0 length(P_K1K2_g2) length(P_K1K2_g3) length(P_K1K2_g4)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;

% SEGMENTO K2-K3
nrighe=[0 length(P_K2K3_g2) length(P_K2K3_g3) length(P_K2K3_g4)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;

% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;

save picchi_Guliaeva.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.3) Cross country long uomini

g.3.1) Atleta 10 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Gao';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
```

```
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.men.LW12(6);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4;atleta.split_time_giro5];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=190;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
[PKS2 LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1:3) splittime(1,5:8) splittime(2,1:3) splittime(2,5:8)
splittime(3,1:3) splittime(3,5:8) splittime(4,1:3) splittime(4,5:8)
splittime(5,1:2) splittime(5,5:8)];
LOC11=[LOC1shift(10:12) LOC1shift(15:18) LOC1shift(29:31) LOC1shift(34:37)
LOC1shift(48:50) LOC1shift(53:56) LOC1shift(65:67) LOC1shift(70:73)
LOC1shift(83:84) LOC1shift(88:91)];
diff1=TC1-LOC11;
vett=1:34;
% regressione lineare dei dati
```

```
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri
(5);LOC11(3)-L
KK=[LOC11(2)-LOC11(1) LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(23)-
LOC11(22) LOC11(30)-LOC11(29); LOC11(3)-LOC11(2) LOC11(10)-LOC11(9)
LOC11(17)-LOC11(16) LOC11(24)-LOC11(23) NaN;  LOC11(3)-LOC11(1) LOC11(10)-
LOC11(8) LOC11(17)-LOC11(15) LOC11(24)-LOC11(22) NaN;NaN NaN NaN NaN NaN;
LOC11(5)-LOC11(4) LOC11(12)-LOC11(11) LOC11(19)-LOC11(18) LOC11(26)-
LOC11(25) LOC11(32)-LOC11(31); LOC11(7)-LOC11(6) LOC11(14)-LOC11(13)
LOC11(21)-LOC11(20) LOC11(28)-LOC11(27) LOC11(34)-LOC11(33)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4;
atleta.intertempi_giro5]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Gao.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(8):pos_t(9),1);
accx_K1K2_g3=acc(pos_t(15):pos_t(16),1);
accx_K1K2_g4=acc(pos_t(22):pos_t(23),1);
accx_K1K2_g5=acc(pos_t(29):pos_t(30),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(8):pos_t(9),2);
accy_K1K2_g3=acc(pos_t(15):pos_t(16),2);
```

```
accy_K1K2_g4=acc(pos_t(22):pos_t(23),2);
accy_K1K2_g5=acc(pos_t(29):pos_t(30),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=-acc(pos_t(8):pos_t(9),3);
accz_K1K2_g3=-acc(pos_t(15):pos_t(16),3);
accz_K1K2_g4=-acc(pos_t(22):pos_t(23),3);
accz_K1K2_g5=-acc(pos_t(29):pos_t(30),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=acc(pos_t(9):pos_t(10),1);
accx_K2K3_g3=acc(pos_t(16):pos_t(17),1);
accx_K2K3_g4=acc(pos_t(23):pos_t(24),1);
accx_K2K3_g5=NaN;
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=acc(pos_t(9):pos_t(10),2);
accy_K2K3_g3=acc(pos_t(16):pos_t(17),2);
accy_K2K3_g4=acc(pos_t(23):pos_t(24),2);
accy_K2K3_g5=NaN;
accz_K2K3_g1=-acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=-acc(pos_t(9):pos_t(10),3);
accz_K2K3_g3=-acc(pos_t(16):pos_t(17),3);
accz_K2K3_g4=-acc(pos_t(23):pos_t(24),3);
accz_K2K3_g5=NaN;
% SEGMENTO K4K5

% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(4):pos_t(5),1);
accx_K5K6_g2=acc(pos_t(11):pos_t(12),1);
accx_K5K6_g3=acc(pos_t(18):pos_t(19),1);
accx_K5K6_g4=acc(pos_t(25):pos_t(26),1);
accx_K5K6_g5=acc(pos_t(31):pos_t(32),1);
accy_K5K6_g1=acc(pos_t(4):pos_t(5),2);
accy_K5K6_g2=acc(pos_t(11):pos_t(12),2);
accy_K5K6_g3=acc(pos_t(18):pos_t(19),2);
accy_K5K6_g4=acc(pos_t(25):pos_t(26),2);
accy_K5K6_g5=acc(pos_t(31):pos_t(32),2);
accz_K5K6_g1=-acc(pos_t(4):pos_t(5),3);
accz_K5K6_g2=-acc(pos_t(11):pos_t(12),3);
accz_K5K6_g3=-acc(pos_t(18):pos_t(19),3);
accz_K5K6_g4=-acc(pos_t(25):pos_t(26),3);
accz_K5K6_g5=-acc(pos_t(31):pos_t(32),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(6):pos_t(7),1);
accx_K7K8_g2=acc(pos_t(13):pos_t(14),1);
accx_K7K8_g3=acc(pos_t(20):pos_t(21),1);
accx_K7K8_g4=acc(pos_t(27):pos_t(28),1);
accx_K7K8_g5=acc(pos_t(33):pos_t(34),1);
accy_K7K8_g1=acc(pos_t(6):pos_t(7),2);
accy_K7K8_g2=acc(pos_t(13):pos_t(14),2);
accy_K7K8_g3=acc(pos_t(20):pos_t(21),2);
accy_K7K8_g4=acc(pos_t(27):pos_t(28),2);
accy_K7K8_g5=acc(pos_t(33):pos_t(34),2);
accz_K7K8_g1=-acc(pos_t(6):pos_t(7),3);
accz_K7K8_g2=-acc(pos_t(13):pos_t(14),3);
accz_K7K8_g3=-acc(pos_t(20):pos_t(21),3);
accz_K7K8_g4=-acc(pos_t(27):pos_t(28),3);
accz_K7K8_g5=-acc(pos_t(33):pos_t(34),3);

pause
close all
%% grafici accelerazione lineare K1K2
```

```
v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);
v5=0.01:0.01:0.01*length(accx_K1K2_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K1K2_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(3,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
```

```
plot(v5,accz_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3
v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);
v5=0.01:0.01:0.01*length(accx_K2K3_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(5,1,1)
plot(v1,accx_K2K3_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(5,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(5,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K4K5
```

```
%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);
v5=0.01:0.01:0.01*length(accx_K5K6_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K5K6_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K5K6_g4)
```

```
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);
v5=0.01:0.01:0.01*length(accx_K7K8_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
```

```
subplot(5,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all
% --> asse principale : asse x
acc_K1K2_g1=-accx_K1K2_g1;
acc_K1K2_g2=-accx_K1K2_g2;
acc_K1K2_g3=-accx_K1K2_g3;
acc_K1K2_g4=-accx_K1K2_g4;
acc_K1K2_g5=-accx_K1K2_g5;

acc_K2K3_g1=-accx_K2K3_g1;
acc_K2K3_g2=-accx_K2K3_g2;
acc_K2K3_g3=-accx_K2K3_g3;
acc_K2K3_g4=-accx_K2K3_g4;
acc_K2K3_g5=-accx_K2K3_g5;

acc_K5K6_g1=-accx_K5K6_g1;
acc_K5K6_g2=-accx_K5K6_g2;
acc_K5K6_g3=-accx_K5K6_g3;
acc_K5K6_g4=-accx_K5K6_g4;
acc_K5K6_g5=-accx_K5K6_g5;

acc_K7K8_g1=-accx_K7K8_g1;
acc_K7K8_g2=-accx_K7K8_g2;
acc_K7K8_g3=-accx_K7K8_g3;
acc_K7K8_g4=-accx_K7K8_g4;
acc_K7K8_g5=-accx_K7K8_g5;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=5;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4) length(acc_K1K2_g5)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;
accK1K2(1:length(acc_K1K2_g5),5)=acc_K1K2_g5;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4) length(acc_K2K3_g5)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
```

```
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;
accK2K3(1:length(acc_K2K3_g5),5)=acc_K2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4) length(acc_K5K6_g5)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;
accK5K6(1:length(acc_K5K6_g5),5)=acc_K5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4) length(acc_K7K8_g5)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;
accK7K8(1:length(acc_K7K8_g5),5)=acc_K7K8_g5;

save acc_Gao.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);
t5=0.01:0.01:0.01*length(acc_K1K2_g5);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=2;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g5,L_K1K2_g5]=findpeaks(acc_K1K2_g5,t5,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
```

```
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K1K2_g5,'k')
plot(L_K1K2_g5,P_K1K2_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end
for i=1:length(L_K1K2_g5)-1
    distK1K2_g5(i)=L_K1K2_g5(i+1)-L_K1K2_g5(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=5;

[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
```

```
[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);
```

```
t5=0.01:0.01:0.01*length(acc_K5K6_g5);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=2;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g5,L_K5K6_g5]=findpeaks(acc_K5K6_g5,t5,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K5K6_g5,'k')
plot(L_K5K6_g5,P_K5K6_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
```

```
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end
for i=1:length(L_K5K6_g5)-1
    distK5K6_g5(i)=L_K5K6_g5(i+1)-L_K5K6_g5(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);
t5=0.01:0.01:0.01*length(acc_K7K8_g5);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=2;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g5,L_K7K8_g5]=findpeaks(acc_K7K8_g5,t5,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
```

```
subplot(5,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K7K8_g5,'k')
plot(L_K7K8_g5,P_K7K8_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end
for i=1:length(L_K7K8_g5)-1
    distK7K8_g5(i)=L_K7K8_g5(i+1)-L_K7K8_g5(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4) length(distK1K2_g5)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;
distK1K2(1:length(distK1K2_g5),5)=distK1K2_g5;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) length(distK2K3_g2) length(distK2K3_g3)
length(distK2K3_g4) 0];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;

%SEGMENTO K5-K6
```

```
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4) length(distK5K6_g5)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;
distK5K6(1:length(distK5K6_g5),5)=distK5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4) length(distK7K8_g5)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;
distK7K8(1:length(distK7K8_g5),5)=distK7K8_g5;

save dist_Gao.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4) length(P_K1K2_g5)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;
P_K1K2(1:length(P_K1K2_g5),5)=P_K1K2_g5;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) length(P_K2K3_g2) length(P_K2K3_g3)
length(P_K2K3_g4) 0];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4) length(P_K5K6_g5)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;
P_K5K6(1:length(P_K5K6_g5),5)=P_K5K6_g5;

% SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4) length(P_K7K8_g5)];
maxrighe=max(nrighe);
```

```
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;
P_K7K8(1:length(P_K7K8_g5),5)=P_K7K8_g5;

save picchi_Gao.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.3.2) Atleta 13 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Davidovich';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.men.LW12(12);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4;atleta.split_time_giro5];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=85;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
[PKS2 LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
```

```
%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1:2) splittime(1,5) splittime(1,7:8) splittime(2,1:3)
splittime(2,5:8) splittime(3,1:3) splittime(3,5) splittime(3,7:8)
splittime(4,1:3) splittime(4,5:8) splittime(5,1:3) splittime(5,5:8)];
LOC11=[LOC1shift(9:10) LOC1shift(13) LOC1shift(14:15) LOC1shift(25:27)
LOC1shift(30:33) LOC1shift(42:44) LOC1shift(46) LOC1shift(47:48)
LOC1shift(57:59) LOC1shift(62:65) LOC1shift(74:76) LOC1shift(79:82)];
diff1=TC1-LOC11;
vett=1:32;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (5);
KK=[LOC11(2)-LOC11(1) LOC11(7)-LOC11(6) LOC11(14)-LOC11(13) LOC11(20)-
LOC11(19) LOC11(27)-LOC11(26); NaN LOC11(8)-LOC11(7) LOC11(15)-LOC11(14)
LOC11(21)-LOC11(20) LOC11(28)-LOC11(27);  NaN LOC11(8)-LOC11(6) LOC11(15)-
LOC11(13) LOC11(21)-LOC11(19) LOC11(28)-LOC11(26);NaN NaN NaN NaN NaN; NaN
LOC11(10)-LOC11(9) NaN LOC11(23)-LOC11(22) LOC11(30)-LOC11(29); LOC11(5)-
LOC11(4) LOC11(12)-LOC11(11) LOC11(18)-LOC11(17) LOC11(25)-LOC11(24)
LOC11(32)-LOC11(31)];
```

```
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4;
atleta.intertempi_giro5]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Davidovich.mat err_perc err_int_perc KK;


% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(6):pos_t(7),1);
accx_K1K2_g3=acc(pos_t(13):pos_t(14),1);
accx_K1K2_g4=acc(pos_t(19):pos_t(20),1);
accx_K1K2_g5=acc(pos_t(26):pos_t(27),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(6):pos_t(7),2);
accy_K1K2_g3=acc(pos_t(13):pos_t(14),2);
accy_K1K2_g4=acc(pos_t(19):pos_t(20),2);
accy_K1K2_g5=acc(pos_t(26):pos_t(27),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=-acc(pos_t(6):pos_t(7),3);
accz_K1K2_g3=-acc(pos_t(13):pos_t(14),3);
accz_K1K2_g4=-acc(pos_t(19):pos_t(20),3);
accz_K1K2_g5=-acc(pos_t(26):pos_t(27),3);
% segmento K2K3
accx_K2K3_g1=NaN;
accx_K2K3_g2=acc(pos_t(7):pos_t(8),1);
accx_K2K3_g3=acc(pos_t(14):pos_t(15),1);
accx_K2K3_g4=acc(pos_t(20):pos_t(21),1);
accx_K2K3_g5=acc(pos_t(27):pos_t(28),1);
accy_K2K3_g1=NaN;
accy_K2K3_g2=acc(pos_t(7):pos_t(8),2);
accy_K2K3_g3=acc(pos_t(14):pos_t(15),2);
accy_K2K3_g4=acc(pos_t(20):pos_t(21),2);
accy_K2K3_g5=acc(pos_t(27):pos_t(28),2);
accz_K2K3_g1=NaN;
accz_K2K3_g2=-acc(pos_t(7):pos_t(8),3);
accz_K2K3_g3=-acc(pos_t(14):pos_t(15),3);
accz_K2K3_g4=-acc(pos_t(20):pos_t(21),3);
accz_K2K3_g5=-acc(pos_t(27):pos_t(28),3);
% SEGMENTO K4K5

% SEGMENTO K5K6
accx_K5K6_g1=NaN;
accx_K5K6_g2=acc(pos_t(9):pos_t(10),1);
accx_K5K6_g3=NaN;
accx_K5K6_g4=acc(pos_t(22):pos_t(23),1);
accx_K5K6_g5=acc(pos_t(29):pos_t(30),1);
accy_K5K6_g1=NaN;
accy_K5K6_g2=acc(pos_t(9):pos_t(10),2);
accy_K5K6_g3=NaN;
accy_K5K6_g4=acc(pos_t(22):pos_t(23),2);
accy_K5K6_g5=acc(pos_t(29):pos_t(30),2);
accz_K5K6_g1=NaN;
accz_K5K6_g2=-acc(pos_t(9):pos_t(10),3);
```

```
accz_K5K6_g3=NaN;
accz_K5K6_g4=-acc(pos_t(22):pos_t(23),3);
accz_K5K6_g5=-acc(pos_t(29):pos_t(30),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(4):pos_t(5),1);
accx_K7K8_g2=acc(pos_t(11):pos_t(12),1);
accx_K7K8_g3=acc(pos_t(17):pos_t(18),1);
accx_K7K8_g4=acc(pos_t(24):pos_t(25),1);
accx_K7K8_g5=acc(pos_t(31):pos_t(32),1);
accy_K7K8_g1=acc(pos_t(4):pos_t(5),2);
accy_K7K8_g2=acc(pos_t(11):pos_t(12),2);
accy_K7K8_g3=acc(pos_t(17):pos_t(18),2);
accy_K7K8_g4=acc(pos_t(24):pos_t(25),2);
accy_K7K8_g5=acc(pos_t(31):pos_t(32),2);
accz_K7K8_g1=-acc(pos_t(4):pos_t(5),3);
accz_K7K8_g2=-acc(pos_t(11):pos_t(12),3);
accz_K7K8_g3=-acc(pos_t(17):pos_t(18),3);
accz_K7K8_g4=-acc(pos_t(24):pos_t(25),3);
accz_K7K8_g5=-acc(pos_t(31):pos_t(32),3);

pause
close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);
v5=0.01:0.01:0.01*length(accx_K1K2_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K1K2_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
```

```
subplot(5,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(3,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3

v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);
v5=0.01:0.01:0.01*length(accx_K2K3_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
```

```
subplot(5,1,5)
plot(v5,accy_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K4K5

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);
v5=0.01:0.01:0.01*length(accx_K5K6_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(5,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K5K6_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(5,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(5,1,2)
```

```
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);
v5=0.01:0.01:0.01*length(accx_K7K8_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accz_K7K8_g1)
```

```
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all

% --> asse principale : asse z
acc_K1K2_g1=accz_K1K2_g1;
acc_K1K2_g2=accz_K1K2_g2;
acc_K1K2_g3=accz_K1K2_g3;
acc_K1K2_g4=accz_K1K2_g4;
acc_K1K2_g5=accz_K1K2_g5;

acc_K2K3_g1=accz_K2K3_g1;
acc_K2K3_g2=accz_K2K3_g2;
acc_K2K3_g3=accz_K2K3_g3;
acc_K2K3_g4=accz_K2K3_g4;
acc_K2K3_g5=accz_K2K3_g5;

acc_K5K6_g1=accz_K5K6_g1;
acc_K5K6_g2=accz_K5K6_g2;
acc_K5K6_g3=accz_K5K6_g3;
acc_K5K6_g4=accz_K5K6_g4;
acc_K5K6_g5=accz_K5K6_g5;

acc_K7K8_g1=accz_K7K8_g1;
acc_K7K8_g2=accz_K7K8_g2;
acc_K7K8_g3=accz_K7K8_g3;
acc_K7K8_g4=accz_K7K8_g4;
acc_K7K8_g5=accz_K7K8_g5;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=5;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4) length(acc_K1K2_g5)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;
accK1K2(1:length(acc_K1K2_g5),5)=acc_K1K2_g5;

%SEGMENTO K2-K3
```

```
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4) length(acc_K2K3_g5)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;
accK2K3(1:length(acc_K2K3_g5),5)=acc_K2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4) length(acc_K5K6_g5)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;
accK5K6(1:length(acc_K5K6_g5),5)=acc_K5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4) length(acc_K7K8_g5)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;
accK7K8(1:length(acc_K7K8_g5),5)=acc_K7K8_g5;

save acc_Davidovich.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);
t5=0.01:0.01:0.01*length(acc_K1K2_g5);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=0;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g5,L_K1K2_g5]=findpeaks(acc_K1K2_g5,t5,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(5,1,1)
hold on
grid
```

```
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K1K2_g5,'k')
plot(L_K1K2_g5,P_K1K2_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end
for i=1:length(L_K1K2_g5)-1
    distK1K2_g5(i)=L_K1K2_g5(i+1)-L_K1K2_g5(i);
end

pause
close all
%% K2K3
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);
t5=0.01:0.01:0.01*length(acc_K2K3_g5);

%da valutare osservando i segnali
mPDmax23=0.7;
```

```
MPHmax23=0;

[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g5,L_K2K3_g5]=findpeaks(acc_K2K3_g5,t5,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K2K3_g5,'k')
plot(L_K2K3_g5,P_K2K3_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end
for i=1:length(L_K2K3_g5)-1
    distK2K3_g5(i)=L_K2K3_g5(i+1)-L_K2K3_g5(i);
end

pause
close all
```

```
%% K5K6
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);
t5=0.01:0.01:0.01*length(acc_K5K6_g5);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;

[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g5,L_K5K6_g5]=findpeaks(acc_K5K6_g5,t5,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K5K6_g5,'k')
plot(L_K5K6_g5,P_K5K6_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end
for i=1:length(L_K5K6_g5)-1
    distK5K6_g5(i)=L_K5K6_g5(i+1)-L_K5K6_g5(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);
```

```
t5=0.01:0.01:0.01*length(acc_K7K8_g5);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g5,L_K7K8_g5]=findpeaks(acc_K7K8_g5,t5,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K7K8_g5,'k')
plot(L_K7K8_g5,P_K7K8_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
```

```
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end
for i=1:length(L_K7K8_g5)-1
    distK7K8_g5(i)=L_K7K8_g5(i+1)-L_K7K8_g5(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4) length(distK1K2_g5)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;
distK1K2(1:length(distK1K2_g5),5)=distK1K2_g5;

%SEGMENTO K2-K3
n_righe=[0 length(distK2K3_g2) length(distK2K3_g3) length(distK2K3_g4)
length(distK2K3_g5)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;
distK2K3(1:length(distK2K3_g5),5)=distK2K3_g5;

%SEGMENTO K5-K6
n_righe=[0 length(distK5K6_g2) 0 length(distK5K6_g4) length(distK5K6_g5)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;
distK5K6(1:length(distK5K6_g5),5)=distK5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) 0 0 length(distK7K8_g4) length(distK7K8_g5)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;
distK7K8(1:length(distK7K8_g5),5)=distK7K8_g5;

save dist_Davidovich.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4) length(P_K1K2_g5)];
maxrighe=max(nrighe);
```

```
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;
P_K1K2(1:length(P_K1K2_g5),5)=P_K1K2_g5;

% SEGMENTO K2-K3
nrighe=[0 length(P_K2K3_g2) length(P_K2K3_g3) length(P_K2K3_g4)
length(P_K2K3_g5)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;
P_K2K3(1:length(P_K2K3_g5),5)=P_K2K3_g5;

