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Classification of land cover and land use using hyperspectral data PRISMA: an application in the Vesuvius National Park

internship at Ariespace s.r.l. (Napoli)

Different forest types, based on different compositions of tree species, can have similar spectral signatures when observed with conventional multispectral satellite sensors. Hyperspectral images, with a more continuous representation of their spectral behavior, can instead be used for their classification.

The new PRecursore IperSpettrale della Missione Applicativa (PRISMA), developed by the Italian Space Agency (ASI), is capable of acquiring images in a continuum of 240 spectral bands between 400 and 2500 nm, with a spectral resolution of less than 12 nm. PRISMA's instrumentation consists of an imaging spectrometer capable of acquiring VNIR (Visible and Near-InfraRed) and SWIR (Short-Wave InfraRed) products, with a spatial resolution of 30 meters and a panchromatic camera with a spatial resolution of 5 meters. The new sensor can be used for a large number of remote sensing applications, including forest species discrimination. As part of this work, images from the PRISMA sensor were processed and analyzed: starting from the data extraction operations in binary HDF format, through comparison with the well-known multispectral Sentinel-2 (MSI) products, in order to obtain a preliminary land cover and land use classification product in the Vesuvius National Park.

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Dr. Claudia Canossa

The semi-automatic reconciliation process of a cartographic geodatabase

internship at ITHACA S.R.L. (Turin)

During the internship carried out at the company ITHACA SRL I had the opportunity to see the whole production process of a reference map.

The paper therefore starts with the definition and description of the different types of maps that can be produced, the software used and the data sources, as well as the different types of data that make up the final map.

Different softwares are used in different moments of the production process and in particular, while Qgis is used initially for the download of data which are almost entirely of open source origin and for the creation of the shaded relief, while ArcGis Pro is used for all the remaining operations.

The data downloaded through the Qgis QuikOSM plugin must be carefully checked, scaled to the scale of the map in production and integrated with each other so that the final result is not only correct but also aesthetically pleasing. The map may also contain other data that cannot be found from open source sources and these are usually provided by the client.

As the work progresses and the data is perfected, a first backup is made on the shared GeoDatabase using the ArcGIS Pro Append tool, one feature class at a time, so you can always have the most up-to-date and correct data available.

Finally, in the post-production phase, the data produced is uploaded to the reconciliation GDb after being re-verified.

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Dr. Andrea Galligari

Integration between interferometry and PhotoMonitoring: an innovative approach for geotechnical and geological monitoring

internship at Nhazca S.r.l. (Rome)

Geotechnical and geological monitoring employs high-tech, high-precision surveying techniques today, such that movements of the measured object can be identified down to the sub-millimetre range. Interferometry and PhotoMonitoring are two techniques that are increasingly being used in this sector. Interferometry measures displacements along the instrumental Line of Sight (sensor-target line), while with the PhotoMonitoring technique it is possible to estimate displacements along the up-down and left-right direction of the image focal plane. This innovative approach is aimed precisely towards the identification of a methodology capable of integrating the data collected by the above mentioned two techniques. For this purpose, a case study of a landslide, located in the southern Apennines, was chosen. The complex nature of the phenomenon required the use of numerous remote sensing techniques, including terrestrial interferometry (TInSAR) and satellite PhotoMonitoring (RapidEye images). The different observation points of the scenario allowed us to test the potential of the PS Toolbox plugin for QGIS, which was developed originally in the field of satellite interferometry.

Through the use of two algorithms of (i) vectorial decomposition and (ii) vector sum, based on the principles of trigonometry, it was possible to generate a datum which expresses the direction and magnitude of the landslide phenomenon, encompassing information from both surveying techniques. The operating principles of the plugin required the preparation of complex models developed on QGIS, allowing the transformation of data from the software dedicated to each technique into data readable by the plugin's current algorithms, according to the type of technique used. The execution of these algorithms, however, allowed the extraction of data limited to two dimensions. A possible direction of development of this approach would involve implementing the plugin in order to improve the adaptation of data from ground-based instrumentation and ultimately generate a datum in three-dimensional space.

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Dr. Nabil Ibnoerrida

Use and development of new topographic software in the "industria 4.0"

internship at Garc S.p.A. (Carpi – MO)

Surveying tools in the construction sector have preponderant position in the building environment. Starting from ancient times up to the present day. Since the Roman age, these tools have been implemented to build the major architectural structures such as the Groma, Dioptra, Corobato, Decempeda and the Odometer.

Since the last century the most important topographic tools were the theodolites; an optical instrument for measuring angles between designated visible points in the horizontal and vertical planes, this has been used in different sectors as land surveying but it is also used extensively for building and infrastructure construction.

Nowadays thanks to the new technologies these are largely not used and all the tools are connected with a software such as total stations, laser measuring and GNSS surveying systems. On this path, the European and Italian institutions have led to a strong incentive to implement all the new topographic software and tools in the construction sector. This new step involves the development of new professional profiles. During the internship at Garc S.p.A in Carpi I had the opportunity to work with a topographic tool as Trimble Business Center. This software is the complete field to finish software for surveyors and construction professionals. With the TBC Monitoring module, survey and construction professionals can create comprehensive monitoring deliverables from any survey data such as GNSS, total station, level, and scanning. According to the road map agreed with the tutor, I started to work on an existing project already built, unfortunately there was no project in the start-up phase. This resulted in not being able to use GNSS systems, but the use of the Hilti PL 300 robotic total station. In a first step, it was defined how to integrate the total station with the software, to do this it was decided to use the area adjacent to the company to simulate a construction area. The interaction between the total station and software yielded a positive result, unfortunately, Hilti total station has a laser range maximum of 50 m.; this led to a review of some aspects of the instrumentation to be used and prompted the company. Thanks to Trimble Business Center, we did some tests with various types of data as point clouds, GNSS calibration data, analysis of excavation surfaces, and calculation of construction excavation volumes. In particular, the calculation of excavation volumes of the foundation leads to a better understanding of the software and the interaction between machine and GNSS systems and excavator. This process makes it possible to create a 3D model of the foundation surfaces with the calculation of the excavation; it also offers the possibility of transferring this information and data directly to the excavator, so it can interact directly with the machine and periodically integrate the data from the office to the machines directly on the construction site. This software in its entirety has led to the development of new possibilities for use in the construction industry, an interaction with excavator machines that allow for real-time data control.

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