Virtual reality to enhance teaching and understanding of geosciences

Proponents:

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Description

Remote sensing techniques for the acquisition of 3D terrain information have evolved rapidly in the last twenty years, leading to the ability to produce detailed 3D virtual outcrop models (VOM) for several different applications. Light detection and ranging technique (LiDAR) provides high-resolution point-clouds of complex target surfaces, and it has been for many years the most popular technique for producing accurate virtual outcrop models. However, logistic and cost limitations due to LiDAR equipment being expensive, bulky, and heavy, presently prevent its widespread use in the geological community. An alternative low-cost and versatile technique for producing VOMs is stereo-photogrammetry. With the increasing availability of low-cost and high-performance hardware and software tools, stereo-photogrammetry is

progressively opening the way to the routine use of virtual outcrop models in geosciences. Airborne and terrestrial digital stereo photogrammetry, indeed, makes it possible to produce high-resolution 3D photo-realistic models of geological outcrops, employing cheap, portable, and user-friendly tools. Point clouds or textured 3D mesh representations of geological exposures generated using digital stereo photogrammetry contain rich geological information, providing opportunities for accurate and cost-effective analysis at resolutions that were, until recently, impossible. In the last decade, indeed, the use of these virtual outcrop models has risen in the different disciplines of geosciences and, nowadays, they are essential to many research fields. Integration of virtual outcrop models in virtual reality platforms is also revolutionizing the way in which geological concepts and structures are learned and taught. Moreover, such technologies are particularly fitted for the popularization of Geology in schools and for the valorisation of Geological Heritage in the frame of sustainable tourism. This project aims at bringing the use of virtual outcrop models to all these contexts of education and communication of Geology.

Project objectives are: (i) To employ virtual outcrop models to map outcrops of educational and touristic interest for the different sub-disciplines of geosciences. (ii) To develop novel solutions for acquisition, georeferentiation, and interrogation of virtual outcrop models. (iii) To develop a workflow for virtual outcrop models integration in desktop and web-based virtual reality platforms.

Proposal for PhD positions

The PhD candidates must hold a Master Degree in Geology or a discipline relevant to the project (e.g. computer engineering, geomatics, landscape architecture). They should be familiar with the capture and processing of digital outcrop datasets and should have a good experience in field work and mapping. Competence in computer programming (e.g. Matlab, R, Python, JavaScript, C/C++ languages) and 3D design software use (e.g. Blender, Unity3D, and/or open source 3D rendering libraries like three.js, and web mapping libraries like Leaflet.js) are welcome.

Projects

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Local P.I. “Progetto Lauree Scientifiche Geologia” per l’orientamento verso le Scuole superiori e il contrasto agli abbandoni. National P.I. Università Firenze, R. Fanti