

Optimized workflows for Structure-from-Motion photogrammetry based on freely-available software

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Photogrammetry based on Structure-from-Motion (SfM) and multi-view stereo (MVS) algorithms has become an established technique for 3-D reconstruction in recent years. A variety of relevant research efforts has been carried out, including applications to contrast geomorphological and laboratory settings, theoretical contributions for the assessment of photogrammetric quality and accuracy and/or the development of user-friendly interfaces. Since the onset of this technology, tools based on open-source or freely-available software (FAS) have been available; although commercial packages have been the most commonly used (e.g. PhotoScan, Pix4D).

Currently, several FAS packages (e.g., Bundler, Micmac, OpenMVG, CMVS-PMVS2, sfm_georef) offer a diverse range of tools for SfM-MVS analyses that have been demonstrated to perform efficiently in a number of studies. Nevertheless, there is a need to understand the differences between them and the commercial packages that have become standard. Also, the SfM community would benefit from a set of comprehensive FAS workflows for efficient, reliable and informed use and an assessment of SfM photogrammetric tools and results.

In this contribution we will present a) a preliminary exploration of the performance (time requirements, matching efficiency) of FAS packages compared to commercial tools for a number of case studies involving different geomorphological scenarios (cliff evolution, ephemeral and permanent gully erosion, soil surface mapping) and imagery-collection strategies (aerial and ground-based surveys); and b) the design of full workflow strategies for a rigorous photogrammetric analysis involving existing FAS scripts and complementary in-house algorithms.