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Honors thesis

COURSE OF
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Abstract

**Thematic analysis of multispectral images for heritage
documentation**

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The aim of this thesis is to use non-invasive techniques from Remote Sensing and Aerial Photogrammetry (two Geomatics disciplines) to recognize traces of cultural heritage exploring the subsoil.

The analysis involves the use of multispectral images acquired by sensors, placed on UAV aircraft (Unmanned Aerial Vehicle), sensitive to the radiation emitted or reflected on different intervals (wavelengths) of the electromagnetic spectrum, from the region of the "visible" (Characterized by the three basic colors RGB: red, green, blue) to others invisible to the human eye. The possibility of extending beyond the "visible" gives the multispectral sensors enormous potential in the survey field. The data acquired in the near infrared (Nir) and Red Edge (RE) spectral ranges, for example, return information related to the stress or vigor of the vegetation, a characteristic that, if located in a specific area of the observed scene, can reveal traces of anthropic presence in the subsoil.

The multispectral image datasets were acquired during two surveying campaigns conducted by the Polytechnic University of Turin (4DiLAN project), in locations that present optimal characteristics for the purposes of this study: the area hosting the Novalesa abbot complex (TO) and the archeological area of Costigliole Saluzzo (CN).

The two cases study are considered interesting due to the high probability that in the underground there are remains of structures that could be brought back to light and reintegrated into the Piedmont Cultural Heritage. An accurate analysis of the two sites through multispectral images represented an important opportunity to verify the reliability of the method proposed in this thesis, thanks to the possibility of obtaining a comparison of the results achieved comparing them with those matured using widely tested techniques such as investigations conducted with Georadar.

The methodological process used for the study of multispectral images envisages, as already mentioned above, the application of techniques deriving from two different but complementary disciplinary fields (respectively aerial photogrammetry and proximal remote sensing). The procedure is therefore divided into two important phases:

- The first phase is aimed at the acquisition and processing of data, to generate orthomosaics (NIR, Red Edge and multispectral) of the territory, geometrically correct and georeferenced.
- The second phase is dedicated to the study of anomalies in the investigated territory.

Starting from the orthomosaics, radiometric calibration procedures are carried out and, subsequently, methods are used to emphasize the signs on the vegetation that will be analyzed with photointerpretation techniques.

During the photo-interpreting process of the multispectral elaborations, some critical factors emerged that did not influence the correct geometric reconstruction of the model and the orthomosaics derived from it, but they were revealed during the analysis/interpretation phase of the radiometric values of the multispectral images.