# Automated detection of palaeoearthquake event locations along fault scarps from surface roughness and texture analysis on Digitial Outcrop Models

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**Résumé**

Photogrammetry is a key technique for quantitative geomorphology as it provides high-resolution Digital Outcrop Model (DOM) at decametre to kilometre outcrop scales. By generating point clouds of fault scarps with associated RGB attributes, it is possible to have an accurate representation of the fault scarp roughness and texture. At this outcrop scale, a challenge is to unravel the successive portions exhumed by palaeoseismic events. Some authors proposed to delimit seismic events from DOMs using fractal dimension computation on surface roughness. In this work, we propose to use both the surface roughness and the texture. To our knowledge, no work relies on texture changes. In computer graphics, textural descriptors such as LBP (Local Binary Pattern) are used to exhibit texture changes in pictures. Therefore, the proposed approach combines the use of fractal dimension $d$ and LBP descriptor to delimit palaeoearthquake events from DOMs. The LBP descriptor is applied on different colour space components (e.g., RGB, Lab, HSV) to highlight particular differences of textures. By combining the descriptors with a Super-Pixel approach, as an image segmentation technique, it is possible to obtain a map of the different seismic events along the fault scarp. The proposed approach has been developed as a CloudCompare plugin and was applied onto active faults, located in the Apennines range in Italy and responsible of recent earthquakes (2016 seismic sequence). On this dataset, 16Cl geochemistry approaches were applied to determine the earthquake event locations and datations along a vertical 1D section of samples. By applying the proposed approach onto the same fault scarp, it was possible to exhibit the same seismic events than the geochemistry analysis, but the interest of the proposed numerical approach is to not only provide a 1D characterization of the seismic event but a 2D map of these events along the fault scarp surface.

**Mots-Clés:** Palaeoearthquake, seismic cyclicity, pattern recognition

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