Geospatial Big Data Processing for the Geometric Documentation of a Complex Archaeological Site

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SUMMARY

Geospatial big data refers to information assets characterized by huge amounts (volume) of frequently updated (velocity) data in various formats (variety). The volume characteristic deals with issues related to data capture, storage and massive analysis; the variety characteristic deals with issues related to data management models and structures; and velocity characteristic refers to issues such as matching the speed of data generation and processing. If the veracity characterist, which refers to quality assessment of data and data improvement, is added to the above, we have an integrated recording of all characteristics that define a data set as 'Geospatial Big Data'.

The fast processing and accurate 3D modelling of geospatial big data methods and techniques enabled the development of additional tools for the geometric documentation and visualization of archaeological sites of large areas not easyly accessible and with complex monuments. In many cases, the preservation of these sites requires high precision, documentation and modelling in a high resolution and varying levels of detail, and continuous monitoring due to spatial-temporal changes, damages, etc. This generates the need for the development and implementation of specialized tools and procedures for the processing of geospatial big data derived from various sources.

The case study described in this paper is for the archaeological area of Meteora in central Greece. Large datasets of images from various sources along with terrestrial measurements and georeferencing information from onboard sensors were available: (i) a dataset of vertical and oblique images acquired by a manned aircraft from a small flying height; (ii) terrestrial measurements; and (iii) a dataset of vertical and oblique images acquired by an unmanned aerial vehicle (UAV) with PPK, depicting two non-accessible huge rocks of the archaeological site. The images were oriented through the structure from motion (SfM) technique and dense point clouds from both image datasets were derived through dense image matching. Dense point cloud editing

and registration, mesh generation, texture generation and texture mapping took place and photorealistic textured models of different resolution were derived. The scale dimension will be used not only for displaying the model of the proper resolution depending on the requirements of each user but also for the efficient visualization of the model, so that points of the model that are closer to the user are depicted in greater detail than distant points, without requiring any action by the user.

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