Title: Augmented and virtual reality applied to the geo-paleontological heritage

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Proposal

The project aims to apply new techniques for high-resolution digitization of fossil and anthropological eminence finds and geosites for remote-enabled use by both researchers and visitors.

Culturally important and useful for environmental planning, these emergencies are the starting point for promoting sustainable tourism and disseminating affective information and suggestions to stakeholders (nature guides, nature parks). The use of new technologies as interaction tools, together with the enhancement of the communication skills of professional geologists, could make the geological sites appreciated by laymen and could help in finding new strategies to give value to geosites and fossil findings.

The project involves the application of photogrammetry, 3D reconstruction, and Virtual and Augmented Reality techniques. The digital restoration and Virtual and Augmented Reality techniques will be applied in a scientifically rigorous, non-artistic manner, and addresses the scientific need to restore the finds to their original form with such precision that they can be used in comparative studies, and to explore innovative digital musealization techniques with specific purposes of enhancing and preserving geosites.

Research Program

The candidate will apply digital registration of biological samples and geoheritage sites first. The aim is to make anthropological sample and the geological heritage available at a distance by creating a suite of algorithms and a database accessible online to facilitate the dissemination of the scientific contents.

The digital techniques for digitizing the cultural heritage include a) photogrammetry, virtual restoration of artifacts, either by mathematically aligning segments of the original artifact that came apart because of breakage and preservation problems, or by recovering the original form of the artifact if it has been altered/compressed due to deformational processes (retrodeformation), b) acquisition of 3D models of selected geosites by aerial-photogrammetry and drones, and c) production of a Virtual Reality Landscape (VRL) in which the digital models will be represented.

During the first and the second year of the doctoral program, the candidate will

participate to the acquisition of the 3D models of the selected geosites through aerial-photogrammetry and drones; will develop the digital models through photogrammetric techniques; will help producing a Virtual Reality Landscape (VRL) in which the digital models will be represented; and will help creating tools and widgets to make the VRL interactive for educational and outreach purposes.

During the second and third years of the PhD program, the candidate will participate in digitizing fossil skulls of large fossil and living apes. By using and implementing software developed by the proponents, the candidate will have the ability to extract internal cavity models from each specimen. This automated and open-source software allows the reproduction of internal surfaces, such as an endocast of the braincase. The candidate will then have to apply Target Deformation and digital alignment techniques to reconstruct the original shape of fossil remains damaged by taphonomic processes.

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