% SEGMENTO K5-K6
nrighe=[0 length(P_K5K6_g2) 0 length(P_K5K6_g4) length(P_K5K6_g5)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;
P_K5K6(1:length(P_K5K6_g5),5)=P_K5K6_g5;

% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4) length(P_K7K8_g5)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;
P_K7K8(1:length(P_K7K8_g5),5)=P_K7K8_g5;

save picchi_Davidovich.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.3.3) Atleta 14 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Larsen';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.men.LW12(11);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4;atleta.split_time_giro5];
```

```
%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=160;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
[PKS2 LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1:3) splittime(1,5:8) splittime(2,1:3) splittime(2,5:8)
splittime(3,1:3) splittime(3,5:8) splittime(4,1:3) splittime(4,5:8)
splittime(5,1:3) splittime(5,5:8)];
LOC11=[LOC1shift(9:11) LOC1shift(14:17) LOC1shift(26:28) LOC1shift(31:34)
LOC1shift(44:46) LOC1shift(49:52) LOC1shift(62:64) LOC1shift(67:70)
LOC1shift(79:81) LOC1shift(84:87)];
diff1=TC1-LOC11;
vett=1:35;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);
```

```
figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (5);
KK=[LOC11(2)-LOC11(1) LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(23)-
LOC11(22) LOC11(30)-LOC11(29); LOC11(3)-LOC11(2) LOC11(10)-LOC11(9)
LOC11(17)-LOC11(16) LOC11(24)-LOC11(23) LOC11(31)-LOC11(30);  LOC11(3)-
LOC11(1) LOC11(10)-LOC11(8) LOC11(17)-LOC11(15) LOC11(24)-LOC11(22)
LOC11(31)-LOC11(29);NaN NaN NaN NaN NaN; LOC11(5)-LOC11(4) LOC11(12)-
LOC11(11) LOC11(19)-LOC11(18) LOC11(26)-LOC11(25) LOC11(33)-LOC11(32);
LOC11(7)-LOC11(6) LOC11(14)-LOC11(13) LOC11(21)-LOC11(20) LOC11(28)-
LOC11(27) LOC11(35)-LOC11(34)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4;
atleta.intertempi_giro5]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Larsen.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(8):pos_t(9),1);
accx_K1K2_g3=acc(pos_t(15):pos_t(16),1);
accx_K1K2_g4=acc(pos_t(22):pos_t(23),1);
accx_K1K2_g5=acc(pos_t(29):pos_t(30),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(8):pos_t(9),2);
accy_K1K2_g3=acc(pos_t(15):pos_t(16),2);
accy_K1K2_g4=acc(pos_t(22):pos_t(23),2);
accy_K1K2_g5=acc(pos_t(29):pos_t(30),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=-acc(pos_t(8):pos_t(9),3);
```

```
accz_K1K2_g3=-acc(pos_t(15):pos_t(16),3);
accz_K1K2_g4=-acc(pos_t(22):pos_t(23),3);
accz_K1K2_g5=-acc(pos_t(29):pos_t(30),3);
% segmento K2K3
accx_K2K3_g1=acc(pos_t(2):pos_t(3),1);
accx_K2K3_g2=acc(pos_t(9):pos_t(10),1);
accx_K2K3_g3=acc(pos_t(16):pos_t(17),1);
accx_K2K3_g4=acc(pos_t(23):pos_t(24),1);
accx_K2K3_g5=acc(pos_t(30):pos_t(31),1);
accy_K2K3_g1=acc(pos_t(2):pos_t(3),2);
accy_K2K3_g2=acc(pos_t(9):pos_t(10),2);
accy_K2K3_g3=acc(pos_t(16):pos_t(17),2);
accy_K2K3_g4=acc(pos_t(23):pos_t(24),2);
accy_K2K3_g5=acc(pos_t(30):pos_t(31),2);
accz_K2K3_g1=-acc(pos_t(2):pos_t(3),3);
accz_K2K3_g2=-acc(pos_t(9):pos_t(10),3);
accz_K2K3_g3=-acc(pos_t(16):pos_t(17),3);
accz_K2K3_g4=-acc(pos_t(23):pos_t(24),3);
accz_K2K3_g5=-acc(pos_t(30):pos_t(31),3);
% SEGMENTO K4K5

% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(4):pos_t(5),1);
accx_K5K6_g2=acc(pos_t(11):pos_t(12),1);
accx_K5K6_g3=acc(pos_t(18):pos_t(19),1);
accx_K5K6_g4=acc(pos_t(25):pos_t(26),1);
accx_K5K6_g5=acc(pos_t(32):pos_t(33),1);
accy_K5K6_g1=acc(pos_t(4):pos_t(5),2);
accy_K5K6_g2=acc(pos_t(11):pos_t(12),2);
accy_K5K6_g3=acc(pos_t(18):pos_t(19),2);
accy_K5K6_g4=acc(pos_t(25):pos_t(26),2);
accy_K5K6_g5=acc(pos_t(32):pos_t(33),2);
accz_K5K6_g1=-acc(pos_t(4):pos_t(5),3);
accz_K5K6_g2=-acc(pos_t(11):pos_t(12),3);
accz_K5K6_g3=-acc(pos_t(18):pos_t(19),3);
accz_K5K6_g4=-acc(pos_t(25):pos_t(26),3);
accz_K5K6_g5=-acc(pos_t(32):pos_t(33),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(6):pos_t(7),1);
accx_K7K8_g2=acc(pos_t(13):pos_t(14),1);
accx_K7K8_g3=acc(pos_t(20):pos_t(21),1);
accx_K7K8_g4=acc(pos_t(27):pos_t(28),1);
accx_K7K8_g5=acc(pos_t(34):pos_t(35),1);
accy_K7K8_g1=acc(pos_t(6):pos_t(7),2);
accy_K7K8_g2=acc(pos_t(13):pos_t(14),2);
accy_K7K8_g3=acc(pos_t(20):pos_t(21),2);
accy_K7K8_g4=acc(pos_t(27):pos_t(28),2);
accy_K7K8_g5=acc(pos_t(34):pos_t(35),2);
accz_K7K8_g1=-acc(pos_t(6):pos_t(7),3);
accz_K7K8_g2=-acc(pos_t(13):pos_t(14),3);
accz_K7K8_g3=-acc(pos_t(20):pos_t(21),3);
accz_K7K8_g4=-acc(pos_t(27):pos_t(28),3);
accz_K7K8_g5=-acc(pos_t(34):pos_t(35),3);

pause
close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
```

```
v4=0.01:0.01:0.01*length(accx_K1K2_g4);
v5=0.01:0.01:0.01*length(accx_K1K2_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K1K2_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(3,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3
```

```
v1=0.01:0.01:0.01*length(accx_K2K3_g1);
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);
v5=0.01:0.01:0.01*length(accx_K2K3_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(5,1,1)
plot(v1,accx_K2K3_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(5,1,1)
plot(v1,accy_K2K3_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(5,1,1)
plot(v1,accz_K2K3_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
```

```
plot(v5,accz_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K4K5

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);
v5=0.01:0.01:0.01*length(accx_K5K6_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K5K6_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K5K6_g2)
```

```
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);
v5=0.01:0.01:0.01*length(accx_K7K8_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
```

```
subplot(5,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all
% Dai grafici si osserva come il segnale di interesse sia presente lungo la
% coordinata y e l'accelerazione -g lungo l'asse z

% --> asse principale : asse Y
acc_K1K2_g1=-accy_K1K2_g1;
acc_K1K2_g2=-accy_K1K2_g2;
acc_K1K2_g3=-accy_K1K2_g3;
acc_K1K2_g4=-accy_K1K2_g4;
acc_K1K2_g5=-accy_K1K2_g5;

acc_K2K3_g1=-accy_K2K3_g1;
acc_K2K3_g2=-accy_K2K3_g2;
acc_K2K3_g3=-accy_K2K3_g3;
acc_K2K3_g4=-accy_K2K3_g4;
acc_K2K3_g5=-accy_K2K3_g5;

acc_K5K6_g1=-accy_K5K6_g1;
acc_K5K6_g2=-accy_K5K6_g2;
acc_K5K6_g3=-accy_K5K6_g3;
acc_K5K6_g4=-accy_K5K6_g4;
acc_K5K6_g5=-accy_K5K6_g5;

acc_K7K8_g1=-accy_K7K8_g1;
acc_K7K8_g2=-accy_K7K8_g2;
acc_K7K8_g3=-accy_K7K8_g3;
acc_K7K8_g4=-accy_K7K8_g4;
acc_K7K8_g5=-accy_K7K8_g5;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=5;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4) length(acc_K1K2_g5)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
```

```
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;
accK1K2(1:length(acc_K1K2_g5),5)=acc_K1K2_g5;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4) length(acc_K2K3_g5)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;
accK2K3(1:length(acc_K2K3_g5),5)=acc_K2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4) length(acc_K5K6_g5)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;
accK5K6(1:length(acc_K5K6_g5),5)=acc_K5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4) length(acc_K7K8_g5)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;
accK7K8(1:length(acc_K7K8_g5),5)=acc_K7K8_g5;

save acc_Larsen.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);
t5=0.01:0.01:0.01*length(acc_K1K2_g5);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=1;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g5,L_K1K2_g5]=findpeaks(acc_K1K2_g5,t5,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
```

```
suptitle('Andamento accelerazione segmento K1-K2')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K1K2_g5,'k')
plot(L_K1K2_g5,P_K1K2_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end
for i=1:length(L_K1K2_g5)-1
    distK1K2_g5(i)=L_K1K2_g5(i+1)-L_K1K2_g5(i);
end

pause
close all
%% K2K3
t1=0.01:0.01:0.01*length(acc_K2K3_g1);
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
```

```
t4=0.01:0.01:0.01*length(acc_K2K3_g4);
t5=0.01:0.01:0.01*length(acc_K2K3_g5);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=0;

[P_K2K3_g1,L_K2K3_g1]=findpeaks(acc_K2K3_g1,t1,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g5,L_K2K3_g5]=findpeaks(acc_K2K3_g5,t5,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K2K3_g1,'k')
plot(L_K2K3_g1,P_K2K3_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K2K3_g5,'k')
plot(L_K2K3_g5,P_K2K3_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g1)-1
    distK2K3_g1(i)=L_K2K3_g1(i+1)-L_K2K3_g1(i);
end
```

```
for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end
for i=1:length(L_K2K3_g5)-1
    distK2K3_g5(i)=L_K2K3_g5(i+1)-L_K2K3_g5(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);
t5=0.01:0.01:0.01*length(acc_K5K6_g5);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=0;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g5,L_K5K6_g5]=findpeaks(acc_K5K6_g5,t5,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
```

```
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K5K6_g5,'k')
plot(L_K5K6_g5,P_K5K6_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end
for i=1:length(L_K5K6_g5)-1
    distK5K6_g5(i)=L_K5K6_g5(i+1)-L_K5K6_g5(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);
t5=0.01:0.01:0.01*length(acc_K7K8_g5);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=0;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g5,L_K7K8_g5]=findpeaks(acc_K7K8_g5,t5,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
```

```
suptitle('Andamento accelerazione segmento K7-K8')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K7K8_g5,'k')
plot(L_K7K8_g5,P_K7K8_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end
for i=1:length(L_K7K8_g5)-1
    distK7K8_g5(i)=L_K7K8_g5(i+1)-L_K7K8_g5(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
```

```
n_righe=[length(distK1K2_g1) length(distK1K2_g2) length(distK1K2_g3)
length(distK1K2_g4) length(distK1K2_g5)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;
distK1K2(1:length(distK1K2_g5),5)=distK1K2_g5;

%SEGMENTO K2-K3
n_righe=[length(distK2K3_g1) length(distK2K3_g2) length(distK2K3_g3)
length(distK2K3_g4) length(distK2K3_g5)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g1),1)=distK2K3_g1;
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;
distK2K3(1:length(distK2K3_g5),5)=distK2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4) length(distK5K6_g5)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;
distK5K6(1:length(distK5K6_g5),5)=distK5K6_g5;

%SEGMENTO K7-K8
% n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4) length(distK7K8_g5)];
% max_righe=max(n_righe);
% distK7K8=NaN(max_righe,n_giri);
% distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
% distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
% distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
% distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;
% distK7K8(1:length(distK7K8_g5),5)=distK7K8_g5;

save dist_Larsen.mat distK1K2 distK2K3 distK5K6;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) length(P_K1K2_g3)
length(P_K1K2_g4) length(P_K1K2_g5)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;
P_K1K2(1:length(P_K1K2_g5),5)=P_K1K2_g5;

% SEGMENTO K2-K3
nrighe=[length(P_K2K3_g1) length(P_K2K3_g2) length(P_K2K3_g3)
length(P_K2K3_g4) length(P_K2K3_g5)];
```

```
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g1),1)=P_K2K3_g1;
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;
P_K2K3(1:length(P_K2K3_g5),5)=P_K2K3_g5;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4) length(P_K5K6_g5)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;
P_K5K6(1:length(P_K5K6_g5),5)=P_K5K6_g5;

% % SEGMENTO K7-K8
% nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4) length(P_K7K8_g5)];
% maxrighe=max(nrighe);
% P_K7K8=NaN(maxrighe,n_giri);
% P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
% P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
% P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
% P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;
% P_K7K8(1:length(P_K7K8_g5),5)=P_K7K8_g5;

save picchi_Larsen.mat P_K1K2 P_K2K3 P_K5K6;
```

g.3.4) Atleta 16 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Rosiek';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.men.LW12(9);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4;atleta.split_time_giro5];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
```

```
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
[PKS2 LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);

figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1:2) splittime(1,5:8) splittime(2,1:3) splittime(2,5:8)
splittime(3,1) splittime(3,3) splittime(3,5:8) splittime(4,1:3)
splittime(4,5:8) splittime(5,1:3) splittime(5,5:8)];
LOC11=[LOC1shift(10:11) LOC1shift(15:18) LOC1shift(28:30) LOC1shift(33:36)
LOC1shift(47) LOC1shift(49) LOC1shift(52:55) LOC1shift(66:68)
LOC1shift(71:74) LOC1shift(84:86) LOC1shift(89:92)];
diff1=TC1-LOC11;
vett=1:33;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);
```

```
figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (5);
KK=[LOC11(2)-LOC11(1) LOC11(8)-LOC11(7) NaN LOC11(21)-LOC11(20) LOC11(28)-
LOC11(27); NaN LOC11(9)-LOC11(8) NaN LOC11(22)-LOC11(21) LOC11(29)-
LOC11(28);  NaN LOC11(9)-LOC11(7) LOC11(15)-LOC11(14) LOC11(22)-LOC11(20)
LOC11(29)-LOC11(27);NaN NaN NaN NaN NaN; LOC11(4)-LOC11(3) LOC11(11)-
LOC11(10) LOC11(17)-LOC11(16) LOC11(24)-LOC11(23) LOC11(31)-LOC11(30);
LOC11(6)-LOC11(5) LOC11(13)-LOC11(12) LOC11(19)-LOC11(18) LOC11(26)-
LOC11(25) LOC11(33)-LOC11(32)];
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4;
atleta.intertempi_giro5]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Rosiek.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=acc(pos_t(1):pos_t(2),1);
accx_K1K2_g2=acc(pos_t(7):pos_t(8),1);
accx_K1K2_g3=NaN;
accx_K1K2_g4=acc(pos_t(20):pos_t(21),1);
accx_K1K2_g5=acc(pos_t(27):pos_t(28),1);
accy_K1K2_g1=acc(pos_t(1):pos_t(2),2);
accy_K1K2_g2=acc(pos_t(7):pos_t(8),2);
accy_K1K2_g3=NaN;
accy_K1K2_g4=acc(pos_t(20):pos_t(21),2);
accy_K1K2_g5=acc(pos_t(27):pos_t(28),2);
accz_K1K2_g1=-acc(pos_t(1):pos_t(2),3);
accz_K1K2_g2=-acc(pos_t(7):pos_t(8),3);
accz_K1K2_g3=NaN;
accz_K1K2_g4=-acc(pos_t(20):pos_t(21),3);
accz_K1K2_g5=-acc(pos_t(27):pos_t(28),3);
% segmento K2K3
accx_K2K3_g1=NaN;
accx_K2K3_g2=acc(pos_t(8):pos_t(9),1);
accx_K2K3_g3=NaN;
accx_K2K3_g4=acc(pos_t(21):pos_t(22),1);
accx_K2K3_g5=acc(pos_t(28):pos_t(29),1);
accy_K2K3_g1=NaN;
accy_K2K3_g2=acc(pos_t(8):pos_t(9),2);
accy_K2K3_g3=NaN;
```

```
accy_K2K3_g4=acc(pos_t(21):pos_t(22),2);
accy_K2K3_g5=acc(pos_t(28):pos_t(29),2);
accz_K2K3_g1=NaN;
accz_K2K3_g2=-acc(pos_t(8):pos_t(9),3);
accz_K2K3_g3=NaN;
accz_K2K3_g4=-acc(pos_t(21):pos_t(22),3);
accz_K2K3_g5=-acc(pos_t(28):pos_t(29),3);
% SEGMENTO K4K5

% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(3):pos_t(4),1);
accx_K5K6_g2=acc(pos_t(10):pos_t(11),1);
accx_K5K6_g3=acc(pos_t(16):pos_t(17),1);
accx_K5K6_g4=acc(pos_t(23):pos_t(24),1);
accx_K5K6_g5=acc(pos_t(30):pos_t(31),1);
accy_K5K6_g1=acc(pos_t(3):pos_t(4),2);
accy_K5K6_g2=acc(pos_t(10):pos_t(11),2);
accy_K5K6_g3=acc(pos_t(16):pos_t(17),2);
accy_K5K6_g4=acc(pos_t(23):pos_t(24),2);
accy_K5K6_g5=acc(pos_t(30):pos_t(31),2);
accz_K5K6_g1=-acc(pos_t(3):pos_t(4),3);
accz_K5K6_g2=-acc(pos_t(10):pos_t(11),3);
accz_K5K6_g3=-acc(pos_t(16):pos_t(17),3);
accz_K5K6_g4=-acc(pos_t(23):pos_t(24),3);
accz_K5K6_g5=-acc(pos_t(30):pos_t(31),3);
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(5):pos_t(6),1);
accx_K7K8_g2=acc(pos_t(12):pos_t(13),1);
accx_K7K8_g3=acc(pos_t(18):pos_t(19),1);
accx_K7K8_g4=acc(pos_t(25):pos_t(26),1);
accx_K7K8_g5=acc(pos_t(32):pos_t(33),1);
accy_K7K8_g1=acc(pos_t(5):pos_t(6),2);
accy_K7K8_g2=acc(pos_t(12):pos_t(13),2);
accy_K7K8_g3=acc(pos_t(18):pos_t(19),2);
accy_K7K8_g4=acc(pos_t(25):pos_t(26),2);
accy_K7K8_g5=acc(pos_t(32):pos_t(33),2);
accz_K7K8_g1=-acc(pos_t(5):pos_t(6),3);
accz_K7K8_g2=-acc(pos_t(12):pos_t(13),3);
accz_K7K8_g3=-acc(pos_t(18):pos_t(19),3);
accz_K7K8_g4=-acc(pos_t(25):pos_t(26),3);
accz_K7K8_g5=-acc(pos_t(32):pos_t(33),3);

pause
close all
%% grafici accelerazione lineare K1K2

v1=0.01:0.01:0.01*length(accx_K1K2_g1);
v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);
v5=0.01:0.01:0.01*length(accx_K1K2_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accx_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K1K2_g4)
```

```
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K1K2_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(5,1,1)
plot(v1,accy_K1K2_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(3,1,1)
plot(v1,accz_K1K2_g1)
xlabel('tempo [s]')
subplot(3,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);
v5=0.01:0.01:0.01*length(accx_K2K3_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accy_K2K3_g2)
```

```
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K4K5

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v3=0.01:0.01:0.01*length(accx_K5K6_g3);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);
v5=0.01:0.01:0.01*length(accx_K5K6_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K5K6_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K5K6_g2)
```

```
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K5K6_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K5K6_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K5K6_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);
v5=0.01:0.01:0.01*length(accx_K7K8_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(5,1,1)
```

```
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all
% --> asse principale : asse Y
acc_K1K2_g1=accz_K1K2_g1;
acc_K1K2_g2=accz_K1K2_g2;
acc_K1K2_g3=accz_K1K2_g3;
acc_K1K2_g4=accz_K1K2_g4;
acc_K1K2_g5=accz_K1K2_g5;

acc_K2K3_g1=accz_K2K3_g1;
acc_K2K3_g2=accz_K2K3_g2;
acc_K2K3_g3=accz_K2K3_g3;
acc_K2K3_g4=accz_K2K3_g4;
acc_K2K3_g5=accz_K2K3_g5;

acc_K5K6_g1=accz_K5K6_g1;
acc_K5K6_g2=accz_K5K6_g2;
acc_K5K6_g3=accz_K5K6_g3;
acc_K5K6_g4=accz_K5K6_g4;
acc_K5K6_g5=accz_K5K6_g5;

acc_K7K8_g1=accz_K7K8_g1;
acc_K7K8_g2=accz_K7K8_g2;
acc_K7K8_g3=accz_K7K8_g3;
```

```
acc_K7K8_g4=accz_K7K8_g4;
acc_K7K8_g5=accz_K7K8_g5;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=5;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4) length(acc_K1K2_g5)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;
accK1K2(1:length(acc_K1K2_g5),5)=acc_K1K2_g5;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4) length(acc_K2K3_g5)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;
accK2K3(1:length(acc_K2K3_g5),5)=acc_K2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4) length(acc_K5K6_g5)];
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;
accK5K6(1:length(acc_K5K6_g5),5)=acc_K5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4) length(acc_K7K8_g5)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;
accK7K8(1:length(acc_K7K8_g5),5)=acc_K7K8_g5;

save acc_Rosiek.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t1=0.01:0.01:0.01*length(acc_K1K2_g1);
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);
t5=0.01:0.01:0.01*length(acc_K1K2_g5);

%da valutare osservando i segnali
```

```
mPDmax12=0.7;
MPHmax12=2;

[P_K1K2_g1,L_K1K2_g1]=findpeaks(acc_K1K2_g1,t1,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g5,L_K1K2_g5]=findpeaks(acc_K1K2_g5,t5,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K1K2_g1,'k')
plot(L_K1K2_g1,P_K1K2_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K1K2_g5,'k')
plot(L_K1K2_g5,P_K1K2_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g1)-1
    distK1K2_g1(i)=L_K1K2_g1(i+1)-L_K1K2_g1(i);
end
for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end
for i=1:length(L_K1K2_g5)-1
    distK1K2_g5(i)=L_K1K2_g5(i+1)-L_K1K2_g5(i);
end

pause
close all
%% K2K3
```

```
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);
t5=0.01:0.01:0.01*length(acc_K2K3_g5);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=2;

[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g5,L_K2K3_g5]=findpeaks(acc_K2K3_g5,t5,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K2K3_g5,'k')
plot(L_K2K3_g5,P_K2K3_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end
for i=1:length(L_K2K3_g5)-1
    distK2K3_g5(i)=L_K2K3_g5(i+1)-L_K2K3_g5(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t3=0.01:0.01:0.01*length(acc_K5K6_g3);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);
t5=0.01:0.01:0.01*length(acc_K5K6_g5);
```

```
%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=2;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g3,L_K5K6_g3]=findpeaks(acc_K5K6_g3,t3,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g5,L_K5K6_g5]=findpeaks(acc_K5K6_g5,t5,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K5K6_g3,'k')
plot(L_K5K6_g3,P_K5K6_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K5K6_g5,'k')
plot(L_K5K6_g5,P_K5K6_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
```

```
end
for i=1:length(L_K5K6_g3)-1
    distK5K6_g3(i)=L_K5K6_g3(i+1)-L_K5K6_g3(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end
for i=1:length(L_K5K6_g5)-1
    distK5K6_g5(i)=L_K5K6_g5(i+1)-L_K5K6_g5(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);
t5=0.01:0.01:0.01*length(acc_K7K8_g5);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=2;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g5,L_K7K8_g5]=findpeaks(acc_K7K8_g5,t5,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
```

```
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K7K8_g5,'k')
plot(L_K7K8_g5,P_K7K8_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end
for i=1:length(L_K7K8_g5)-1
    distK7K8_g5(i)=L_K7K8_g5(i+1)-L_K7K8_g5(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[length(distK1K2_g1) length(distK1K2_g2) 0 length(distK1K2_g4)
length(distK1K2_g5)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g1),1)=distK1K2_g1;
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;
distK1K2(1:length(distK1K2_g5),5)=distK1K2_g5;

%SEGMENTO K2-K3
n_righe=[0 length(distK2K3_g2) 0 length(distK2K3_g4) length(distK2K3_g5)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;
distK2K3(1:length(distK2K3_g5),5)=distK2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) length(distK5K6_g3)
length(distK5K6_g4) length(distK5K6_g5)];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
```

```
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g3),3)=distK5K6_g3;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;
distK5K6(1:length(distK5K6_g5),5)=distK5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4) length(distK7K8_g5)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;
distK7K8(1:length(distK7K8_g5),5)=distK7K8_g5;

save dist_Rosiek.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[length(P_K1K2_g1) length(P_K1K2_g2) 0 length(P_K1K2_g4)
length(P_K1K2_g5)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g1),1)=P_K1K2_g1;
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;
P_K1K2(1:length(P_K1K2_g5),5)=P_K1K2_g5;

% SEGMENTO K2-K3
nrighe=[0 length(P_K2K3_g2) 0 length(P_K2K3_g4) length(P_K2K3_g5)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;
P_K2K3(1:length(P_K2K3_g5),5)=P_K2K3_g5;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) length(P_K5K6_g3)
length(P_K5K6_g4) length(P_K5K6_g5)];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g3),3)=P_K5K6_g3;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;
P_K5K6(1:length(P_K5K6_g5),5)=P_K5K6_g5;

% SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4) length(P_K7K8_g5)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;
P_K7K8(1:length(P_K7K8_g5),5)=P_K7K8_g5;

save picchi_Rosiek.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.3.5) Atleta 17 – classe LW12

