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Video technologies to detect superficial movements of a landslide area

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The proposed paper describes an experiment devoted to check the performances of video technologies in order to measure movements of some peculiar and noticeable patches of a landslide area. Usual instrumentation which operates from fixed station often needs the installation of reference devices and allows the evaluation of only a limited number of points, which, moreover, must be accessible in order to place the reference devices. Video and image technologies are very challenging, because they allow non contact measurements. Up to now their greater drawback was the low resolution of the sensor and so the low accuracy in the motion evaluation. Present actual sensors reach a resolution of few microns, so the TV cameras can be equipped with proper lens in order to reach an accuracy in the measurements of few millimeters at a distance of two hundred meters. We checked the performances of a computer vision system built with a progressive BW camera, whose sensor has 6μm x 6μm pixel size, and a telelens of 300mm focal length. This set is able to detect motion of about 1 mm using artificial targets and motion of about 4 mm using simple natural targets.

The system uses natural and lighting invariant features as reference features to detect motion. These features have been detected analysing a large database of images collected at different daylight and weather conditions. Invariant patches have been used as token (models) to be tracked and measured along time. A particular attention have been paid to the model matching algorithm in order to overcome problems arising from different lighting conditions. Matches have been carried out on the edge points of the selected areas. A proper algorithm has been used which detects edge points with a subpixel accuracy. A model match algorithm is used to measure the horizontal and the vertical components of the possible motion. The system has been tested at the

Gardiola monitoring station (Val Germanasca) mainly to evaluate its performances according to the weather and lighting conditions. Since from August 2003 no movement of the checked point has been detected, a simulation of motion has been made on site placing a stone on a linear stage. Accurate motions have been applied and the corresponding shifts measured. Both artificial and natural features give good results which are comparable with those achievable by robotized total station. These results suggest to improve the system, providing the camera of pan & tilt motion in order to allow the exploration of larger area of the landslide.