Visualisation of landslide deformation directions using range flow motion constraint applied on LiDAR data

GHUFFAR, S.[1], SZÉKELY, B.[1,2], PFEIFER, N.[1] & RONCAT, A.[1]
[1] Institute of Photogrammetry and Remote Sensing, Vienna University of Technology, Vienna, Austria
[2] Department of Geophysics and Space Sciences, Eötvös University, Budapest, Hungary

As in many environmental applications the change monitoring of the geomorphic surface is important on various timescales. Increased or sudden erosion (e.g. gully head retreat), sedimentation and, especially mass movements are important not only from the point of view of surface processes, but they may have severe impact on human environment or, in extreme cases they may even endanger property or human lives. The latter possibility verifies the efforts invested in change detection, and prediction of estimations on rates of such processes. For the study of a landslide spatially and temporally resolved analysis is required. Because of the ability to derive dense flow fields, the range flow algorithm developed in the computer vision industry was tested for our study area situated at Doren (Vorarlberg, Austria). Several epochs of airborne and terrestrial laser scanning data were available, of which the 3D velocity fields of a moving surface has been computed using the range flow algorithm. The surface of the landslide (the DTM) is a function of the spatial location and time. If the determination of the local velocities is successful, a vector field is resulted with the 3D motion rates. At some places the determination of 3D velocities cannot be performed; these problematic areas originate as a result of vegetation filtering, large deformation of the surface, erosion and artificial roughness caused by human activity. It is essential that these areas are automatically identified and filtered out to avoid the computation of erroneous flow vectors. The accuracy of the unknowns gives the quality of velocity estimates from least squares solution. An empirically determined threshold is used to check for these areas.
The results for certain, vegetation-free areas are very inspiring: both the horizontal and vertical vector maps seem to be reliable. However, in some cases the aforementioned factors hampered the determination of the vectors with the required accuracy.
SG received support from the Doctoral College on Computational Perception at Vienna University of Technology, Austria, AR from Karl Neumaier PhD scholarship. TLS data acquisition has been supported by the Austrian Academy of Sciences (ÖAW).