```
%%
clc
clear all
close all

nome_atleta='\Sin';
filepath1= [cd '\dati'];
filepath2=[cd '\dati noti'];
filepath_save=[cd '\GRAFICI'];
load([filepath1 '\accelerazione.mat']);
load([filepath1 '\velocita_angolare.mat']);
load([filepath1 '\mag.mat']);
load([filepath1 '\tempo.mat']);

XC_long=load([filepath2 '\XC_long_finale']);

atleta=XC_long.men.LW12(13);
splittime=[atleta.split_time_giro1;atleta.split_time_giro2;atleta.split_tim
e_giro3;atleta.split_time_giro4;atleta.split_time_giro5];

%%
MAG=sqrt(mag(:,1).^2+mag(:,2).^2+mag(:,3).^2);

[b,a] = butter(4,0.3);
figure()
freqz(b,a);
saveas(gcf,[cd '\figure' '\filtro.fig']);

MAGfilt = filter(b,a,MAG);

figure()
subplot(2,1,1)
plot(t,MAG),grid
title('MAG non filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
subplot(2,1,2)
plot(t,MAGfilt),grid
title('MAG filtrato')
xlabel('tempo [s]')
ylabel('MAG [mTesla]')
saveas(gcf,[cd '\figure' '\mag.fig']);

%% INDIVIDUAZIONE DEI PICCHI
% Vado a valutare la bontà delle info ottenute tramite sensori inerziali e
% quelle fornite dalla time company
mPD=3;
MPH=200;
[PKS1,LOC1]=findpeaks(MAG,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);
[PKS2 LOC2]=findpeaks(MAGfilt,t,'MinPeakDistance',mPD,'MinPeakHeight',MPH);

%% lavoro prima con MAG non filtrato
pos=find(t==LOC1(1));
MAGshift1=MAG(pos:end);
tshift1=(LOC1(1):(t(2)-t(1)):t(end))-LOC1(1);
```

```
figure()
plot(tshift1,MAGshift1),grid
title('MAG shiftato')

LOC1shift=LOC1-LOC1(1);

% Valuto i valori di LOC1shift e splittime in modo da considerare gli
% stessi istanti temporali (valuto confrontando i valori)

TC1=[splittime(1,1) splittime(1,3) splittime(1,5:8) splittime(2,1:3)
splittime(2,5:8) splittime(3,1:3) splittime(3,5) splittime(3,7:8)
splittime(4,1:3) splittime(4,5:8) splittime(5,1:3) splittime(5,5)
splittime(5,7:8)];
LOC11=[LOC1shift(10) LOC1shift(11) LOC1shift(14:17) LOC1shift(27:29)
LOC1shift(32:35) LOC1shift(44:46) LOC1shift(49) LOC1shift(50:51)
LOC1shift(60:62) LOC1shift(65:68) LOC1shift(78:80) LOC1shift(83)
LOC1shift(84:85)];
diff1=TC1-LOC11;
vett=1:32;
% regressione lineare dei dati
[p,S]=polyfit(TC1,LOC11,1);
[y,delta]=polyval(p,TC1,S);
[p2,S2]=polyfit(vett,diff1,1);
[y2,delta2]=polyval(p2,vett,S2);

figure()
plot(TC1,LOC11,'r','LineWidth',2)
hold on
plot(TC1,y,'-ok');
errorbar(TC1,y,delta,'.k');
title('bontà magnetometro (MAG) vs time company (TC)');
xlabel('TC [s]')
ylabel('MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC1.fig']);

figure()
plot(diff1,'r','LineWidth',2)
hold on
plot(vett,y2,'-ok');
title('distribuzione differenze TC-MAG')
xlabel('punti rilevati')
ylabel('TC-MAG [s]')
hold off
saveas(gcf,[cd '\figure' '\MAG_vs_TC2.fig']);

err_perc=(abs(TC1-LOC11)./TC1).*100;

%% valutazione dei KK
% KK --> righe = numero KK analizzati (6), colonne = numero giri (5);
KK=[NaN LOC11(8)-LOC11(7) LOC11(15)-LOC11(14) LOC11(21)-LOC11(20)
LOC11(28)-LOC11(27); NaN LOC11(9)-LOC11(8) LOC11(16)-LOC11(15) LOC11(22)-
LOC11(21) LOC11(29)-LOC11(28);  LOC11(2)-LOC11(1) LOC11(9)-LOC11(7)
LOC11(16)-LOC11(14) LOC11(22)-LOC11(20) LOC11(29)-LOC11(27);NaN NaN NaN NaN
NaN; LOC11(4)-LOC11(3) LOC11(11)-LOC11(10) NaN LOC11(24)-LOC11(23) NaN;
LOC11(6)-LOC11(5) LOC11(13)-LOC11(12) LOC11(19)-LOC11(18) LOC11(26)-
LOC11(25) LOC11(32)-LOC11(31)];
```

```
intertempi=[atleta.intertempi_giro1; atleta.intertempi_giro2;
atleta.intertempi_giro3; atleta.intertempi_giro4;
atleta.intertempi_giro5]';
for j=1:size(KK,2)
    err_int_perc(:,j)=(abs(intertempi(:,j)-KK(:,j))./intertempi(:,j)).*100;
end
save err_Sin.mat err_perc err_int_perc KK;

% il segnale dell'acc non è shiftato --> devo usare le stesse coordinate
% temporali (LOC) del MAG non shiftato --> ai LOC shiftati riaggiunto
% LOC1(1) del primo picco.
pos_t=(LOC11+LOC1(1))*100;

% segmento K1K2
accx_K1K2_g1=NaN;
accx_K1K2_g2=acc(pos_t(7):pos_t(8),1);
accx_K1K2_g3=acc(pos_t(14):pos_t(15),1);
accx_K1K2_g4=acc(pos_t(20):pos_t(21),1);
accx_K1K2_g5=acc(pos_t(27):pos_t(28),1);
accy_K1K2_g1=NaN;
accy_K1K2_g2=acc(pos_t(7):pos_t(8),2);
accy_K1K2_g3=acc(pos_t(14):pos_t(15),2);
accy_K1K2_g4=acc(pos_t(20):pos_t(21),2);
accy_K1K2_g5=acc(pos_t(27):pos_t(28),2);
accz_K1K2_g1=NaN;
accz_K1K2_g2=-acc(pos_t(7):pos_t(8),3);
accz_K1K2_g3=-acc(pos_t(14):pos_t(15),3);
accz_K1K2_g4=-acc(pos_t(20):pos_t(21),3);
accz_K1K2_g5=-acc(pos_t(27):pos_t(28),3);
% segmento K2K3
accx_K2K3_g1=NaN;
accx_K2K3_g2=acc(pos_t(8):pos_t(9),1);
accx_K2K3_g3=acc(pos_t(15):pos_t(16),1);
accx_K2K3_g4=acc(pos_t(21):pos_t(22),1);
accx_K2K3_g5=acc(pos_t(28):pos_t(29),1);
accy_K2K3_g1=NaN;
accy_K2K3_g2=acc(pos_t(8):pos_t(9),2);
accy_K2K3_g3=acc(pos_t(15):pos_t(16),2);
accy_K2K3_g4=acc(pos_t(21):pos_t(22),2);
accy_K2K3_g5=acc(pos_t(28):pos_t(29),2);
accz_K2K3_g1=NaN;
accz_K2K3_g2=-acc(pos_t(8):pos_t(9),3);
accz_K2K3_g3=-acc(pos_t(15):pos_t(16),3);
accz_K2K3_g4=-acc(pos_t(21):pos_t(22),3);
accz_K2K3_g5=-acc(pos_t(28):pos_t(29),3);
% SEGMENTO K4K5

% SEGMENTO K5K6
accx_K5K6_g1=acc(pos_t(3):pos_t(4),1);
accx_K5K6_g2=acc(pos_t(10):pos_t(11),1);
accx_K5K6_g3=NaN;
accx_K5K6_g4=acc(pos_t(23):pos_t(24),1);
accx_K5K6_g5=NaN;
accy_K5K6_g1=acc(pos_t(3):pos_t(4),2);
accy_K5K6_g2=acc(pos_t(10):pos_t(11),2);
accy_K5K6_g3=NaN;
accy_K5K6_g4=acc(pos_t(23):pos_t(24),2);
accy_K5K6_g5=NaN;
accz_K5K6_g1=-acc(pos_t(3):pos_t(4),3);
accz_K5K6_g2=-acc(pos_t(10):pos_t(11),3);
accz_K5K6_g3=NaN;
```

```
accz_K5K6_g4=-acc(pos_t(23):pos_t(24),3);
accz_K5K6_g5=NaN;
%SEGMENTO K7K8
accx_K7K8_g1=acc(pos_t(5):pos_t(6),1);
accx_K7K8_g2=acc(pos_t(12):pos_t(13),1);
accx_K7K8_g3=acc(pos_t(18):pos_t(19),1);
accx_K7K8_g4=acc(pos_t(25):pos_t(26),1);
accx_K7K8_g5=acc(pos_t(31):pos_t(32),1);
accy_K7K8_g1=acc(pos_t(5):pos_t(6),2);
accy_K7K8_g2=acc(pos_t(12):pos_t(13),2);
accy_K7K8_g3=acc(pos_t(18):pos_t(19),2);
accy_K7K8_g4=acc(pos_t(25):pos_t(26),2);
accy_K7K8_g5=acc(pos_t(31):pos_t(32),2);
accz_K7K8_g1=-acc(pos_t(5):pos_t(6),3);
accz_K7K8_g2=-acc(pos_t(12):pos_t(13),3);
accz_K7K8_g3=-acc(pos_t(18):pos_t(19),3);
accz_K7K8_g4=-acc(pos_t(25):pos_t(26),3);
accz_K7K8_g5=-acc(pos_t(31):pos_t(32),3);

pause
close all
%% grafici accelerazione lineare K1K2

v2=0.01:0.01:0.01*length(accx_K1K2_g2);
v3=0.01:0.01:0.01*length(accx_K1K2_g3);
v4=0.01:0.01:0.01*length(accx_K1K2_g4);
v5=0.01:0.01:0.01*length(accx_K1K2_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K1-K2')
hold on
subplot(5,1,2)
plot(v2,accx_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K1K2_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K1K2.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K1-K2')
hold on
subplot(5,1,2)
plot(v2,accy_K1K2_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_y_K1K2.fig']);

figure()
```

```
suptitle('accelerazione lineare z [m/s^2] K1-K2')
hold on
subplot(3,1,2)
plot(v2,accz_K1K2_g2)
xlabel('tempo [s]')
subplot(3,1,3)
plot(v3,accz_K1K2_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K1K2_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K1K2_g5)
saveas(gcf,[filepath_save '\acc_lin_z_K1K2.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K2K3
v2=0.01:0.01:0.01*length(accx_K2K3_g2);
v3=0.01:0.01:0.01*length(accx_K2K3_g3);
v4=0.01:0.01:0.01*length(accx_K2K3_g4);
v5=0.01:0.01:0.01*length(accx_K2K3_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accx_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K2K3.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accy_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K2K3.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K2-K3')
hold on
subplot(5,1,2)
plot(v2,accz_K2K3_g2)
xlabel('tempo [s]')
subplot(5,1,3)
```

```
plot(v3,accz_K2K3_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K2K3_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K2K3_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K2K3.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K4K5

%% GRAFICI ACCELERAZIONE LINEARE K5K6

v1=0.01:0.01:0.01*length(accx_K5K6_g1);
v2=0.01:0.01:0.01*length(accx_K5K6_g2);
v4=0.01:0.01:0.01*length(accx_K5K6_g4);
figure()
suptitle('accelerazione lineare x [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accx_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K5K6_g4)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K5K6.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accy_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K5K6_g4)
saveas(gcf,[filepath_save '\acc_lin_y_K5K6.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K5-K6')
hold on
subplot(5,1,1)
plot(v1,accz_K5K6_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K5K6_g2)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K5K6_g4)
saveas(gcf,[filepath_save '\acc_lin_z_K5K6.fig']);

%% GRAFICI ACCELERAZIONE LINEARE K7K8

v1=0.01:0.01:0.01*length(accx_K7K8_g1);
```

```
v2=0.01:0.01:0.01*length(accx_K7K8_g2);
v3=0.01:0.01:0.01*length(accx_K7K8_g3);
v4=0.01:0.01:0.01*length(accx_K7K8_g4);
v5=0.01:0.01:0.01*length(accx_K7K8_g5);
figure()
suptitle('accelerazione lineare x [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accx_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accx_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accx_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accx_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accx_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_x_K7K8.fig']);

figure()
suptitle('accelerazione lineare y [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accy_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accy_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accy_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accy_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accy_K7K8_g5)
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_y_K7K8.fig']);

figure()
suptitle('accelerazione lineare z [m/s^2] K7-K8')
hold on
subplot(5,1,1)
plot(v1,accz_K7K8_g1)
xlabel('tempo [s]')
subplot(5,1,2)
plot(v2,accz_K7K8_g2)
xlabel('tempo [s]')
subplot(5,1,3)
plot(v3,accz_K7K8_g3)
xlabel('tempo [s]')
subplot(5,1,4)
plot(v4,accz_K7K8_g4)
xlabel('tempo [s]')
subplot(5,1,5)
plot(v5,accz_K7K8_g5)
```

```
xlabel('tempo [s]')
saveas(gcf,[filepath_save '\acc_lin_z_K7K8.fig']);

pause
close all
% --> asse principale : asse z
acc_K1K2_g1=-accz_K1K2_g1;
acc_K1K2_g2=-accz_K1K2_g2;
acc_K1K2_g3=-accz_K1K2_g3;
acc_K1K2_g4=-accz_K1K2_g4;
acc_K1K2_g5=-accz_K1K2_g5;

acc_K2K3_g1=-accz_K2K3_g1;
acc_K2K3_g2=-accz_K2K3_g2;
acc_K2K3_g3=-accz_K2K3_g3;
acc_K2K3_g4=-accz_K2K3_g4;
acc_K2K3_g5=-accz_K2K3_g5;

acc_K5K6_g1=-accz_K5K6_g1;
acc_K5K6_g2=-accz_K5K6_g2;
acc_K5K6_g3=-accz_K5K6_g3;
acc_K5K6_g4=-accz_K5K6_g4;
acc_K5K6_g5=-accz_K5K6_g5;

acc_K7K8_g1=-accz_K7K8_g1;
acc_K7K8_g2=-accz_K7K8_g2;
acc_K7K8_g3=-accz_K7K8_g3;
acc_K7K8_g4=-accz_K7K8_g4;
acc_K7K8_g5=-accz_K7K8_g5;

%% Creo le matrici per le accelerazioni da salvare da inserire all'interno
di una struttura con tutti gli
% atleti inseriti
n_giri=5;

% SEGMENTO K1-K2
n_righe=[length(acc_K1K2_g1) length(acc_K1K2_g2) length(acc_K1K2_g3)
length(acc_K1K2_g4) length(acc_K1K2_g5)];
max_righe=max(n_righe);
accK1K2=NaN(max_righe,n_giri);
accK1K2(1:length(acc_K1K2_g1),1)=acc_K1K2_g1;
accK1K2(1:length(acc_K1K2_g2),2)=acc_K1K2_g2;
accK1K2(1:length(acc_K1K2_g3),3)=acc_K1K2_g3;
accK1K2(1:length(acc_K1K2_g4),4)=acc_K1K2_g4;
accK1K2(1:length(acc_K1K2_g5),5)=acc_K1K2_g5;

%SEGMENTO K2-K3
n_righe=[length(acc_K2K3_g1) length(acc_K2K3_g2) length(acc_K2K3_g3)
length(acc_K2K3_g4) length(acc_K2K3_g5)];
max_righe=max(n_righe);
accK2K3=NaN(max_righe,n_giri);
accK2K3(1:length(acc_K2K3_g1),1)=acc_K2K3_g1;
accK2K3(1:length(acc_K2K3_g2),2)=acc_K2K3_g2;
accK2K3(1:length(acc_K2K3_g3),3)=acc_K2K3_g3;
accK2K3(1:length(acc_K2K3_g4),4)=acc_K2K3_g4;
accK2K3(1:length(acc_K2K3_g5),5)=acc_K2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(acc_K5K6_g1) length(acc_K5K6_g2) length(acc_K5K6_g3)
length(acc_K5K6_g4) length(acc_K5K6_g5)];
```

```
max_righe=max(n_righe);
accK5K6=NaN(max_righe,n_giri);
accK5K6(1:length(acc_K5K6_g1),1)=acc_K5K6_g1;
accK5K6(1:length(acc_K5K6_g2),2)=acc_K5K6_g2;
accK5K6(1:length(acc_K5K6_g3),3)=acc_K5K6_g3;
accK5K6(1:length(acc_K5K6_g4),4)=acc_K5K6_g4;
accK5K6(1:length(acc_K5K6_g5),5)=acc_K5K6_g5;

