Measuring the ground surface movements by applying the object based approach

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The landslide is a kind of natural disasters and usually causes the damages for the people living near the landslide regions. Detecting ground surface movements may be an important clue to locate the landslide regions. Particle image velocimetry (PIV), an approach to measure the temporal displacements of a patch by comparing the similarities of the same patch shown in temporal orthophotos, has been widely applied to identify the landslide regions. Sometimes, the ground movement information can provide the warning signal to those people living in the areas such that the damages caused by land sliding can be reduced. However, for those areas suffering from natural disasters (like earthquakes, typhoons), the topographical surfaces in those areas have massive changes such that the texture information collected by the different sensor is partly different. The ground movements measured by PIV are not reliable if those areas of topographical changes are included. The paper proposes to classify the topographical conditions into two classes: one class contains large topographical changes, and another one does have few topographic changes. The object-based approach is proposed to segment the whole image into several sub-regions, and for those segmented regions with similar properties, those segmented regions can be further merged. In doing so, different objects can be formed in temporal orthophotos. Those areas with large topographical changes can be identified by comparing the objects shown in temporal orthophotos. PIV is used to those regions with few topographical changes to accurately measure the ground movements. The villages located in the mountain regions are also monitored and extracted such the whole villages can be treated as objects. Those village objects are employed as templates, and with comparing the changes of the templates from temporal orthophotos, the translations, rotations and scales of the templates showing in orthophotos can be determined by employing the correlations among the templates by measuring the similarities. In doing so, the distorted information among temporal orthophotos can be identified, and with continuously comparing the differences of the distorted information, the warning of the landslide can be issued if the differences are larger over the pre-defined threshold to keep the safeties of the monitored villages. In Taiwan, Li-Shing estate road is a mountain road which is famous for its geological complexity, and instruments used to monitor the displacements are installed along the road. This paper used the temporal orthophotos covering the villages located along the road as an example to demonstrate the feasibility of the proposed approach. From the processed results, the proposed approach offers an economical way the monitor the ground movements of the mountain villages and those areas without people living.

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