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## **A new method for geomorphological studies and territorial classification also using Machine Learning techniques**

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Processing high-resolution aerial images is key to territorial mapping and change detection analysis in hydro-geomorphological high-risk areas. Aiming this goals, an original photogrammetric workflow based on Structure from Motion (SfM) algorithm and on a Free Open-Source Software FOSS (MicMac, GDAL and Orfeo ToolBox libraries) has been developed in the context of Close to the Earth and RPASInAir projects. For this study two datasets made of 1139 and 2190 image sequences respectively were chosen. The images were captured exploiting UAVs (Unmanned Aerial Vehicles), very powerful tools which allow on-demand acquisition of high-resolution aerial images which turn to be very useful to identify and monitor active phenomena that results in topographic changes. The selected areas of interest are located along the hilly plain of the Basento river, in the Basilicata region of southeastern Italy.

The workflow optimization aims to extract the output (orthophotomosaic, point cloud and the Digital Surface Model (DSM) of the selected areas) minimizing the overall processing time at once. Very good results were obtained both using this new command configuration technique based on FOSS and exploiting the resources available at ReCaS-Bari data center. All the computing cluster configurations used for our study will be thoroughly presented.

The high quality of the image details can be used for territorial classification, extrapolating features useful to mitigate the hydro-geomorphological hazard, exploiting Machine Learning (ML) techniques. For this purpose several Neural Networks were trained using progressively more complex layer sequence configurations, and data augmentation methods. The ML results are given in terms of model accuracy and loss.

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