%SEGMENTO K7-K8
n_righe=[length(acc_K7K8_g1) length(acc_K7K8_g2) length(acc_K7K8_g3)
length(acc_K7K8_g4) length(acc_K7K8_g5)];
max_righe=max(n_righe);
accK7K8=NaN(max_righe,n_giri);
accK7K8(1:length(acc_K7K8_g1),1)=acc_K7K8_g1;
accK7K8(1:length(acc_K7K8_g2),2)=acc_K7K8_g2;
accK7K8(1:length(acc_K7K8_g3),3)=acc_K7K8_g3;
accK7K8(1:length(acc_K7K8_g4),4)=acc_K7K8_g4;
accK7K8(1:length(acc_K7K8_g5),5)=acc_K7K8_g5;

save acc_Sin.mat accK1K2 accK2K3 accK5K6 accK7K8;
%% K1K2
t2=0.01:0.01:0.01*length(acc_K1K2_g2);
t3=0.01:0.01:0.01*length(acc_K1K2_g3);
t4=0.01:0.01:0.01*length(acc_K1K2_g4);
t5=0.01:0.01:0.01*length(acc_K1K2_g5);

%da valutare osservando i segnali
mPDmax12=0.7;
MPHmax12=2;

[P_K1K2_g2,L_K1K2_g2]=findpeaks(acc_K1K2_g2,t2,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g3,L_K1K2_g3]=findpeaks(acc_K1K2_g3,t3,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g4,L_K1K2_g4]=findpeaks(acc_K1K2_g4,t4,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);
[P_K1K2_g5,L_K1K2_g5]=findpeaks(acc_K1K2_g5,t5,'MinPeakDistance',mPDmax12,'
MinPeakHeight',MPHmax12);

figure()
suptitle('Andamento accelerazione segmento K1-K2')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K1K2_g2,'k')
plot(L_K1K2_g2,P_K1K2_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K1K2_g3,'k')
plot(L_K1K2_g3,P_K1K2_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K1K2_g4,'k')
plot(L_K1K2_g4,P_K1K2_g4,'rv','MarkerFaceColor','r')
grid
```

```
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K1K2_g5,'k')
plot(L_K1K2_g5,P_K1K2_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K1K2.fig']);

for i=1:length(L_K1K2_g2)-1
    distK1K2_g2(i)=L_K1K2_g2(i+1)-L_K1K2_g2(i);
end
for i=1:length(L_K1K2_g3)-1
    distK1K2_g3(i)=L_K1K2_g3(i+1)-L_K1K2_g3(i);
end
for i=1:length(L_K1K2_g4)-1
    distK1K2_g4(i)=L_K1K2_g4(i+1)-L_K1K2_g4(i);
end
for i=1:length(L_K1K2_g5)-1
    distK1K2_g5(i)=L_K1K2_g5(i+1)-L_K1K2_g5(i);
end

pause
close all
%% K2K3
t2=0.01:0.01:0.01*length(acc_K2K3_g2);
t3=0.01:0.01:0.01*length(acc_K2K3_g3);
t4=0.01:0.01:0.01*length(acc_K2K3_g4);
t5=0.01:0.01:0.01*length(acc_K2K3_g5);

%da valutare osservando i segnali
mPDmax23=0.7;
MPHmax23=2;

[P_K2K3_g2,L_K2K3_g2]=findpeaks(acc_K2K3_g2,t2,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g3,L_K2K3_g3]=findpeaks(acc_K2K3_g3,t3,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g4,L_K2K3_g4]=findpeaks(acc_K2K3_g4,t4,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);
[P_K2K3_g5,L_K2K3_g5]=findpeaks(acc_K2K3_g5,t5,'MinPeakDistance',mPDmax23,'
MinPeakHeight',MPHmax23);

figure()
suptitle('Andamento accelerazione segmento K2-K3')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K2K3_g2,'k')
plot(L_K2K3_g2,P_K2K3_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K2K3_g3,'k')
plot(L_K2K3_g3,P_K2K3_g3,'rv','MarkerFaceColor','r')
grid
```

```
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K2K3_g4,'k')
plot(L_K2K3_g4,P_K2K3_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K2K3_g5,'k')
plot(L_K2K3_g5,P_K2K3_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K2K3.fig']);

for i=1:length(L_K2K3_g2)-1
    distK2K3_g2(i)=L_K2K3_g2(i+1)-L_K2K3_g2(i);
end
for i=1:length(L_K2K3_g3)-1
    distK2K3_g3(i)=L_K2K3_g3(i+1)-L_K2K3_g3(i);
end
for i=1:length(L_K2K3_g4)-1
    distK2K3_g4(i)=L_K2K3_g4(i+1)-L_K2K3_g4(i);
end
for i=1:length(L_K2K3_g5)-1
    distK2K3_g5(i)=L_K2K3_g5(i+1)-L_K2K3_g5(i);
end

pause
close all

%% K5K6
t1=0.01:0.01:0.01*length(acc_K5K6_g1);
t2=0.01:0.01:0.01*length(acc_K5K6_g2);
t4=0.01:0.01:0.01*length(acc_K5K6_g4);

%da valutare osservando i segnali
mPDmax56=0.7;
MPHmax56=2;

[P_K5K6_g1,L_K5K6_g1]=findpeaks(acc_K5K6_g1,t1,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g2,L_K5K6_g2]=findpeaks(acc_K5K6_g2,t2,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);
[P_K5K6_g4,L_K5K6_g4]=findpeaks(acc_K5K6_g4,t4,'MinPeakDistance',mPDmax56,'
MinPeakHeight',MPHmax56);

figure()
suptitle('Andamento accelerazione segmento K5-K6')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K5K6_g1,'k')
plot(L_K5K6_g1,P_K5K6_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
ylabel('acc [m/s^2]')
```

```
subplot(5,1,2)
hold on
grid
plot(t2,acc_K5K6_g2,'k')
plot(L_K5K6_g2,P_K5K6_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K5K6_g4,'k')
plot(L_K5K6_g4,P_K5K6_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K5K6.fig']);

for i=1:length(L_K5K6_g1)-1
    distK5K6_g1(i)=L_K5K6_g1(i+1)-L_K5K6_g1(i);
end
for i=1:length(L_K5K6_g2)-1
    distK5K6_g2(i)=L_K5K6_g2(i+1)-L_K5K6_g2(i);
end
for i=1:length(L_K5K6_g4)-1
    distK5K6_g4(i)=L_K5K6_g4(i+1)-L_K5K6_g4(i);
end

pause
close all

%% K7K8
t1=0.01:0.01:0.01*length(acc_K7K8_g1);
t2=0.01:0.01:0.01*length(acc_K7K8_g2);
t3=0.01:0.01:0.01*length(acc_K7K8_g3);
t4=0.01:0.01:0.01*length(acc_K7K8_g4);
t5=0.01:0.01:0.01*length(acc_K7K8_g5);

%da valutare osservando i segnali
mPDmax78=0.7;
MPHmax78=2;

[P_K7K8_g1,L_K7K8_g1]=findpeaks(acc_K7K8_g1,t1,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g2,L_K7K8_g2]=findpeaks(acc_K7K8_g2,t2,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g3,L_K7K8_g3]=findpeaks(acc_K7K8_g3,t3,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g4,L_K7K8_g4]=findpeaks(acc_K7K8_g4,t4,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);
[P_K7K8_g5,L_K7K8_g5]=findpeaks(acc_K7K8_g5,t5,'MinPeakDistance',mPDmax78,'
MinPeakHeight',MPHmax78);

figure()
suptitle('Andamento accelerazione segmento K7-K8')
subplot(5,1,1)
hold on
grid
plot(t1,acc_K7K8_g1,'k')
plot(L_K7K8_g1,P_K7K8_g1,'rv','MarkerFaceColor','r')
xlabel('tempo-g1 [s]');
```

```
ylabel('acc [m/s^2]')
subplot(5,1,2)
hold on
grid
plot(t2,acc_K7K8_g2,'k')
plot(L_K7K8_g2,P_K7K8_g2,'rv','MarkerFaceColor','r')
xlabel('tempo-g2 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,3)
hold on
plot(t3,acc_K7K8_g3,'k')
plot(L_K7K8_g3,P_K7K8_g3,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g3 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,4)
hold on
plot(t4,acc_K7K8_g4,'k')
plot(L_K7K8_g4,P_K7K8_g4,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g4 [s]');
ylabel('acc [m/s^2]')
subplot(5,1,5)
hold on
plot(t5,acc_K7K8_g5,'k')
plot(L_K7K8_g5,P_K7K8_g5,'rv','MarkerFaceColor','r')
grid
xlabel('tempo-g5 [s]');
ylabel('acc [m/s^2]')
hold off
saveas(gcf,[filepath_save '\acc_picchi_K7K8.fig']);

for i=1:length(L_K7K8_g1)-1
    distK7K8_g1(i)=L_K7K8_g1(i+1)-L_K7K8_g1(i);
end
for i=1:length(L_K7K8_g2)-1
    distK7K8_g2(i)=L_K7K8_g2(i+1)-L_K7K8_g2(i);
end
for i=1:length(L_K7K8_g3)-1
    distK7K8_g3(i)=L_K7K8_g3(i+1)-L_K7K8_g3(i);
end
for i=1:length(L_K7K8_g4)-1
    distK7K8_g4(i)=L_K7K8_g4(i+1)-L_K7K8_g4(i);
end
for i=1:length(L_K7K8_g5)-1
    distK7K8_g5(i)=L_K7K8_g5(i+1)-L_K7K8_g5(i);
end

pause
close all
%% SALVATAGGIO DELLE DISTANZE TRA I PICCHI SUCCESSIVI

% SEGMENTO K1-K2
n_righe=[0 length(distK1K2_g2) length(distK1K2_g3) length(distK1K2_g4)
length(distK1K2_g5)];
max_righe=max(n_righe);
distK1K2=NaN(max_righe,n_giri);
distK1K2(1:length(distK1K2_g2),2)=distK1K2_g2;
distK1K2(1:length(distK1K2_g3),3)=distK1K2_g3;
distK1K2(1:length(distK1K2_g4),4)=distK1K2_g4;
distK1K2(1:length(distK1K2_g5),5)=distK1K2_g5;
```

```
%SEGMENTO K2-K3
n_righe=[0 length(distK2K3_g2) length(distK2K3_g3) length(distK2K3_g4)
length(distK2K3_g5)];
max_righe=max(n_righe);
distK2K3=NaN(max_righe,n_giri);
distK2K3(1:length(distK2K3_g2),2)=distK2K3_g2;
distK2K3(1:length(distK2K3_g3),3)=distK2K3_g3;
distK2K3(1:length(distK2K3_g4),4)=distK2K3_g4;
distK2K3(1:length(distK2K3_g5),5)=distK2K3_g5;

%SEGMENTO K5-K6
n_righe=[length(distK5K6_g1) length(distK5K6_g2) 0 length(distK5K6_g4) 0];
max_righe=max(n_righe);
distK5K6=NaN(max_righe,n_giri);
distK5K6(1:length(distK5K6_g1),1)=distK5K6_g1;
distK5K6(1:length(distK5K6_g2),2)=distK5K6_g2;
distK5K6(1:length(distK5K6_g4),4)=distK5K6_g4;

%SEGMENTO K7-K8
n_righe=[length(distK7K8_g1) length(distK7K8_g2) length(distK7K8_g3)
length(distK7K8_g4) length(distK7K8_g5)];
max_righe=max(n_righe);
distK7K8=NaN(max_righe,n_giri);
distK7K8(1:length(distK7K8_g1),1)=distK7K8_g1;
distK7K8(1:length(distK7K8_g2),2)=distK7K8_g2;
distK7K8(1:length(distK7K8_g3),3)=distK7K8_g3;
distK7K8(1:length(distK7K8_g4),4)=distK7K8_g4;
distK7K8(1:length(distK7K8_g5),5)=distK7K8_g5;

save dist_Sin.mat distK1K2 distK2K3 distK5K6 distK7K8;
%% Salvataggio valori dei picchi

% SEGMENTO K1-K2
nrighe=[0 length(P_K1K2_g2) length(P_K1K2_g3) length(P_K1K2_g4)
length(P_K1K2_g5)];
maxrighe=max(nrighe);
P_K1K2=NaN(maxrighe,n_giri);
P_K1K2(1:length(P_K1K2_g2),2)=P_K1K2_g2;
P_K1K2(1:length(P_K1K2_g3),3)=P_K1K2_g3;
P_K1K2(1:length(P_K1K2_g4),4)=P_K1K2_g4;
P_K1K2(1:length(P_K1K2_g5),5)=P_K1K2_g5;

% SEGMENTO K2-K3
nrighe=[0 length(P_K2K3_g2) length(P_K2K3_g3) length(P_K2K3_g4)
length(P_K2K3_g5)];
maxrighe=max(nrighe);
P_K2K3=NaN(maxrighe,n_giri);
P_K2K3(1:length(P_K2K3_g2),2)=P_K2K3_g2;
P_K2K3(1:length(P_K2K3_g3),3)=P_K2K3_g3;
P_K2K3(1:length(P_K2K3_g4),4)=P_K2K3_g4;
P_K2K3(1:length(P_K2K3_g5),5)=P_K2K3_g5;

% SEGMENTO K5-K6
nrighe=[length(P_K5K6_g1) length(P_K5K6_g2) 0 length(P_K5K6_g4) 0];
maxrighe=max(nrighe);
P_K5K6=NaN(maxrighe,n_giri);
P_K5K6(1:length(P_K5K6_g1),1)=P_K5K6_g1;
P_K5K6(1:length(P_K5K6_g2),2)=P_K5K6_g2;
P_K5K6(1:length(P_K5K6_g4),4)=P_K5K6_g4;
```

```
% % SEGMENTO K7-K8
nrighe=[length(P_K7K8_g1) length(P_K7K8_g2) length(P_K7K8_g3)
length(P_K7K8_g4) length(P_K7K8_g5)];
maxrighe=max(nrighe);
P_K7K8=NaN(maxrighe,n_giri);
P_K7K8(1:length(P_K7K8_g1),1)=P_K7K8_g1;
P_K7K8(1:length(P_K7K8_g2),2)=P_K7K8_g2;
P_K7K8(1:length(P_K7K8_g3),3)=P_K7K8_g3;
P_K7K8(1:length(P_K7K8_g4),4)=P_K7K8_g4;
P_K7K8(1:length(P_K7K8_g5),5)=P_K7K8_g5;

save picchi_Sin.mat P_K1K2 P_K2K3 P_K5K6 P_K7K8;
```

g.4) Elaborazione dati magnetometro e accelerometro

g.4.1) Cross country middle maschile

```
%%
clc
clear all
close all

XC_long=load('XC_long_finale.mat');

filepath1={'\03_Dos_Santos_06' '\04_Seo_14' '\05_Abdikarimova_15'
'\09_Guliaeva_13' '\10_Zainullina_08' '\11_Skarstein_02'};
filepath2={'\38_Larsen_11' '\31_Gao_01' '\40_Sin_03' '\36_Rosiek_05'
'\39_Davidovich_09'};
genere={'\Donne' '\Uomini'};

% Caricamento dati donne
err_Dos_Santos=load([cd genere{1} filepath1{1} '\err_Dos_Santos.mat']);
err_Seo=load([cd genere{1} filepath1{2} '\err_Seo.mat']);
err_Abdikarimova=load([cd genere{1} filepath1{3} '\err_Abdikarimova.mat']);
err_Guliaeva=load([cd genere{1} filepath1{4} '\err_Guliaeva.mat']);
err_Zainullina=load([cd genere{1} filepath1{5} '\err_Zainullina.mat']);
err_Skarstein=load([cd genere{1} filepath1{6} '\err_Skarstein.mat']);
acc_Dos_Santos=load([cd genere{1} filepath1{1} '\acc_Dos_Santos.mat']);
acc_Seo=load([cd genere{1} filepath1{2} '\acc_Seo.mat']);
acc_Abdikarimova=load([cd genere{1} filepath1{3} '\acc_Abdikarimova.mat']);
acc_Guliaeva=load([cd genere{1} filepath1{4} '\acc_Guliaeva.mat']);
acc_Zainullina=load([cd genere{1} filepath1{5} '\acc_Zainullina.mat']);
acc_Skarstein=load([cd genere{1} filepath1{6} '\acc_Skarstein.mat']);
dist_Dos_Santos=load([cd genere{1} filepath1{1} '\dist_Dos_Santos.mat']);
dist_Seo=load([cd genere{1} filepath1{2} '\dist_Seo.mat']);
dist_Abdikarimova=load([cd genere{1} filepath1{3}
'\dist_Abdikarimova.mat']);
dist_Guliaeva=load([cd genere{1} filepath1{4} '\dist_Guliaeva.mat']);
dist_Zainullina=load([cd genere{1} filepath1{5} '\dist_Zainullina.mat']);
dist_Skarstein=load([cd genere{1} filepath1{6} '\dist_Skarstein.mat']);
picchi_Dos_Santos=load([cd genere{1} filepath1{1}
'\picchi_Dos_Santos.mat']);
picchi_Seo=load([cd genere{1} filepath1{2} '\picchi_Seo.mat']);
picchi_Abdikarimova=load([cd genere{1} filepath1{3}
'\picchi_Abdikarimova.mat']);
picchi_Guliaeva=load([cd genere{1} filepath1{4} '\picchi_Guliaeva.mat']);
picchi_Zainullina=load([cd genere{1} filepath1{5}
'\picchi_Zainullina.mat']);
```

```
picchi_Skarstein=load([cd genere{1} filepath1{6} '\picchi_Skarstein.mat']);

% Cricamento dati uomini
err_Larsen=load([cd genere{2} filepath2{1} '\err_Larsen.mat']);
err_Gao=load([cd genere{2} filepath2{2} '\err_Gao.mat']);
err_Sin=load([cd genere{2} filepath2{3} '\err_Sin.mat']);
err_Rosiek=load([cd genere{2} filepath2{4} '\err_Rosiek.mat']);
err_Davidovich=load([cd genere{2} filepath2{5} '\err_Davidovich.mat']);
acc_Larsen=load([cd genere{2} filepath2{1} '\acc_Larsen.mat']);
acc_Gao=load([cd genere{2} filepath2{2} '\acc_Gao.mat']);
acc_Sin=load([cd genere{2} filepath2{3} '\acc_Sin.mat']);
acc_Rosiek=load([cd genere{2} filepath2{4} '\acc_Rosiek.mat']);
acc_Davidovich=load([cd genere{2} filepath2{5} '\acc_Davidovich.mat']);
dist_Larsen=load([cd genere{2} filepath2{1} '\dist_Larsen.mat']);
dist_Gao=load([cd genere{2} filepath2{2} '\dist_Gao.mat']);
dist_Sin=load([cd genere{2} filepath2{3} '\dist_Sin.mat']);
dist_Rosiek=load([cd genere{2} filepath2{4} '\dist_Rosiek.mat']);
dist_Davidovich=load([cd genere{2} filepath2{5} '\dist_Davidovich.mat']);
picchi_Larsen=load([cd genere{2} filepath2{1} '\picchi_Larsen.mat']);
picchi_Gao=load([cd genere{2} filepath2{2} '\picchi_Gao.mat']);
picchi_Sin=load([cd genere{2} filepath2{3} '\picchi_Sin.mat']);
picchi_Rosiek=load([cd genere{2} filepath2{4} '\picchi_Rosiek.mat']);
picchi_Davidovich=load([cd genere{2} filepath2{5}
'\picchi_Davidovich.mat']);
%% Creazione della struttura

XCL_sensori=struct('women',[], 'men',[]);

%donne
XCL_sensori.women.LW10_5.seo=err_Seo;
XCL_sensori.women.LW10_5.abdikarimova=err_Abdikarimova;
XCL_sensori.women.LW11.dos_santos=err_Dos_Santos;
XCL_sensori.women.LW11.skarstein=err_Skarstein;
XCL_sensori.women.LW12.guliaeva=err_Guliaeva;
XCL_sensori.women.LW12.zainullina=err_Zainullina;

%uomini
XCL_sensori.men.LW12.larsen=err_Larsen;
XCL_sensori.men.LW12.gao=err_Gao;
XCL_sensori.men.LW12.sin=err_Sin;
XCL_sensori.men.LW12.rosiek=err_Rosiek;
XCL_sensori.men.LW12.davidovich=err_Davidovich;

%% ERRORI PUNTUALI - DONNE

n_atleti_W=6;
K_max_W=28;
err_puntuale=NaN(n_atleti_W,K_max_W);

% riga 1 = Seo (LW10.5)
% riga 2 = Abdikarimova (LW10.5)
% riga 3 = Dos Santos (LW11)
% riga 4 = Skarstein(LW11)
% riga 5 = Guliaeva (LW12)
% riga 6 = Zainullina (LW12)

err_puntuale(1,:)=err_Seo.err_perc;
err_puntuale(2,:)=err_Abdikarimova.err_perc;
err_puntuale(3,:)=[err_Dos_Santos.err_perc(1:2) NaN
err_Dos_Santos.err_perc(3:27)];
```

```
err_puntuale(4,:)=err_Skarstein.err_perc;
err_puntuale(5,:)=[err_Guliaeva.err_perc(1) NaN
err_Guliaeva.err_perc(2:27)];
err_puntuale(6,:)=[err_Zainullina.err_perc(1:9) NaN
err_Zainullina.err_perc(10:27)];

XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_pun
tuale(1:2,:));
XCL_sensori.women.LW11.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_puntu
ale(3:4,:));
XCL_sensori.women.LW12.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_puntu
ale(5:6,:));
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntua
le(1:2,:));
XCL_sensori.women.LW11.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntuale
(3:4,:));
XCL_sensori.women.LW12.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntuale
(5:6,:));

%% ERRORI PUNTUALI - UOMINI
n_atleti_M=5;
K_max_M=35;
err_puntuale=NaN(n_atleti_M,K_max_M);

