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Robust affine-invariant feature points matching for 3D surface reconstruction of complex landslide scenes

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Multi-view stereo surface reconstruction from dense terrestrial photographs is being increasingly applied for geoscience applications such as quantitative geomorphology, and a number of different software solution and processing streamlines have been suggested. For image matching, camera self-calibration and bundle block adjustment, most approaches make use of scale-invariant feature transform (SIFT) to identify homologous points in multiple images. SIFT-like point matching is robust to apparent translation, rotation, and scaling of objects in multiple viewing geometries but the number of correctly identified matching points typically declines drastically with increasing angles between the viewpoints.

For the application of multi-view stereo of complex landslide scenes, the viewing geometry is often constrained by the local topography and barriers such as rocks and vegetation occluding the target. Under such conditions it is not uncommon to encounter view angle differences of > 30% that hinder the image matching and eventually prohibit the joint estimation of the camera parameters from all views.

Recently an affine invariant extension of the SIFT detector (ASIFT) has been demonstrated to provide more robust matches when large view-angle differences become an issue. In this study the ASIFT detector was adopted to detect homologous points in terrestrial photographs preceding 3D reconstruction of different parts (main scarp, toe) of the Super-Sauze landslide (Southern French Alps). 3D surface models for different time periods and different parts of the landslide were derived using the multi-view stereo framework implemented in MicMac (©IGN). The obtained 3D models were compared with reconstructions using the traditional SIFT detectors as well as alternative structure-from-motion implementations. An estimate of the absolute accuracy of the photogrammetric models was obtained through co-registration and comparison with high-resolution terrestrial LiDAR scans.