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Methodology for rockfall activity identification and Machine Learning classification based on Point Clouds monitoring in Montserrat Massif (Spain)

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In recent years, different techniques and devices (LIDAR, photogrammetry, UAVs or hyperspectral sensors...) have been used to acquire large amounts of data for the study of the earth's surface offering high temporal, spatial and spectral resolutions. However, a problem lies on the availability of an efficient methodology to extract the desired information with geological signification from these large datasets. Minimal intervention of the experienced users and automatic or semi-automatic data processing are mandatory to avoid dilatory processes and to obtain productive results.

Our aim is to develop a new methodology for the identification and classification of changes in the surface of cliffs from consecutive point clouds. The new algorithms implemented recognize the different orientations of the point cloud and then, compare each point respect to a previous one in the normal direction isolating clusters of displaced points. Thereafter, these clusters of points are classified according to geometrical and raw data parameters in a) rockfalls, b) small movements of the rock surface and c) non-interest clusters of vegetation or noise like edge effects. The methodology is focused on creating more geometrical features which serve as criteria to identify and classify the differences between two point clouds. Actually, the number of clusters remains slightly high for manual processing. In this regard, the aim is to minimize the interaction of the user and take advantage of the large volume of data generated from high temporal resolution associated with the monitoring. The high number of events collected along years of monitoring allows the use of Machine Learning techniques to improve the classification of clusters automatically.

Montserrat Massif (Catalonia, Spain) is a singular case study of rockfall risk to apply the developed methodology due to the high presence of visitors, whose security conflicts with natural heritage preservation. For a correct design of infrastructures protection measures, a rockfall monitoring

plan is under development including Terrestrial Laser Scanner from 2007.

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