% riga 1 = Larsen
% riga 2 = Gao
% riga 3 = Sin
% riga 4 = Rosiek
% riga 5 = Davidovich

err_puntuale(1,:)=err_Larsen.err_perc;
err_puntuale(2,:)=[err_Gao.err_perc(1:30) NaN err_Gao.err_perc(31:34)];
err_puntuale(3,:)=[err_Sin.err_perc(1) NaN err_Sin.err_perc(2:17) NaN
err_Sin.err_perc(18:30) NaN err_Sin.err_perc(31:32)];
err_puntuale(4,:)=[err_Rosiek.err_perc(1:2) NaN err_Rosiek.err_perc(3:14)
NaN err_Rosiek.err_perc(15:33)];
err_puntuale(5,:)=[err_Davidovich.err_perc(1:2) NaN
err_Davidovich.err_perc(3) NaN err_Davidovich.err_perc(4:16) NaN
err_Davidovich.err_perc(17:32)];

XCL_sensori.men.LW12.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_puntual
e);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntuale);

%% ANALISI DEI SEGMENTI - DONNE

% riga 1 = Seo (LW10.5)
% riga 2 = Abdikarimova (LW10.5)
% riga 3 = Dos Santos (LW11)
% riga 4 = Skarstein(LW11)
% riga 5 = Guliaeva (LW12)
% riga 6 = Zainullina (LW12)

atleta1_TC=XC_long.women.LW10_5(1);
atleta2_TC=XC_long.women.LW10_5(2);
atleta3_TC=XC_long.women.LW11(1);
atleta4_TC=XC_long.women.LW11(2);
atleta5_TC=XC_long.women.LW12(5);
atleta6_TC=XC_long.women.LW12(6);
```

```
% inserisco tutto nella struttura
%TC
%classe LW10.5
int105_g1_TC=[atleta1_TC.intertempi_giro1; atleta2_TC.intertempi_giro1;];
int105_g2_TC=[atleta1_TC.intertempi_giro2; atleta2_TC.intertempi_giro2;];
int105_g3_TC=[atleta1_TC.intertempi_giro3; atleta2_TC.intertempi_giro3;];
int105_g4_TC=[atleta1_TC.intertempi_giro4; atleta2_TC.intertempi_giro4;];

XCL_sensori.women.LW10_5.TC_medio(1,:)=nanmean(int105_g1_TC);
XCL_sensori.women.LW10_5.TC_medio(2,:)=nanmean(int105_g2_TC);
XCL_sensori.women.LW10_5.TC_medio(3,:)=nanmean(int105_g3_TC);
XCL_sensori.women.LW10_5.TC_medio(4,:)=nanmean(int105_g4_TC);
XCL_sensori.women.LW10_5.TC_std(1,:)=nanstd(int105_g1_TC);
XCL_sensori.women.LW10_5.TC_std(2,:)=nanstd(int105_g2_TC);
XCL_sensori.women.LW10_5.TC_std(3,:)=nanstd(int105_g3_TC);
XCL_sensori.women.LW10_5.TC_std(4,:)=nanstd(int105_g4_TC);

%classe LW11
int11_g1_TC=[atleta3_TC.intertempi_giro1; atleta4_TC.intertempi_giro1;];
int11_g2_TC=[atleta3_TC.intertempi_giro2; atleta4_TC.intertempi_giro2;];
int11_g3_TC=[atleta3_TC.intertempi_giro3; atleta4_TC.intertempi_giro3;];
int11_g4_TC=[atleta3_TC.intertempi_giro4; atleta4_TC.intertempi_giro4;];

XCL_sensori.women.LW11.TC_medio(1,:)=nanmean(int11_g1_TC);
XCL_sensori.women.LW11.TC_medio(2,:)=nanmean(int11_g2_TC);
XCL_sensori.women.LW11.TC_medio(3,:)=nanmean(int11_g3_TC);
XCL_sensori.women.LW11.TC_medio(4,:)=nanmean(int11_g4_TC);
XCL_sensori.women.LW11.TC_std(1,:)=nanstd(int11_g1_TC);
XCL_sensori.women.LW11.TC_std(2,:)=nanstd(int11_g2_TC);
XCL_sensori.women.LW11.TC_std(3,:)=nanstd(int11_g3_TC);
XCL_sensori.women.LW11.TC_std(4,:)=nanstd(int11_g4_TC);

%classe LW12
int12_g1_TC=[atleta5_TC.intertempi_giro1; atleta6_TC.intertempi_giro1;];
int12_g2_TC=[atleta5_TC.intertempi_giro2; atleta6_TC.intertempi_giro2;];
int12_g3_TC=[atleta5_TC.intertempi_giro3; atleta6_TC.intertempi_giro3;];
int12_g4_TC=[atleta5_TC.intertempi_giro4; atleta6_TC.intertempi_giro4;];

XCL_sensori.women.LW12.TC_medio(1,:)=nanmean(int12_g1_TC);
XCL_sensori.women.LW12.TC_medio(2,:)=nanmean(int12_g2_TC);
XCL_sensori.women.LW12.TC_medio(3,:)=nanmean(int12_g3_TC);
XCL_sensori.women.LW12.TC_medio(4,:)=nanmean(int12_g4_TC);
XCL_sensori.women.LW12.TC_std(1,:)=nanstd(int12_g1_TC);
XCL_sensori.women.LW12.TC_std(2,:)=nanstd(int12_g2_TC);
XCL_sensori.women.LW12.TC_std(3,:)=nanstd(int12_g3_TC);
XCL_sensori.women.LW12.TC_std(4,:)=nanstd(int12_g4_TC);

%MAG
%classe LW10.5
int105_g1_MAG=[err_Seo.KK(:,1)'; err_Abdikarimova.KK(:,1)'];
int105_g2_MAG=[err_Seo.KK(:,2)'; err_Abdikarimova.KK(:,2)'];
int105_g3_MAG=[err_Seo.KK(:,3)'; err_Abdikarimova.KK(:,3)'];
int105_g4_MAG=[err_Seo.KK(:,4)'; err_Abdikarimova.KK(:,4)'];

XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int105_g1_MAG)
;
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int105_g2_MAG)
;
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int105_g3_MAG)
;
```

```
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int105_g4_MAG)
;
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(1,:)=nanstd(int105_g1_MAG);
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(2,:)=nanstd(int105_g2_MAG);
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(3,:)=nanstd(int105_g3_MAG);
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(4,:)=nanstd(int105_g4_MAG);

%classe LW11
int11_g1_MAG=[err_Dos_Santos.KK(:,1)'; err_Skarstein.KK(:,1)'];
int11_g2_MAG=[err_Dos_Santos.KK(:,2)'; err_Skarstein.KK(:,2)'];
int11_g3_MAG=[err_Dos_Santos.KK(:,3)'; err_Skarstein.KK(:,3)'];
int11_g4_MAG=[err_Dos_Santos.KK(:,4)'; err_Skarstein.KK(:,4)'];

XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int11_g1_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int11_g2_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int11_g3_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int11_g4_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(1,:)=nanstd(int11_g1_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(2,:)=nanstd(int11_g2_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(3,:)=nanstd(int11_g3_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(4,:)=nanstd(int11_g4_MAG);

%classe LW12
int12_g1_MAG=[err_Guliaeva.KK(:,1)'; err_Zainullina.KK(:,1)'];
int12_g2_MAG=[err_Guliaeva.KK(:,2)'; err_Zainullina.KK(:,2)'];
int12_g3_MAG=[err_Guliaeva.KK(:,3)'; err_Zainullina.KK(:,3)'];
int12_g4_MAG=[err_Guliaeva.KK(:,4)'; err_Zainullina.KK(:,4)'];

XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int12_g1_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int12_g2_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int12_g3_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int12_g4_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(1,:)=nanstd(int12_g1_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(2,:)=nanstd(int12_g2_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(3,:)=nanstd(int12_g3_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(4,:)=nanstd(int12_g4_MAG);

% errore
%classe LW10.5
err105_g1=[err_Seo.err_int_perc(:,1)';
err_Abdikarimova.err_int_perc(:,1)'];
err105_g2=[err_Seo.err_int_perc(:,2)';
err_Abdikarimova.err_int_perc(:,2)'];
err105_g3=[err_Seo.err_int_perc(:,3)';
err_Abdikarimova.err_int_perc(:,3)'];
err105_g4=[err_Seo.err_int_perc(:,4)';
err_Abdikarimova.err_int_perc(:,4)'];

XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(er
r105_g1);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(er
r105_g2);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(er
r105_g3);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(er
r105_g4);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err10
5_g1);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err10
5_g2);
```

```
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err10
5_g3);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err10
5_g4);

%classe LW11
err11_g1=[err_Dos_Santos.err_int_perc(:,1)';
err_Skarstein.err_int_perc(:,1)'];
err11_g2=[err_Dos_Santos.err_int_perc(:,2)';
err_Skarstein.err_int_perc(:,2)'];
err11_g3=[err_Dos_Santos.err_int_perc(:,3)';
err_Skarstein.err_int_perc(:,3)'];
err11_g4=[err_Dos_Santos.err_int_perc(:,4)';
err_Skarstein.err_int_perc(:,4)'];

XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(err1
1_g1);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(err1
1_g2);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(err1
1_g3);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(err1
1_g4);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err11_g
1);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err11_g
2);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err11_g
3);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err11_g
4);

%classe LW12
err12_g1=[err_Guliaeva.err_int_perc(:,1)';
err_Zainullina.err_int_perc(:,1)'];
err12_g2=[err_Guliaeva.err_int_perc(:,2)';
err_Zainullina.err_int_perc(:,2)'];
err12_g3=[err_Guliaeva.err_int_perc(:,3)';
err_Zainullina.err_int_perc(:,3)'];
err12_g4=[err_Guliaeva.err_int_perc(:,4)';
err_Zainullina.err_int_perc(:,4)'];

XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(err1
2_g1);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(err1
2_g2);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(err1
2_g3);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(err1
2_g4);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err12_g
1);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err12_g
2);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err12_g
3);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err12_g
4);

%% ANALISI DEI SEGMENTI - UOMINI
```

```
% riga 1 = Larsen
% riga 2 = Gao
% riga 3 = Sin
% riga 4 = Rosiek
% riga 5 = Davidovich

atleta11_TC=XC_long.men.LW12(11);
atleta22_TC=XC_long.men.LW12(6);
atleta33_TC=XC_long.men.LW12(13);
atleta44_TC=XC_long.men.LW12(9);
atleta55_TC=XC_long.men.LW12(12);

% TC
%classe LW12
int_g1_TC=[atleta11_TC.intertempi_giro1;atleta22_TC.intertempi_giro1;atleta
33_TC.intertempi_giro1;atleta44_TC.intertempi_giro1;atleta55_TC.intertempi_
giro1];
int_g2_TC=[atleta11_TC.intertempi_giro2;atleta22_TC.intertempi_giro2;atleta
33_TC.intertempi_giro2;atleta44_TC.intertempi_giro2;atleta55_TC.intertempi_
giro2];
int_g3_TC=[atleta11_TC.intertempi_giro3;atleta22_TC.intertempi_giro3;atleta
33_TC.intertempi_giro3;atleta44_TC.intertempi_giro3;atleta55_TC.intertempi_
giro3];
int_g4_TC=[atleta11_TC.intertempi_giro4;atleta22_TC.intertempi_giro4;atleta
33_TC.intertempi_giro4;atleta44_TC.intertempi_giro4;atleta55_TC.intertempi_
giro4];
int_g5_TC=[atleta11_TC.intertempi_giro5;atleta22_TC.intertempi_giro5;atleta
33_TC.intertempi_giro5;atleta44_TC.intertempi_giro5;atleta55_TC.intertempi_
giro5];

XCL_sensori.men.LW12.TC_medio(1,:)=nanmean(int_g1_TC);
XCL_sensori.men.LW12.TC_medio(2,:)=nanmean(int_g2_TC);
XCL_sensori.men.LW12.TC_medio(3,:)=nanmean(int_g3_TC);
XCL_sensori.men.LW12.TC_medio(4,:)=nanmean(int_g4_TC);
XCL_sensori.men.LW12.TC_medio(5,:)=nanmean(int_g5_TC);
XCL_sensori.men.LW12.TC_std(1,:)=nanstd(int_g1_TC);
XCL_sensori.men.LW12.TC_std(2,:)=nanstd(int_g2_TC);
XCL_sensori.men.LW12.TC_std(3,:)=nanstd(int_g3_TC);
XCL_sensori.men.LW12.TC_std(4,:)=nanstd(int_g4_TC);
XCL_sensori.men.LW12.TC_std(5,:)=nanstd(int_g5_TC);

%MAG
%classe LW12
int_g1_MAG=[err_Larsen.KK(:,1)'; err_Gao.KK(:,1)'; err_Sin.KK(:,1)';
err_Rosiek.KK(:,1)'; err_Davidovich.KK(:,1)'];
int_g2_MAG=[err_Larsen.KK(:,2)'; err_Gao.KK(:,2)'; err_Sin.KK(:,2)';
err_Rosiek.KK(:,2)'; err_Davidovich.KK(:,2)'];
int_g3_MAG=[err_Larsen.KK(:,3)'; err_Gao.KK(:,3)'; err_Sin.KK(:,3)';
err_Rosiek.KK(:,3)'; err_Davidovich.KK(:,3)'];
int_g4_MAG=[err_Larsen.KK(:,4)'; err_Gao.KK(:,4)'; err_Sin.KK(:,4)';
err_Rosiek.KK(:,4)'; err_Davidovich.KK(:,4)'];
int_g5_MAG=[err_Larsen.KK(:,5)'; err_Gao.KK(:,5)'; err_Sin.KK(:,5)';
err_Rosiek.KK(:,5)'; err_Davidovich.KK(:,5)'];

XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int_g1_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int_g2_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int_g3_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int_g4_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(5,:)=nanmean(int_g5_MAG);
```

```
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(1,:)=nanstd(int_g1_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(2,:)=nanstd(int_g2_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(3,:)=nanstd(int_g3_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(4,:)=nanstd(int_g4_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(5,:)=nanstd(int_g5_MAG);

% errore
%classe LW12
err_g1=[err_Larsen.err_int_perc(:,1)'; err_Gao.err_int_perc(:,1)';
err_Sin.err_int_perc(:,1)'; err_Rosiek.err_int_perc(:,1)';
err_Davidovich.err_int_perc(:,1)'];
err_g2=[err_Larsen.err_int_perc(:,2)'; err_Gao.err_int_perc(:,2)';
err_Sin.err_int_perc(:,2)'; err_Rosiek.err_int_perc(:,2)';
err_Davidovich.err_int_perc(:,2)'];
err_g3=[err_Larsen.err_int_perc(:,3)'; err_Gao.err_int_perc(:,3)';
err_Sin.err_int_perc(:,3)'; err_Rosiek.err_int_perc(:,3)';
err_Davidovich.err_int_perc(:,3)'];
err_g4=[err_Larsen.err_int_perc(:,4)'; err_Gao.err_int_perc(:,4)';
err_Sin.err_int_perc(:,4)'; err_Rosiek.err_int_perc(:,4)';
err_Davidovich.err_int_perc(:,4)'];
err_g5=[err_Larsen.err_int_perc(:,5)'; err_Gao.err_int_perc(:,5)';
err_Sin.err_int_perc(:,5)'; err_Rosiek.err_int_perc(:,5)';
err_Davidovich.err_int_perc(:,5)'];

XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(err_g1
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(err_g2
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(err_g3
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(err_g4
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(5,:)=nanmean(err_g5
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err_g1);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err_g2);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err_g3);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err_g4);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(5,:)=nanstd(err_g5);

%% accelerazioni lineari
%% CALCOLO ACCELERAZIONI MEDIE PER OGNI CLASSE - DONNE
% CLASSE LW10.5
acc_Abdikarimova.media_K1K2=nanmean(acc_Abdikarimova.accK1K2);
acc_Abdikarimova.media_K2K3=nanmean(acc_Abdikarimova.accK2K3);
acc_Abdikarimova.media_K5K6=nanmean(acc_Abdikarimova.accK5K6);
acc_Abdikarimova.media_K7K8=nanmean(acc_Abdikarimova.accK7K8);
acc_Seo.media_K1K2=nanmean(acc_Seo.accK1K2);
acc_Seo.media_K2K3=nanmean(acc_Seo.accK2K3);
acc_Seo.media_K5K6=nanmean(acc_Seo.accK5K6);
acc_Seo.media_K7K8=nanmean(acc_Seo.accK7K8);

acc_LW10_5_K1K2=[acc_Abdikarimova.media_K1K2; acc_Seo.media_K1K2];
acc_LW10_5_K2K3=[acc_Abdikarimova.media_K2K3; acc_Seo.media_K2K3];
acc_LW10_5_K5K6=[acc_Abdikarimova.media_K5K6; acc_Seo.media_K5K6];
acc_LW10_5_K7K8=[acc_Abdikarimova.media_K7K8; acc_Seo.media_K7K8];

XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc
_LW10_5_K1K2);
```

```
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc
_LW10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc
_LW10_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc
_LW10_5_K7K8);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW
10_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW
10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW
10_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW
10_5_K7K8);



% CLASSE LW11
acc_Dos_Santos.media_K1K2=nanmean(acc_Dos_Santos.accK1K2);
acc_Dos_Santos.media_K2K3=nanmean(acc_Dos_Santos.accK2K3);
acc_Dos_Santos.media_K5K6=nanmean(acc_Dos_Santos.accK5K6);
acc_Dos_Santos.media_K7K8=nanmean(acc_Dos_Santos.accK7K8);
acc_Skarstein.media_K1K2=nanmean(acc_Skarstein.accK1K2);
acc_Skarstein.media_K2K3=nanmean(acc_Skarstein.accK2K3);
acc_Skarstein.media_K5K6=nanmean(acc_Skarstein.accK5K6);
acc_Skarstein.media_K7K8=nanmean(acc_Skarstein.accK7K8);

acc_LW11_K1K2=[acc_Dos_Santos.media_K1K2; acc_Skarstein.media_K1K2];
acc_LW11_K2K3=[acc_Dos_Santos.media_K2K3; acc_Skarstein.media_K2K3];
acc_LW11_K5K6=[acc_Dos_Santos.media_K5K6; acc_Skarstein.media_K5K6];
acc_LW11_K7K8=[acc_Dos_Santos.media_K7K8; acc_Skarstein.media_K7K8];

XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc_L
W11_K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc_L
W11_K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc_L
W11_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc_L
W11_K7K8);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW11
_K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW11
_K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW11
_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW11
_K7K8);



% CLASSE LW12
acc_Guliaeva.media_K1K2=nanmean(acc_Guliaeva.accK1K2);
acc_Guliaeva.media_K2K3=nanmean(acc_Guliaeva.accK2K3);
acc_Guliaeva.media_K5K6=nanmean(acc_Guliaeva.accK5K6);
acc_Guliaeva.media_K7K8=nanmean(acc_Guliaeva.accK7K8);
acc_Zainullina.media_K1K2=nanmean(acc_Zainullina.accK1K2);
acc_Zainullina.media_K2K3=nanmean(acc_Zainullina.accK2K3);
acc_Zainullina.media_K5K6=nanmean(acc_Zainullina.accK5K6);
```

```
acc_Zainullina.media_K7K8=nanmean(acc_Zainullina.accK7K8);

acc_LW12_K1K2=[acc_Guliaeva.media_K1K2; acc_Zainullina.media_K1K2];
acc_LW12_K2K3=[acc_Guliaeva.media_K2K3; acc_Zainullina.media_K2K3];
acc_LW12_K5K6=[acc_Guliaeva.media_K5K6; acc_Zainullina.media_K5K6];
acc_LW12_K7K8=[acc_Guliaeva.media_K7K8; acc_Zainullina.media_K7K8];

XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc_L
W12_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc_L
W12_K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc_L
W12_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc_L
W12_K7K8);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW12
_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW12
_K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW12
_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW12
_K7K8);

%% CALCOLO ACCELERAZIONI MEDIE PER OGNI CLASSE - UOMINI

% riga 1 = Larsen
% riga 2 = Gao
% riga 3 = Sin
% riga 4 = Rosiek
% riga 5 = Davidovich

% CLASSE LW12
acc_Larsen.media_K1K2=nanmean(acc_Larsen.accK1K2);
acc_Larsen.media_K2K3=nanmean(acc_Larsen.accK2K3);
acc_Larsen.media_K5K6=nanmean(acc_Larsen.accK5K6);
acc_Larsen.media_K7K8=nanmean(acc_Larsen.accK7K8);
acc_Gao.media_K1K2=nanmean(acc_Gao.accK1K2);
acc_Gao.media_K2K3=nanmean(acc_Gao.accK2K3);
acc_Gao.media_K5K6=nanmean(acc_Gao.accK5K6);
acc_Gao.media_K7K8=nanmean(acc_Gao.accK7K8);
acc_Sin.media_K1K2=nanmean(acc_Sin.accK1K2);
acc_Sin.media_K2K3=nanmean(acc_Sin.accK2K3);
acc_Sin.media_K5K6=nanmean(acc_Sin.accK5K6);
acc_Sin.media_K7K8=nanmean(acc_Sin.accK7K8);
acc_Rosiek.media_K1K2=nanmean(acc_Rosiek.accK1K2);
acc_Rosiek.media_K2K3=nanmean(acc_Rosiek.accK2K3);
acc_Rosiek.media_K5K6=nanmean(acc_Rosiek.accK5K6);
acc_Rosiek.media_K7K8=nanmean(acc_Rosiek.accK7K8);
acc_Davidovich.media_K1K2=nanmean(acc_Davidovich.accK1K2);
acc_Davidovich.media_K2K3=nanmean(acc_Davidovich.accK2K3);
acc_Davidovich.media_K5K6=nanmean(acc_Davidovich.accK5K6);
acc_Davidovich.media_K7K8=nanmean(acc_Davidovich.accK7K8);

acc_LW12_K1K2=[acc_Larsen.media_K1K2; acc_Gao.media_K1K2;
acc_Sin.media_K1K2; acc_Rosiek.media_K1K2; acc_Davidovich.media_K1K2];
acc_LW12_K2K3=[acc_Larsen.media_K2K3; acc_Gao.media_K2K3;
acc_Sin.media_K2K3; acc_Rosiek.media_K2K3; acc_Davidovich.media_K2K3];
acc_LW12_K5K6=[acc_Larsen.media_K5K6; acc_Gao.media_K5K6;
acc_Sin.media_K5K6; acc_Rosiek.media_K5K6; acc_Davidovich.media_K5K6];
```

```
acc_LW12_K7K8=[acc_Larsen.media_K7K8; acc_Gao.media_K7K8;
acc_Sin.media_K7K8; acc_Rosiek.media_K7K8; acc_Davidovich.media_K7K8];

XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc_LW1
2_K1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc_LW1
2_K2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc_LW1
2_K5K6);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc_LW1
2_K7K8);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW12_K
1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW12_K
2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW12_K
5K6);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW12_K
7K8);

%% CALCOLO VALOR MEDIO DEI PICCHI PER OGNI CLASSE - DONNE
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW10.5
picchi_Abdikarimova.media_K1K2=nanmean(picchi_Abdikarimova.P_K1K2);
picchi_Abdikarimova.media_K2K3=nanmean(picchi_Abdikarimova.P_K2K3);
picchi_Abdikarimova.media_K5K6=nanmean(picchi_Abdikarimova.P_K5K6);
picchi_Abdikarimova.media_K7K8=nanmean(picchi_Abdikarimova.P_K7K8);
picchi_Seo.media_K1K2=nanmean(picchi_Seo.P_K1K2);
picchi_Seo.media_K2K3=nanmean(picchi_Seo.P_K2K3);
picchi_Seo.media_K5K6=nanmean(picchi_Seo.P_K5K6);
picchi_Seo.media_K7K8=nanmean(picchi_Seo.P_K7K8);

picchi_LW10_5_K1K2=[picchi_Abdikarimova.media_K1K2; picchi_Seo.media_K1K2];
picchi_LW10_5_K2K3=[picchi_Abdikarimova.media_K2K3; picchi_Seo.media_K2K3];
picchi_LW10_5_K5K6=[picchi_Abdikarimova.media_K5K6; picchi_Seo.media_K5K6];
picchi_LW10_5_K7K8=[picchi_Abdikarimova.media_K7K8; picchi_Seo.media_K7K8];

XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW1
0_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW1
0_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW1
0_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW1
0_5_K7K8);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW10_5
_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW10_5
_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW10_5
_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW10_5
_K7K8);


% CLASSE LW11
picchi_Dos_Santos.media_K1K2=nanmean(picchi_Dos_Santos.P_K1K2);
picchi_Dos_Santos.media_K2K3=nanmean(picchi_Dos_Santos.P_K2K3);
picchi_Dos_Santos.media_K5K6=nanmean(picchi_Dos_Santos.P_K5K6);
picchi_Dos_Santos.media_K7K8=nanmean(picchi_Dos_Santos.P_K7K8);
```

```
picchi_Skarstein.media_K1K2=nanmean(picchi_Skarstein.P_K1K2);
picchi_Skarstein.media_K2K3=nanmean(picchi_Skarstein.P_K2K3);
picchi_Skarstein.media_K5K6=nanmean(picchi_Skarstein.P_K5K6);
picchi_Skarstein.media_K7K8=nanmean(picchi_Skarstein.P_K7K8);

picchi_LW11_K1K2=[picchi_Dos_Santos.media_K1K2;
picchi_Skarstein.media_K1K2];
picchi_LW11_K2K3=[picchi_Dos_Santos.media_K2K3;
picchi_Skarstein.media_K2K3];
picchi_LW11_K5K6=[picchi_Dos_Santos.media_K5K6;
picchi_Skarstein.media_K5K6];
picchi_LW11_K7K8=[picchi_Dos_Santos.media_K7K8;
picchi_Skarstein.media_K7K8];

XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW11_
K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW11_
K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW11_
K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW11_
K7K8);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW11_K1K
2);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW11_K2K
3);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW11_K5K
6);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW11_K7K
8);




% CLASSE LW12
picchi_Guliaeva.media_K1K2=nanmean(picchi_Guliaeva.P_K1K2);
picchi_Guliaeva.media_K2K3=nanmean(picchi_Guliaeva.P_K2K3);
picchi_Guliaeva.media_K5K6=nanmean(picchi_Guliaeva.P_K5K6);
picchi_Guliaeva.media_K7K8=nanmean(picchi_Guliaeva.P_K7K8);
picchi_Zainullina.media_K1K2=nanmean(picchi_Zainullina.P_K1K2);
picchi_Zainullina.media_K2K3=nanmean(picchi_Zainullina.P_K2K3);
picchi_Zainullina.media_K5K6=nanmean(picchi_Zainullina.P_K5K6);
picchi_Zainullina.media_K7K8=nanmean(picchi_Zainullina.P_K7K8);

picchi_LW12_K1K2=[picchi_Guliaeva.media_K1K2;
picchi_Zainullina.media_K1K2];
picchi_LW12_K2K3=[picchi_Guliaeva.media_K2K3;
picchi_Zainullina.media_K2K3];
picchi_LW12_K5K6=[picchi_Guliaeva.media_K5K6;
picchi_Zainullina.media_K5K6];
picchi_LW12_K7K8=[picchi_Guliaeva.media_K7K8;
picchi_Zainullina.media_K7K8];

XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW12_
K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW12_
K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW12_
K5K6);
```

```
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW12_
K7K8);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW12_K1K
2);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW12_K2K
3);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW12_K5K
6);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW12_K7K
8);

%% CALCOLO VALOR MEDIO DEI PICCHI PER OGNI CLASSE - UOMINI
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW12
% CLASSE LW12
picchi_Larsen.media_K1K2=nanmean(picchi_Larsen.P_K1K2);
picchi_Larsen.media_K2K3=nanmean(picchi_Larsen.P_K2K3);
picchi_Larsen.media_K5K6=nanmean(picchi_Larsen.P_K5K6);
% picchi_Larsen.media_K7K8=nanmean(picchi_Larsen.P_K7K8);
picchi_Gao.media_K1K2=nanmean(picchi_Gao.P_K1K2);
picchi_Gao.media_K2K3=nanmean(picchi_Gao.P_K2K3);
picchi_Gao.media_K5K6=nanmean(picchi_Gao.P_K5K6);
picchi_Gao.media_K7K8=nanmean(picchi_Gao.P_K7K8);
picchi_Sin.media_K1K2=nanmean(picchi_Sin.P_K1K2);
picchi_Sin.media_K2K3=nanmean(picchi_Sin.P_K2K3);
picchi_Sin.media_K5K6=nanmean(picchi_Sin.P_K5K6);
picchi_Sin.media_K7K8=nanmean(picchi_Sin.P_K7K8);
picchi_Rosiek.media_K1K2=nanmean(picchi_Rosiek.P_K1K2);
picchi_Rosiek.media_K2K3=nanmean(picchi_Rosiek.P_K2K3);
picchi_Rosiek.media_K5K6=nanmean(picchi_Rosiek.P_K5K6);
picchi_Rosiek.media_K7K8=nanmean(picchi_Rosiek.P_K7K8);
picchi_Davidovich.media_K1K2=nanmean(picchi_Davidovich.P_K1K2);
picchi_Davidovich.media_K2K3=nanmean(picchi_Davidovich.P_K2K3);
picchi_Davidovich.media_K5K6=nanmean(picchi_Davidovich.P_K5K6);
picchi_Davidovich.media_K7K8=nanmean(picchi_Davidovich.P_K7K8);

picchi_LW12_K1K2=[picchi_Larsen.media_K1K2; picchi_Gao.media_K1K2;
picchi_Sin.media_K1K2; picchi_Rosiek.media_K1K2;
picchi_Davidovich.media_K1K2];
picchi_LW12_K2K3=[picchi_Larsen.media_K2K3; picchi_Gao.media_K2K3;
picchi_Sin.media_K2K3; picchi_Rosiek.media_K2K3;
picchi_Davidovich.media_K2K3];
picchi_LW12_K5K6=[picchi_Larsen.media_K5K6; picchi_Gao.media_K5K6;
picchi_Sin.media_K5K6; picchi_Rosiek.media_K5K6;
picchi_Davidovich.media_K5K6];
picchi_LW12_K7K8=[NaN NaN NaN NaN NaN; picchi_Gao.media_K7K8;
picchi_Sin.media_K7K8; picchi_Rosiek.media_K7K8;
picchi_Davidovich.media_K7K8];

XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW12_K1
K2);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW12_K2
K3);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW12_K5
K6);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW12_K7
K8);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW12_K1K2)
;
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW12_K2K3)
;
```

```
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW12_K5K6)
;
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW12_K7K8)
;

%% CALCOLO VALOR MEDIO DELLA DISTANZA DEI PICCHI PER OGNI CLASSE - DONNE
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW10.5
dist_Abdikarimova.media_K1K2=nanmean(dist_Abdikarimova.distK1K2);
dist_Abdikarimova.media_K2K3=nanmean(dist_Abdikarimova.distK2K3);
dist_Abdikarimova.media_K5K6=nanmean(dist_Abdikarimova.distK5K6);
dist_Abdikarimova.media_K7K8=nanmean(dist_Abdikarimova.distK7K8);
dist_Seo.media_K1K2=nanmean(dist_Seo.distK1K2);
dist_Seo.media_K2K3=nanmean(dist_Seo.distK2K3);
dist_Seo.media_K5K6=nanmean(dist_Seo.distK5K6);
dist_Seo.media_K7K8=nanmean(dist_Seo.distK7K8);

dist_LW10_5_K1K2=[dist_Abdikarimova.media_K1K2; dist_Seo.media_K1K2];
dist_LW10_5_K2K3=[dist_Abdikarimova.media_K2K3; dist_Seo.media_K2K3];
dist_LW10_5_K5K6=[dist_Abdikarimova.media_K5K6; dist_Seo.media_K5K6];
dist_LW10_5_K7K8=[dist_Abdikarimova.media_K7K8; dist_Seo.media_K7K8];

XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(d
ist_LW10_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(d
ist_LW10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(d
ist_LW10_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(d
ist_LW10_5_K7K8);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist
_LW10_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist
_LW10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist
_LW10_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist
_LW10_5_K7K8);



% CLASSE LW11
dist_Dos_Santos.media_K1K2=nanmean(dist_Dos_Santos.distK1K2);
dist_Dos_Santos.media_K2K3=nanmean(dist_Dos_Santos.distK2K3);
dist_Dos_Santos.media_K5K6=nanmean(dist_Dos_Santos.distK5K6);
dist_Dos_Santos.media_K7K8=nanmean(dist_Dos_Santos.distK7K8);
dist_Skarstein.media_K1K2=nanmean(dist_Skarstein.distK1K2);
dist_Skarstein.media_K2K3=nanmean(dist_Skarstein.distK2K3);
dist_Skarstein.media_K5K6=nanmean(dist_Skarstein.distK5K6);
dist_Skarstein.media_K7K8=nanmean(dist_Skarstein.distK7K8);

dist_LW11_K1K2=[dist_Dos_Santos.media_K1K2; dist_Skarstein.media_K1K2];
dist_LW11_K2K3=[dist_Dos_Santos.media_K2K3; dist_Skarstein.media_K2K3];
dist_LW11_K5K6=[dist_Dos_Santos.media_K5K6; dist_Skarstein.media_K5K6];
dist_LW11_K7K8=[dist_Dos_Santos.media_K7K8; dist_Skarstein.media_K7K8];

XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(dis
t_LW11_K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(dis
t_LW11_K2K3);
```

```
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(dis
t_LW11_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(dis
t_LW11_K7K8);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist_L
W11_K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist_L
W11_K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist_L
W11_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist_L
W11_K7K8);



% CLASSE LW12
dist_Guliaeva.media_K1K2=nanmean(dist_Guliaeva.distK1K2);
dist_Guliaeva.media_K2K3=nanmean(dist_Guliaeva.distK2K3);
dist_Guliaeva.media_K5K6=nanmean(dist_Guliaeva.distK5K6);
dist_Guliaeva.media_K7K8=nanmean(dist_Guliaeva.distK7K8);
dist_Zainullina.media_K1K2=nanmean(dist_Zainullina.distK1K2);
dist_Zainullina.media_K2K3=nanmean(dist_Zainullina.distK2K3);
dist_Zainullina.media_K5K6=nanmean(dist_Zainullina.distK5K6);
dist_Zainullina.media_K7K8=nanmean(dist_Zainullina.distK7K8);

dist_LW12_K1K2=[dist_Guliaeva.media_K1K2; dist_Zainullina.media_K1K2];
dist_LW12_K2K3=[dist_Guliaeva.media_K2K3; dist_Zainullina.media_K2K3];
dist_LW12_K5K6=[dist_Guliaeva.media_K5K6; dist_Zainullina.media_K5K6];
dist_LW12_K7K8=[dist_Guliaeva.media_K7K8; dist_Zainullina.media_K7K8];

XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(dis
t_LW12_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(dis
t_LW12_K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(dis
t_LW12_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(dis
t_LW12_K7K8);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist_L
W12_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist_L
W12_K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist_L
W12_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist_L
W12_K7K8);

%% CALCOLO VALOR MEDIO DELLA DISTANZA DEI PICCHI PER OGNI CLASSE - UOMINI
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW12
dist_Larsen.media_K1K2=nanmean(dist_Larsen.distK1K2);
dist_Larsen.media_K2K3=nanmean(dist_Larsen.distK2K3);
dist_Larsen.media_K5K6=nanmean(dist_Larsen.distK5K6);
% dist_Larsen.media_K7K8=nanmean(dist_Larsen.distK7K8);
dist_Gao.media_K1K2=nanmean(dist_Gao.distK1K2);
dist_Gao.media_K2K3=nanmean(dist_Gao.distK2K3);
dist_Gao.media_K5K6=nanmean(dist_Gao.distK5K6);
dist_Gao.media_K7K8=nanmean(dist_Gao.distK7K8);
dist_Sin.media_K1K2=nanmean(dist_Sin.distK1K2);
dist_Sin.media_K2K3=nanmean(dist_Sin.distK2K3);
```

```
dist_Sin.media_K5K6=nanmean(dist_Sin.distK5K6);
dist_Sin.media_K7K8=nanmean(dist_Sin.distK7K8);
dist_Rosiek.media_K1K2=nanmean(dist_Rosiek.distK1K2);
dist_Rosiek.media_K2K3=nanmean(dist_Rosiek.distK2K3);
dist_Rosiek.media_K5K6=nanmean(dist_Rosiek.distK5K6);
dist_Rosiek.media_K7K8=nanmean(dist_Rosiek.distK7K8);
dist_Davidovich.media_K1K2=nanmean(dist_Davidovich.distK1K2);
dist_Davidovich.media_K2K3=nanmean(dist_Davidovich.distK2K3);
dist_Davidovich.media_K5K6=nanmean(dist_Davidovich.distK5K6);
dist_Davidovich.media_K7K8=nanmean(dist_Davidovich.distK7K8);

dist_LW12_K1K2=[dist_Larsen.media_K1K2; dist_Gao.media_K1K2;
dist_Sin.media_K1K2; dist_Rosiek.media_K1K2; dist_Davidovich.media_K1K2];
dist_LW12_K2K3=[dist_Larsen.media_K2K3; dist_Gao.media_K2K3;
dist_Sin.media_K2K3; dist_Rosiek.media_K2K3; dist_Davidovich.media_K2K3];
dist_LW12_K5K6=[dist_Larsen.media_K5K6; dist_Gao.media_K5K6;
dist_Sin.media_K5K6; dist_Rosiek.media_K5K6; dist_Davidovich.media_K5K6];
dist_LW12_K7K8=[NaN NaN NaN NaN NaN; dist_Gao.media_K7K8;
dist_Sin.media_K7K8; dist_Rosiek.media_K7K8; dist_Davidovich.media_K7K8];

XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(dist_
LW12_K1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(dist_
LW12_K2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(dist_
LW12_K5K6);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(dist_
LW12_K7K8);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist_LW1
2_K1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist_LW1
2_K2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist_LW1
2_K5K6);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist_LW1
2_K7K8);

%% SALVATAGGIO STRUTTURA
save('XCL_IMU.mat','-struct','XCL_sensori');
```

g.4.2) Cross country long maschile e femminile

```
%%
clc
clear all
close all

XC_long=load('XC_long_finale.mat');

filepath1={'\03_Dos_Santos_06' '\04_Seo_14' '\05_Abdikarimova_15'
'\09_Guliaeva_13' '\10_Zainullina_08' '\11_Skarstein_02'};
filepath2={'\38_Larsen_11' '\31_Gao_01' '\40_Sin_03' '\36_Rosiek_05'
'\39_Davidovich_09'};
genere={'\Donne' '\Uomini'};

% Caricamento dati donne
err_Dos_Santos=load([cd genere{1} filepath1{1} '\err_Dos_Santos.mat']);
```

```
err_Seo=load([cd genere{1} filepath1{2} '\err_Seo.mat']);
err_Abdikarimova=load([cd genere{1} filepath1{3} '\err_Abdikarimova.mat']);
err_Guliaeva=load([cd genere{1} filepath1{4} '\err_Guliaeva.mat']);
err_Zainullina=load([cd genere{1} filepath1{5} '\err_Zainullina.mat']);
err_Skarstein=load([cd genere{1} filepath1{6} '\err_Skarstein.mat']);
acc_Dos_Santos=load([cd genere{1} filepath1{1} '\acc_Dos_Santos.mat']);
acc_Seo=load([cd genere{1} filepath1{2} '\acc_Seo.mat']);
acc_Abdikarimova=load([cd genere{1} filepath1{3} '\acc_Abdikarimova.mat']);
acc_Guliaeva=load([cd genere{1} filepath1{4} '\acc_Guliaeva.mat']);
acc_Zainullina=load([cd genere{1} filepath1{5} '\acc_Zainullina.mat']);
acc_Skarstein=load([cd genere{1} filepath1{6} '\acc_Skarstein.mat']);
dist_Dos_Santos=load([cd genere{1} filepath1{1} '\dist_Dos_Santos.mat']);
dist_Seo=load([cd genere{1} filepath1{2} '\dist_Seo.mat']);
dist_Abdikarimova=load([cd genere{1} filepath1{3}
'\dist_Abdikarimova.mat']);
dist_Guliaeva=load([cd genere{1} filepath1{4} '\dist_Guliaeva.mat']);
dist_Zainullina=load([cd genere{1} filepath1{5} '\dist_Zainullina.mat']);
dist_Skarstein=load([cd genere{1} filepath1{6} '\dist_Skarstein.mat']);
picchi_Dos_Santos=load([cd genere{1} filepath1{1}
'\picchi_Dos_Santos.mat']);
picchi_Seo=load([cd genere{1} filepath1{2} '\picchi_Seo.mat']);
picchi_Abdikarimova=load([cd genere{1} filepath1{3}
'\picchi_Abdikarimova.mat']);
picchi_Guliaeva=load([cd genere{1} filepath1{4} '\picchi_Guliaeva.mat']);
picchi_Zainullina=load([cd genere{1} filepath1{5}
'\picchi_Zainullina.mat']);
picchi_Skarstein=load([cd genere{1} filepath1{6} '\picchi_Skarstein.mat']);

% Cricamento dati uomini
err_Larsen=load([cd genere{2} filepath2{1} '\err_Larsen.mat']);
err_Gao=load([cd genere{2} filepath2{2} '\err_Gao.mat']);
err_Sin=load([cd genere{2} filepath2{3} '\err_Sin.mat']);
err_Rosiek=load([cd genere{2} filepath2{4} '\err_Rosiek.mat']);
err_Davidovich=load([cd genere{2} filepath2{5} '\err_Davidovich.mat']);
acc_Larsen=load([cd genere{2} filepath2{1} '\acc_Larsen.mat']);
acc_Gao=load([cd genere{2} filepath2{2} '\acc_Gao.mat']);
acc_Sin=load([cd genere{2} filepath2{3} '\acc_Sin.mat']);
acc_Rosiek=load([cd genere{2} filepath2{4} '\acc_Rosiek.mat']);
acc_Davidovich=load([cd genere{2} filepath2{5} '\acc_Davidovich.mat']);
dist_Larsen=load([cd genere{2} filepath2{1} '\dist_Larsen.mat']);
dist_Gao=load([cd genere{2} filepath2{2} '\dist_Gao.mat']);
dist_Sin=load([cd genere{2} filepath2{3} '\dist_Sin.mat']);
dist_Rosiek=load([cd genere{2} filepath2{4} '\dist_Rosiek.mat']);
dist_Davidovich=load([cd genere{2} filepath2{5} '\dist_Davidovich.mat']);
picchi_Larsen=load([cd genere{2} filepath2{1} '\picchi_Larsen.mat']);
picchi_Gao=load([cd genere{2} filepath2{2} '\picchi_Gao.mat']);
picchi_Sin=load([cd genere{2} filepath2{3} '\picchi_Sin.mat']);
picchi_Rosiek=load([cd genere{2} filepath2{4} '\picchi_Rosiek.mat']);
picchi_Davidovich=load([cd genere{2} filepath2{5}
'\picchi_Davidovich.mat']);
%% Creazione della struttura

XCL_sensori=struct('women',[], 'men',[]);

%donne
XCL_sensori.women.LW10_5.seo=err_Seo;
XCL_sensori.women.LW10_5.abdikarimova=err_Abdikarimova;
XCL_sensori.women.LW11.dos_santos=err_Dos_Santos;
XCL_sensori.women.LW11.skarstein=err_Skarstein;
XCL_sensori.women.LW12.guliaeva=err_Guliaeva;
XCL_sensori.women.LW12.zainullina=err_Zainullina;
```

```
%uomini
XCL_sensori.men.LW12.larsen=err_Larsen;
XCL_sensori.men.LW12.gao=err_Gao;
XCL_sensori.men.LW12.sin=err_Sin;
XCL_sensori.men.LW12.rosiek=err_Rosiek;
XCL_sensori.men.LW12.davidovich=err_Davidovich;

%% ERRORI PUNTUALI - DONNE

n_atleti_W=6;
K_max_W=28;
err_puntuale=NaN(n_atleti_W,K_max_W);

% riga 1 = Seo (LW10.5)
% riga 2 = Abdikarimova (LW10.5)
% riga 3 = Dos Santos (LW11)
% riga 4 = Skarstein(LW11)
% riga 5 = Guliaeva (LW12)
% riga 6 = Zainullina (LW12)

err_puntuale(1,:)=err_Seo.err_perc;
err_puntuale(2,:)=err_Abdikarimova.err_perc;
err_puntuale(3,:)=[err_Dos_Santos.err_perc(1:2) NaN
err_Dos_Santos.err_perc(3:27)];
err_puntuale(4,:)=err_Skarstein.err_perc;
err_puntuale(5,:)=[err_Guliaeva.err_perc(1) NaN
err_Guliaeva.err_perc(2:27)];
err_puntuale(6,:)=[err_Zainullina.err_perc(1:9) NaN
err_Zainullina.err_perc(10:27)];

XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_pun
tuale(1:2,:));
XCL_sensori.women.LW11.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_puntu
ale(3:4,:));
XCL_sensori.women.LW12.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_puntu
ale(5:6,:));
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntua
le(1:2,:));
XCL_sensori.women.LW11.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntuale
(3:4,:));
XCL_sensori.women.LW12.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntuale
(5:6,:));

%% ERRORI PUNTUALI - UOMINI
n_atleti_M=5;
K_max_M=35;
err_puntuale=NaN(n_atleti_M,K_max_M);

% riga 1 = Larsen
% riga 2 = Gao
% riga 3 = Sin
% riga 4 = Rosiek
% riga 5 = Davidovich

err_puntuale(1,:)=err_Larsen.err_perc;
err_puntuale(2,:)=[err_Gao.err_perc(1:30) NaN err_Gao.err_perc(31:34)];
err_puntuale(3,:)=[err_Sin.err_perc(1) NaN err_Sin.err_perc(2:17) NaN
err_Sin.err_perc(18:30) NaN err_Sin.err_perc(31:32)];
```

```
err_puntuale(4,:)=[err_Rosiek.err_perc(1:2) NaN err_Rosiek.err_perc(3:14)
NaN err_Rosiek.err_perc(15:33)];
err_puntuale(5,:)=[err_Davidovich.err_perc(1:2) NaN
err_Davidovich.err_perc(3) NaN err_Davidovich.err_perc(4:16) NaN
err_Davidovich.err_perc(17:32)];

XCL_sensori.men.LW12.MAGNETOMETRO.errore_puntuale_medio=nanmean(err_puntual
e);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_puntuale_std=nanstd(err_puntuale);

%% ANALISI DEI SEGMENTI - DONNE

% riga 1 = Seo (LW10.5)
% riga 2 = Abdikarimova (LW10.5)
% riga 3 = Dos Santos (LW11)
% riga 4 = Skarstein(LW11)
% riga 5 = Guliaeva (LW12)
% riga 6 = Zainullina (LW12)

atleta1_TC=XC_long.women.LW10_5(1);
atleta2_TC=XC_long.women.LW10_5(2);
atleta3_TC=XC_long.women.LW11(1);
atleta4_TC=XC_long.women.LW11(2);
atleta5_TC=XC_long.women.LW12(5);
atleta6_TC=XC_long.women.LW12(6);

% inserisco tutto nella struttura
%TC
%classe LW10.5
int105_g1_TC=[atleta1_TC.intertempi_giro1; atleta2_TC.intertempi_giro1;];
int105_g2_TC=[atleta1_TC.intertempi_giro2; atleta2_TC.intertempi_giro2;];
int105_g3_TC=[atleta1_TC.intertempi_giro3; atleta2_TC.intertempi_giro3;];
int105_g4_TC=[atleta1_TC.intertempi_giro4; atleta2_TC.intertempi_giro4;];

XCL_sensori.women.LW10_5.TC_medio(1,:)=nanmean(int105_g1_TC);
XCL_sensori.women.LW10_5.TC_medio(2,:)=nanmean(int105_g2_TC);
XCL_sensori.women.LW10_5.TC_medio(3,:)=nanmean(int105_g3_TC);
XCL_sensori.women.LW10_5.TC_medio(4,:)=nanmean(int105_g4_TC);
XCL_sensori.women.LW10_5.TC_std(1,:)=nanstd(int105_g1_TC);
XCL_sensori.women.LW10_5.TC_std(2,:)=nanstd(int105_g2_TC);
XCL_sensori.women.LW10_5.TC_std(3,:)=nanstd(int105_g3_TC);
XCL_sensori.women.LW10_5.TC_std(4,:)=nanstd(int105_g4_TC);

%classe LW11
int11_g1_TC=[atleta3_TC.intertempi_giro1; atleta4_TC.intertempi_giro1;];
int11_g2_TC=[atleta3_TC.intertempi_giro2; atleta4_TC.intertempi_giro2;];
int11_g3_TC=[atleta3_TC.intertempi_giro3; atleta4_TC.intertempi_giro3;];
int11_g4_TC=[atleta3_TC.intertempi_giro4; atleta4_TC.intertempi_giro4;];

XCL_sensori.women.LW11.TC_medio(1,:)=nanmean(int11_g1_TC);
XCL_sensori.women.LW11.TC_medio(2,:)=nanmean(int11_g2_TC);
XCL_sensori.women.LW11.TC_medio(3,:)=nanmean(int11_g3_TC);
XCL_sensori.women.LW11.TC_medio(4,:)=nanmean(int11_g4_TC);
XCL_sensori.women.LW11.TC_std(1,:)=nanstd(int11_g1_TC);
XCL_sensori.women.LW11.TC_std(2,:)=nanstd(int11_g2_TC);
XCL_sensori.women.LW11.TC_std(3,:)=nanstd(int11_g3_TC);
XCL_sensori.women.LW11.TC_std(4,:)=nanstd(int11_g4_TC);

%classe LW12
int12_g1_TC=[atleta5_TC.intertempi_giro1; atleta6_TC.intertempi_giro1;];
```

```
int12_g2_TC=[atleta5_TC.intertempi_giro2; atleta6_TC.intertempi_giro2;];
int12_g3_TC=[atleta5_TC.intertempi_giro3; atleta6_TC.intertempi_giro3;];
int12_g4_TC=[atleta5_TC.intertempi_giro4; atleta6_TC.intertempi_giro4;];

XCL_sensori.women.LW12.TC_medio(1,:)=nanmean(int12_g1_TC);
XCL_sensori.women.LW12.TC_medio(2,:)=nanmean(int12_g2_TC);
XCL_sensori.women.LW12.TC_medio(3,:)=nanmean(int12_g3_TC);
XCL_sensori.women.LW12.TC_medio(4,:)=nanmean(int12_g4_TC);
XCL_sensori.women.LW12.TC_std(1,:)=nanstd(int12_g1_TC);
XCL_sensori.women.LW12.TC_std(2,:)=nanstd(int12_g2_TC);
XCL_sensori.women.LW12.TC_std(3,:)=nanstd(int12_g3_TC);
XCL_sensori.women.LW12.TC_std(4,:)=nanstd(int12_g4_TC);

%MAG
%classe LW10.5
int105_g1_MAG=[err_Seo.KK(:,1)'; err_Abdikarimova.KK(:,1)'];
int105_g2_MAG=[err_Seo.KK(:,2)'; err_Abdikarimova.KK(:,2)'];
int105_g3_MAG=[err_Seo.KK(:,3)'; err_Abdikarimova.KK(:,3)'];
int105_g4_MAG=[err_Seo.KK(:,4)'; err_Abdikarimova.KK(:,4)'];

XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int105_g1_MAG)
;
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int105_g2_MAG)
;
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int105_g3_MAG)
;
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int105_g4_MAG)
;
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(1,:)=nanstd(int105_g1_MAG);
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(2,:)=nanstd(int105_g2_MAG);
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(3,:)=nanstd(int105_g3_MAG);
XCL_sensori.women.LW10_5.MAGNETOMETRO.MAG_std(4,:)=nanstd(int105_g4_MAG);

%classe LW11
int11_g1_MAG=[err_Dos_Santos.KK(:,1)'; err_Skarstein.KK(:,1)'];
int11_g2_MAG=[err_Dos_Santos.KK(:,2)'; err_Skarstein.KK(:,2)'];
int11_g3_MAG=[err_Dos_Santos.KK(:,3)'; err_Skarstein.KK(:,3)'];
int11_g4_MAG=[err_Dos_Santos.KK(:,4)'; err_Skarstein.KK(:,4)'];

XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int11_g1_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int11_g2_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int11_g3_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int11_g4_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(1,:)=nanstd(int11_g1_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(2,:)=nanstd(int11_g2_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(3,:)=nanstd(int11_g3_MAG);
XCL_sensori.women.LW11.MAGNETOMETRO.MAG_std(4,:)=nanstd(int11_g4_MAG);

%classe LW12
int12_g1_MAG=[err_Guliaeva.KK(:,1)'; err_Zainullina.KK(:,1)'];
int12_g2_MAG=[err_Guliaeva.KK(:,2)'; err_Zainullina.KK(:,2)'];
int12_g3_MAG=[err_Guliaeva.KK(:,3)'; err_Zainullina.KK(:,3)'];
int12_g4_MAG=[err_Guliaeva.KK(:,4)'; err_Zainullina.KK(:,4)'];

XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int12_g1_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int12_g2_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int12_g3_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int12_g4_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(1,:)=nanstd(int12_g1_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(2,:)=nanstd(int12_g2_MAG);
```

```
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(3,:)=nanstd(int12_g3_MAG);
XCL_sensori.women.LW12.MAGNETOMETRO.MAG_std(4,:)=nanstd(int12_g4_MAG);

% errore
%classe LW10.5
err105_g1=[err_Seo.err_int_perc(:,1)';
err_Abdikarimova.err_int_perc(:,1)'];
err105_g2=[err_Seo.err_int_perc(:,2)';
err_Abdikarimova.err_int_perc(:,2)'];
err105_g3=[err_Seo.err_int_perc(:,3)';
err_Abdikarimova.err_int_perc(:,3)'];
err105_g4=[err_Seo.err_int_perc(:,4)';
err_Abdikarimova.err_int_perc(:,4)'];

XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(er
r105_g1);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(er
r105_g2);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(er
r105_g3);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(er
r105_g4);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err10
5_g1);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err10
5_g2);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err10
5_g3);
XCL_sensori.women.LW10_5.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err10
5_g4);

%classe LW11
err11_g1=[err_Dos_Santos.err_int_perc(:,1)';
err_Skarstein.err_int_perc(:,1)'];
err11_g2=[err_Dos_Santos.err_int_perc(:,2)';
err_Skarstein.err_int_perc(:,2)'];
err11_g3=[err_Dos_Santos.err_int_perc(:,3)';
err_Skarstein.err_int_perc(:,3)'];
err11_g4=[err_Dos_Santos.err_int_perc(:,4)';
err_Skarstein.err_int_perc(:,4)'];

XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(err1
1_g1);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(err1
1_g2);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(err1
1_g3);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(err1
1_g4);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err11_g
1);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err11_g
2);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err11_g
3);
XCL_sensori.women.LW11.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err11_g
4);

%classe LW12
```

```
err12_g1=[err_Guliaeva.err_int_perc(:,1)';
err_Zainullina.err_int_perc(:,1)'];
err12_g2=[err_Guliaeva.err_int_perc(:,2)';
err_Zainullina.err_int_perc(:,2)'];
err12_g3=[err_Guliaeva.err_int_perc(:,3)';
err_Zainullina.err_int_perc(:,3)'];
err12_g4=[err_Guliaeva.err_int_perc(:,4)';
err_Zainullina.err_int_perc(:,4)'];

XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(err1
2_g1);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(err1
2_g2);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(err1
2_g3);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(err1
2_g4);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err12_g
1);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err12_g
2);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err12_g
3);
XCL_sensori.women.LW12.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err12_g
4);

%% ANALISI DEI SEGMENTI - UOMINI

% riga 1 = Larsen
% riga 2 = Gao
% riga 3 = Sin
% riga 4 = Rosiek
% riga 5 = Davidovich

atleta11_TC=XC_long.men.LW12(11);
atleta22_TC=XC_long.men.LW12(6);
atleta33_TC=XC_long.men.LW12(13);
atleta44_TC=XC_long.men.LW12(9);
atleta55_TC=XC_long.men.LW12(12);

% TC
%classe LW12
int_g1_TC=[atleta11_TC.intertempi_giro1;atleta22_TC.intertempi_giro1;atleta
33_TC.intertempi_giro1;atleta44_TC.intertempi_giro1;atleta55_TC.intertempi_
giro1];
int_g2_TC=[atleta11_TC.intertempi_giro2;atleta22_TC.intertempi_giro2;atleta
33_TC.intertempi_giro2;atleta44_TC.intertempi_giro2;atleta55_TC.intertempi_
giro2];
int_g3_TC=[atleta11_TC.intertempi_giro3;atleta22_TC.intertempi_giro3;atleta
33_TC.intertempi_giro3;atleta44_TC.intertempi_giro3;atleta55_TC.intertempi_
giro3];
int_g4_TC=[atleta11_TC.intertempi_giro4;atleta22_TC.intertempi_giro4;atleta
33_TC.intertempi_giro4;atleta44_TC.intertempi_giro4;atleta55_TC.intertempi_
giro4];
int_g5_TC=[atleta11_TC.intertempi_giro5;atleta22_TC.intertempi_giro5;atleta
33_TC.intertempi_giro5;atleta44_TC.intertempi_giro5;atleta55_TC.intertempi_
giro5];

XCL_sensori.men.LW12.TC_medio(1,:)=nanmean(int_g1_TC);
XCL_sensori.men.LW12.TC_medio(2,:)=nanmean(int_g2_TC);
```

```
XCL_sensori.men.LW12.TC_medio(3,:)=nanmean(int_g3_TC);
XCL_sensori.men.LW12.TC_medio(4,:)=nanmean(int_g4_TC);
XCL_sensori.men.LW12.TC_medio(5,:)=nanmean(int_g5_TC);
XCL_sensori.men.LW12.TC_std(1,:)=nanstd(int_g1_TC);
XCL_sensori.men.LW12.TC_std(2,:)=nanstd(int_g2_TC);
XCL_sensori.men.LW12.TC_std(3,:)=nanstd(int_g3_TC);
XCL_sensori.men.LW12.TC_std(4,:)=nanstd(int_g4_TC);
XCL_sensori.men.LW12.TC_std(5,:)=nanstd(int_g5_TC);

%MAG
%classe LW12
int_g1_MAG=[err_Larsen.KK(:,1)'; err_Gao.KK(:,1)'; err_Sin.KK(:,1)';
err_Rosiek.KK(:,1)'; err_Davidovich.KK(:,1)'];
int_g2_MAG=[err_Larsen.KK(:,2)'; err_Gao.KK(:,2)'; err_Sin.KK(:,2)';
err_Rosiek.KK(:,2)'; err_Davidovich.KK(:,2)'];
int_g3_MAG=[err_Larsen.KK(:,3)'; err_Gao.KK(:,3)'; err_Sin.KK(:,3)';
err_Rosiek.KK(:,3)'; err_Davidovich.KK(:,3)'];
int_g4_MAG=[err_Larsen.KK(:,4)'; err_Gao.KK(:,4)'; err_Sin.KK(:,4)';
err_Rosiek.KK(:,4)'; err_Davidovich.KK(:,4)'];
int_g5_MAG=[err_Larsen.KK(:,5)'; err_Gao.KK(:,5)'; err_Sin.KK(:,5)';
err_Rosiek.KK(:,5)'; err_Davidovich.KK(:,5)'];

XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(1,:)=nanmean(int_g1_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(2,:)=nanmean(int_g2_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(3,:)=nanmean(int_g3_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(4,:)=nanmean(int_g4_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_medio(5,:)=nanmean(int_g5_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(1,:)=nanstd(int_g1_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(2,:)=nanstd(int_g2_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(3,:)=nanstd(int_g3_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(4,:)=nanstd(int_g4_MAG);
XCL_sensori.men.LW12.MAGNETOMETRO.MAG_std(5,:)=nanstd(int_g5_MAG);

% errore
%classe LW12
err_g1=[err_Larsen.err_int_perc(:,1)'; err_Gao.err_int_perc(:,1)';
err_Sin.err_int_perc(:,1)'; err_Rosiek.err_int_perc(:,1)';
err_Davidovich.err_int_perc(:,1)'];
err_g2=[err_Larsen.err_int_perc(:,2)'; err_Gao.err_int_perc(:,2)';
err_Sin.err_int_perc(:,2)'; err_Rosiek.err_int_perc(:,2)';
err_Davidovich.err_int_perc(:,2)'];
err_g3=[err_Larsen.err_int_perc(:,3)'; err_Gao.err_int_perc(:,3)';
err_Sin.err_int_perc(:,3)'; err_Rosiek.err_int_perc(:,3)';
err_Davidovich.err_int_perc(:,3)'];
err_g4=[err_Larsen.err_int_perc(:,4)'; err_Gao.err_int_perc(:,4)';
err_Sin.err_int_perc(:,4)'; err_Rosiek.err_int_perc(:,4)';
err_Davidovich.err_int_perc(:,4)'];
err_g5=[err_Larsen.err_int_perc(:,5)'; err_Gao.err_int_perc(:,5)';
err_Sin.err_int_perc(:,5)'; err_Rosiek.err_int_perc(:,5)';
err_Davidovich.err_int_perc(:,5)'];

XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(1,:)=nanmean(err_g1
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(2,:)=nanmean(err_g2
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(3,:)=nanmean(err_g3
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(4,:)=nanmean(err_g4
);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_medio(5,:)=nanmean(err_g5
);
```

```
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(1,:)=nanstd(err_g1);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(2,:)=nanstd(err_g2);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(3,:)=nanstd(err_g3);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(4,:)=nanstd(err_g4);
XCL_sensori.men.LW12.MAGNETOMETRO.errore_segmenti_std(5,:)=nanstd(err_g5);

%% accelerazioni lineari
%% CALCOLO ACCELERAZIONI MEDIE PER OGNI CLASSE - DONNE
% CLASSE LW10.5
acc_Abdikarimova.media_K1K2=nanmean(acc_Abdikarimova.accK1K2);
acc_Abdikarimova.media_K2K3=nanmean(acc_Abdikarimova.accK2K3);
acc_Abdikarimova.media_K5K6=nanmean(acc_Abdikarimova.accK5K6);
acc_Abdikarimova.media_K7K8=nanmean(acc_Abdikarimova.accK7K8);
acc_Seo.media_K1K2=nanmean(acc_Seo.accK1K2);
acc_Seo.media_K2K3=nanmean(acc_Seo.accK2K3);
acc_Seo.media_K5K6=nanmean(acc_Seo.accK5K6);
acc_Seo.media_K7K8=nanmean(acc_Seo.accK7K8);

acc_LW10_5_K1K2=[acc_Abdikarimova.media_K1K2; acc_Seo.media_K1K2];
acc_LW10_5_K2K3=[acc_Abdikarimova.media_K2K3; acc_Seo.media_K2K3];
acc_LW10_5_K5K6=[acc_Abdikarimova.media_K5K6; acc_Seo.media_K5K6];
acc_LW10_5_K7K8=[acc_Abdikarimova.media_K7K8; acc_Seo.media_K7K8];

XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc
_LW10_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc
_LW10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc
_LW10_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc
_LW10_5_K7K8);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW
10_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW
10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW
10_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW
10_5_K7K8);



% CLASSE LW11
acc_Dos_Santos.media_K1K2=nanmean(acc_Dos_Santos.accK1K2);
acc_Dos_Santos.media_K2K3=nanmean(acc_Dos_Santos.accK2K3);
acc_Dos_Santos.media_K5K6=nanmean(acc_Dos_Santos.accK5K6);
acc_Dos_Santos.media_K7K8=nanmean(acc_Dos_Santos.accK7K8);
acc_Skarstein.media_K1K2=nanmean(acc_Skarstein.accK1K2);
acc_Skarstein.media_K2K3=nanmean(acc_Skarstein.accK2K3);
acc_Skarstein.media_K5K6=nanmean(acc_Skarstein.accK5K6);
acc_Skarstein.media_K7K8=nanmean(acc_Skarstein.accK7K8);

acc_LW11_K1K2=[acc_Dos_Santos.media_K1K2; acc_Skarstein.media_K1K2];
acc_LW11_K2K3=[acc_Dos_Santos.media_K2K3; acc_Skarstein.media_K2K3];
acc_LW11_K5K6=[acc_Dos_Santos.media_K5K6; acc_Skarstein.media_K5K6];
acc_LW11_K7K8=[acc_Dos_Santos.media_K7K8; acc_Skarstein.media_K7K8];

XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc_L
W11_K1K2);
```

```
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc_L
W11_K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc_L
W11_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc_L
W11_K7K8);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW11
_K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW11
_K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW11
_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW11
_K7K8);




% CLASSE LW12
acc_Guliaeva.media_K1K2=nanmean(acc_Guliaeva.accK1K2);
acc_Guliaeva.media_K2K3=nanmean(acc_Guliaeva.accK2K3);
acc_Guliaeva.media_K5K6=nanmean(acc_Guliaeva.accK5K6);
acc_Guliaeva.media_K7K8=nanmean(acc_Guliaeva.accK7K8);
acc_Zainullina.media_K1K2=nanmean(acc_Zainullina.accK1K2);
acc_Zainullina.media_K2K3=nanmean(acc_Zainullina.accK2K3);
acc_Zainullina.media_K5K6=nanmean(acc_Zainullina.accK5K6);
acc_Zainullina.media_K7K8=nanmean(acc_Zainullina.accK7K8);

acc_LW12_K1K2=[acc_Guliaeva.media_K1K2; acc_Zainullina.media_K1K2];
acc_LW12_K2K3=[acc_Guliaeva.media_K2K3; acc_Zainullina.media_K2K3];
acc_LW12_K5K6=[acc_Guliaeva.media_K5K6; acc_Zainullina.media_K5K6];
acc_LW12_K7K8=[acc_Guliaeva.media_K7K8; acc_Zainullina.media_K7K8];

XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc_L
W12_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc_L
W12_K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc_L
W12_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc_L
W12_K7K8);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW12
_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW12
_K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW12
_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW12
_K7K8);

%% CALCOLO ACCELERAZIONI MEDIE PER OGNI CLASSE - UOMINI

% riga 1 = Larsen
% riga 2 = Gao
% riga 3 = Sin
% riga 4 = Rosiek
% riga 5 = Davidovich

% CLASSE LW12
acc_Larsen.media_K1K2=nanmean(acc_Larsen.accK1K2);
```

```
acc_Larsen.media_K2K3=nanmean(acc_Larsen.accK2K3);
acc_Larsen.media_K5K6=nanmean(acc_Larsen.accK5K6);
acc_Larsen.media_K7K8=nanmean(acc_Larsen.accK7K8);
acc_Gao.media_K1K2=nanmean(acc_Gao.accK1K2);
acc_Gao.media_K2K3=nanmean(acc_Gao.accK2K3);
acc_Gao.media_K5K6=nanmean(acc_Gao.accK5K6);
acc_Gao.media_K7K8=nanmean(acc_Gao.accK7K8);
acc_Sin.media_K1K2=nanmean(acc_Sin.accK1K2);
acc_Sin.media_K2K3=nanmean(acc_Sin.accK2K3);
acc_Sin.media_K5K6=nanmean(acc_Sin.accK5K6);
acc_Sin.media_K7K8=nanmean(acc_Sin.accK7K8);
acc_Rosiek.media_K1K2=nanmean(acc_Rosiek.accK1K2);
acc_Rosiek.media_K2K3=nanmean(acc_Rosiek.accK2K3);
acc_Rosiek.media_K5K6=nanmean(acc_Rosiek.accK5K6);
acc_Rosiek.media_K7K8=nanmean(acc_Rosiek.accK7K8);
acc_Davidovich.media_K1K2=nanmean(acc_Davidovich.accK1K2);
acc_Davidovich.media_K2K3=nanmean(acc_Davidovich.accK2K3);
acc_Davidovich.media_K5K6=nanmean(acc_Davidovich.accK5K6);
acc_Davidovich.media_K7K8=nanmean(acc_Davidovich.accK7K8);

acc_LW12_K1K2=[acc_Larsen.media_K1K2; acc_Gao.media_K1K2;
acc_Sin.media_K1K2; acc_Rosiek.media_K1K2; acc_Davidovich.media_K1K2];
acc_LW12_K2K3=[acc_Larsen.media_K2K3; acc_Gao.media_K2K3;
acc_Sin.media_K2K3; acc_Rosiek.media_K2K3; acc_Davidovich.media_K2K3];
acc_LW12_K5K6=[acc_Larsen.media_K5K6; acc_Gao.media_K5K6;
acc_Sin.media_K5K6; acc_Rosiek.media_K5K6; acc_Davidovich.media_K5K6];
acc_LW12_K7K8=[acc_Larsen.media_K7K8; acc_Gao.media_K7K8;
acc_Sin.media_K7K8; acc_Rosiek.media_K7K8; acc_Davidovich.media_K7K8];

XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(1,:)=nanmean(acc_LW1
2_K1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(2,:)=nanmean(acc_LW1
2_K2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(3,:)=nanmean(acc_LW1
2_K5K6);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_media(4,:)=nanmean(acc_LW1
2_K7K8);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(1,:)=nanstd(acc_LW12_K
1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(2,:)=nanstd(acc_LW12_K
2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(3,:)=nanstd(acc_LW12_K
5K6);
XCL_sensori.men.LW12.ACCELEROMETRO.accelerazione_std(4,:)=nanstd(acc_LW12_K
7K8);

%% CALCOLO VALOR MEDIO DEI PICCHI PER OGNI CLASSE - DONNE
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW10.5
picchi_Abdikarimova.media_K1K2=nanmean(picchi_Abdikarimova.P_K1K2);
picchi_Abdikarimova.media_K2K3=nanmean(picchi_Abdikarimova.P_K2K3);
picchi_Abdikarimova.media_K5K6=nanmean(picchi_Abdikarimova.P_K5K6);
picchi_Abdikarimova.media_K7K8=nanmean(picchi_Abdikarimova.P_K7K8);
picchi_Seo.media_K1K2=nanmean(picchi_Seo.P_K1K2);
picchi_Seo.media_K2K3=nanmean(picchi_Seo.P_K2K3);
picchi_Seo.media_K5K6=nanmean(picchi_Seo.P_K5K6);
picchi_Seo.media_K7K8=nanmean(picchi_Seo.P_K7K8);

picchi_LW10_5_K1K2=[picchi_Abdikarimova.media_K1K2; picchi_Seo.media_K1K2];
picchi_LW10_5_K2K3=[picchi_Abdikarimova.media_K2K3; picchi_Seo.media_K2K3];
picchi_LW10_5_K5K6=[picchi_Abdikarimova.media_K5K6; picchi_Seo.media_K5K6];
```

```
picchi_LW10_5_K7K8=[picchi_Abdikarimova.media_K7K8; picchi_Seo.media_K7K8];

XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW1
0_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW1
0_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW1
0_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW1
0_5_K7K8);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW10_5
_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW10_5
_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW10_5
_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW10_5
_K7K8);


% CLASSE LW11
picchi_Dos_Santos.media_K1K2=nanmean(picchi_Dos_Santos.P_K1K2);
picchi_Dos_Santos.media_K2K3=nanmean(picchi_Dos_Santos.P_K2K3);
picchi_Dos_Santos.media_K5K6=nanmean(picchi_Dos_Santos.P_K5K6);
picchi_Dos_Santos.media_K7K8=nanmean(picchi_Dos_Santos.P_K7K8);
picchi_Skarstein.media_K1K2=nanmean(picchi_Skarstein.P_K1K2);
picchi_Skarstein.media_K2K3=nanmean(picchi_Skarstein.P_K2K3);
picchi_Skarstein.media_K5K6=nanmean(picchi_Skarstein.P_K5K6);
picchi_Skarstein.media_K7K8=nanmean(picchi_Skarstein.P_K7K8);

picchi_LW11_K1K2=[picchi_Dos_Santos.media_K1K2;
picchi_Skarstein.media_K1K2];
picchi_LW11_K2K3=[picchi_Dos_Santos.media_K2K3;
picchi_Skarstein.media_K2K3];
picchi_LW11_K5K6=[picchi_Dos_Santos.media_K5K6;
picchi_Skarstein.media_K5K6];
picchi_LW11_K7K8=[picchi_Dos_Santos.media_K7K8;
picchi_Skarstein.media_K7K8];

XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW11_
K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW11_
K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW11_
K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW11_
K7K8);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW11_K1K
2);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW11_K2K
3);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW11_K5K
6);
XCL_sensori.women.LW11.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW11_K7K
8);



% CLASSE LW12
```

```
picchi_Guliaeva.media_K1K2=nanmean(picchi_Guliaeva.P_K1K2);
picchi_Guliaeva.media_K2K3=nanmean(picchi_Guliaeva.P_K2K3);
picchi_Guliaeva.media_K5K6=nanmean(picchi_Guliaeva.P_K5K6);
picchi_Guliaeva.media_K7K8=nanmean(picchi_Guliaeva.P_K7K8);
picchi_Zainullina.media_K1K2=nanmean(picchi_Zainullina.P_K1K2);
picchi_Zainullina.media_K2K3=nanmean(picchi_Zainullina.P_K2K3);
picchi_Zainullina.media_K5K6=nanmean(picchi_Zainullina.P_K5K6);
picchi_Zainullina.media_K7K8=nanmean(picchi_Zainullina.P_K7K8);

picchi_LW12_K1K2=[picchi_Guliaeva.media_K1K2;
picchi_Zainullina.media_K1K2];
picchi_LW12_K2K3=[picchi_Guliaeva.media_K2K3;
picchi_Zainullina.media_K2K3];
picchi_LW12_K5K6=[picchi_Guliaeva.media_K5K6;
picchi_Zainullina.media_K5K6];
picchi_LW12_K7K8=[picchi_Guliaeva.media_K7K8;
picchi_Zainullina.media_K7K8];

XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW12_
K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW12_
K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW12_
K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW12_
K7K8);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW12_K1K
2);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW12_K2K
3);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW12_K5K
6);
XCL_sensori.women.LW12.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW12_K7K
8);

%% CALCOLO VALOR MEDIO DEI PICCHI PER OGNI CLASSE - UOMINI
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW12
% CLASSE LW12
picchi_Larsen.media_K1K2=nanmean(picchi_Larsen.P_K1K2);
picchi_Larsen.media_K2K3=nanmean(picchi_Larsen.P_K2K3);
picchi_Larsen.media_K5K6=nanmean(picchi_Larsen.P_K5K6);
% picchi_Larsen.media_K7K8=nanmean(picchi_Larsen.P_K7K8);
picchi_Gao.media_K1K2=nanmean(picchi_Gao.P_K1K2);
picchi_Gao.media_K2K3=nanmean(picchi_Gao.P_K2K3);
picchi_Gao.media_K5K6=nanmean(picchi_Gao.P_K5K6);
picchi_Gao.media_K7K8=nanmean(picchi_Gao.P_K7K8);
picchi_Sin.media_K1K2=nanmean(picchi_Sin.P_K1K2);
picchi_Sin.media_K2K3=nanmean(picchi_Sin.P_K2K3);
picchi_Sin.media_K5K6=nanmean(picchi_Sin.P_K5K6);
picchi_Sin.media_K7K8=nanmean(picchi_Sin.P_K7K8);
picchi_Rosiek.media_K1K2=nanmean(picchi_Rosiek.P_K1K2);
picchi_Rosiek.media_K2K3=nanmean(picchi_Rosiek.P_K2K3);
picchi_Rosiek.media_K5K6=nanmean(picchi_Rosiek.P_K5K6);
picchi_Rosiek.media_K7K8=nanmean(picchi_Rosiek.P_K7K8);
picchi_Davidovich.media_K1K2=nanmean(picchi_Davidovich.P_K1K2);
picchi_Davidovich.media_K2K3=nanmean(picchi_Davidovich.P_K2K3);
picchi_Davidovich.media_K5K6=nanmean(picchi_Davidovich.P_K5K6);
picchi_Davidovich.media_K7K8=nanmean(picchi_Davidovich.P_K7K8);
```

```
picchi_LW12_K1K2=[picchi_Larsen.media_K1K2; picchi_Gao.media_K1K2;
picchi_Sin.media_K1K2; picchi_Rosiek.media_K1K2;
picchi_Davidovich.media_K1K2];
picchi_LW12_K2K3=[picchi_Larsen.media_K2K3; picchi_Gao.media_K2K3;
picchi_Sin.media_K2K3; picchi_Rosiek.media_K2K3;
picchi_Davidovich.media_K2K3];
picchi_LW12_K5K6=[picchi_Larsen.media_K5K6; picchi_Gao.media_K5K6;
picchi_Sin.media_K5K6; picchi_Rosiek.media_K5K6;
picchi_Davidovich.media_K5K6];
picchi_LW12_K7K8=[NaN NaN NaN NaN NaN; picchi_Gao.media_K7K8;
picchi_Sin.media_K7K8; picchi_Rosiek.media_K7K8;
picchi_Davidovich.media_K7K8];

XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(1,:)=nanmean(picchi_LW12_K1
K2);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(2,:)=nanmean(picchi_LW12_K2
K3);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(3,:)=nanmean(picchi_LW12_K5
K6);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_media(4,:)=nanmean(picchi_LW12_K7
K8);
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(1,:)=nanstd(picchi_LW12_K1K2)
;
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(2,:)=nanstd(picchi_LW12_K2K3)
;
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(3,:)=nanstd(picchi_LW12_K5K6)
;
XCL_sensori.men.LW12.ACCELEROMETRO.picchi_std(4,:)=nanstd(picchi_LW12_K7K8)
;

%% CALCOLO VALOR MEDIO DELLA DISTANZA DEI PICCHI PER OGNI CLASSE - DONNE
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW10.5
dist_Abdikarimova.media_K1K2=nanmean(dist_Abdikarimova.distK1K2);
dist_Abdikarimova.media_K2K3=nanmean(dist_Abdikarimova.distK2K3);
dist_Abdikarimova.media_K5K6=nanmean(dist_Abdikarimova.distK5K6);
dist_Abdikarimova.media_K7K8=nanmean(dist_Abdikarimova.distK7K8);
dist_Seo.media_K1K2=nanmean(dist_Seo.distK1K2);
dist_Seo.media_K2K3=nanmean(dist_Seo.distK2K3);
dist_Seo.media_K5K6=nanmean(dist_Seo.distK5K6);
dist_Seo.media_K7K8=nanmean(dist_Seo.distK7K8);

dist_LW10_5_K1K2=[dist_Abdikarimova.media_K1K2; dist_Seo.media_K1K2];
dist_LW10_5_K2K3=[dist_Abdikarimova.media_K2K3; dist_Seo.media_K2K3];
dist_LW10_5_K5K6=[dist_Abdikarimova.media_K5K6; dist_Seo.media_K5K6];
dist_LW10_5_K7K8=[dist_Abdikarimova.media_K7K8; dist_Seo.media_K7K8];

XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(d
ist_LW10_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(d
ist_LW10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(d
ist_LW10_5_K5K6);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(d
ist_LW10_5_K7K8);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist
_LW10_5_K1K2);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist
_LW10_5_K2K3);
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist
_LW10_5_K5K6);
```

```
XCL_sensori.women.LW10_5.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist
_LW10_5_K7K8);



% CLASSE LW11
dist_Dos_Santos.media_K1K2=nanmean(dist_Dos_Santos.distK1K2);
dist_Dos_Santos.media_K2K3=nanmean(dist_Dos_Santos.distK2K3);
dist_Dos_Santos.media_K5K6=nanmean(dist_Dos_Santos.distK5K6);
dist_Dos_Santos.media_K7K8=nanmean(dist_Dos_Santos.distK7K8);
dist_Skarstein.media_K1K2=nanmean(dist_Skarstein.distK1K2);
dist_Skarstein.media_K2K3=nanmean(dist_Skarstein.distK2K3);
dist_Skarstein.media_K5K6=nanmean(dist_Skarstein.distK5K6);
dist_Skarstein.media_K7K8=nanmean(dist_Skarstein.distK7K8);

dist_LW11_K1K2=[dist_Dos_Santos.media_K1K2; dist_Skarstein.media_K1K2];
dist_LW11_K2K3=[dist_Dos_Santos.media_K2K3; dist_Skarstein.media_K2K3];
dist_LW11_K5K6=[dist_Dos_Santos.media_K5K6; dist_Skarstein.media_K5K6];
dist_LW11_K7K8=[dist_Dos_Santos.media_K7K8; dist_Skarstein.media_K7K8];

XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(dis
t_LW11_K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(dis
t_LW11_K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(dis
t_LW11_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(dis
t_LW11_K7K8);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist_L
W11_K1K2);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist_L
W11_K2K3);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist_L
W11_K5K6);
XCL_sensori.women.LW11.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist_L
W11_K7K8);



% CLASSE LW12
dist_Guliaeva.media_K1K2=nanmean(dist_Guliaeva.distK1K2);
dist_Guliaeva.media_K2K3=nanmean(dist_Guliaeva.distK2K3);
dist_Guliaeva.media_K5K6=nanmean(dist_Guliaeva.distK5K6);
dist_Guliaeva.media_K7K8=nanmean(dist_Guliaeva.distK7K8);
dist_Zainullina.media_K1K2=nanmean(dist_Zainullina.distK1K2);
dist_Zainullina.media_K2K3=nanmean(dist_Zainullina.distK2K3);
dist_Zainullina.media_K5K6=nanmean(dist_Zainullina.distK5K6);
dist_Zainullina.media_K7K8=nanmean(dist_Zainullina.distK7K8);

dist_LW12_K1K2=[dist_Guliaeva.media_K1K2; dist_Zainullina.media_K1K2];
dist_LW12_K2K3=[dist_Guliaeva.media_K2K3; dist_Zainullina.media_K2K3];
dist_LW12_K5K6=[dist_Guliaeva.media_K5K6; dist_Zainullina.media_K5K6];
dist_LW12_K7K8=[dist_Guliaeva.media_K7K8; dist_Zainullina.media_K7K8];

XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(dis
t_LW12_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(dis
t_LW12_K2K3);
```

```
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(dis
t_LW12_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(dis
t_LW12_K7K8);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist_L
W12_K1K2);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist_L
W12_K2K3);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist_L
W12_K5K6);
XCL_sensori.women.LW12.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist_L
W12_K7K8);

%% CALCOLO VALOR MEDIO DELLA DISTANZA DEI PICCHI PER OGNI CLASSE - UOMINI
%il procedimento è lo stesso fatto per l'accelerazione media.
% CLASSE LW12
dist_Larsen.media_K1K2=nanmean(dist_Larsen.distK1K2);
dist_Larsen.media_K2K3=nanmean(dist_Larsen.distK2K3);
dist_Larsen.media_K5K6=nanmean(dist_Larsen.distK5K6);
% dist_Larsen.media_K7K8=nanmean(dist_Larsen.distK7K8);
dist_Gao.media_K1K2=nanmean(dist_Gao.distK1K2);
dist_Gao.media_K2K3=nanmean(dist_Gao.distK2K3);
dist_Gao.media_K5K6=nanmean(dist_Gao.distK5K6);
dist_Gao.media_K7K8=nanmean(dist_Gao.distK7K8);
dist_Sin.media_K1K2=nanmean(dist_Sin.distK1K2);
dist_Sin.media_K2K3=nanmean(dist_Sin.distK2K3);
dist_Sin.media_K5K6=nanmean(dist_Sin.distK5K6);
dist_Sin.media_K7K8=nanmean(dist_Sin.distK7K8);
dist_Rosiek.media_K1K2=nanmean(dist_Rosiek.distK1K2);
dist_Rosiek.media_K2K3=nanmean(dist_Rosiek.distK2K3);
dist_Rosiek.media_K5K6=nanmean(dist_Rosiek.distK5K6);
dist_Rosiek.media_K7K8=nanmean(dist_Rosiek.distK7K8);
dist_Davidovich.media_K1K2=nanmean(dist_Davidovich.distK1K2);
dist_Davidovich.media_K2K3=nanmean(dist_Davidovich.distK2K3);
dist_Davidovich.media_K5K6=nanmean(dist_Davidovich.distK5K6);
dist_Davidovich.media_K7K8=nanmean(dist_Davidovich.distK7K8);

dist_LW12_K1K2=[dist_Larsen.media_K1K2; dist_Gao.media_K1K2;
dist_Sin.media_K1K2; dist_Rosiek.media_K1K2; dist_Davidovich.media_K1K2];
dist_LW12_K2K3=[dist_Larsen.media_K2K3; dist_Gao.media_K2K3;
dist_Sin.media_K2K3; dist_Rosiek.media_K2K3; dist_Davidovich.media_K2K3];
dist_LW12_K5K6=[dist_Larsen.media_K5K6; dist_Gao.media_K5K6;
dist_Sin.media_K5K6; dist_Rosiek.media_K5K6; dist_Davidovich.media_K5K6];
dist_LW12_K7K8=[NaN NaN NaN NaN NaN; dist_Gao.media_K7K8;
dist_Sin.media_K7K8; dist_Rosiek.media_K7K8; dist_Davidovich.media_K7K8];

XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(1,:)=nanmean(dist_
LW12_K1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(2,:)=nanmean(dist_
LW12_K2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(3,:)=nanmean(dist_
LW12_K5K6);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_media(4,:)=nanmean(dist_
LW12_K7K8);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(1,:)=nanstd(dist_LW1
2_K1K2);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(2,:)=nanstd(dist_LW1
2_K2K3);
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(3,:)=nanstd(dist_LW1
2_K5K6);
```

```
XCL_sensori.men.LW12.ACCELEROMETRO.distanza_picchi_std(4,:)=nanstd(dist_LW1
2_K7K8);

%% SALVATAGGIO STRUTTURA
save('XCL_IMU.mat','-struct','XCL_sensori');
```