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Potential Analysis of Rainfall-induced Sediment Disaster

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Most of the mountain regions in Taiwan are sedimentary and metamorphic rocks which are fragile and highly weathered. Severe erosion occurs due to intensive rainfall and rapid flow, the erosion is even worsen by frequent earthquakes and severely affects the stability of hillsides. Rivers are short and steep in Taiwan with large runoff differences in wet and dry seasons. Discharges respond rapidly with rainfall intensity and flood flows usually carry large amount of sediment. Because of the highly growth in economics and social change, the development in the slope land is inevitable in Taiwan. However, sediment disasters occur frequently in high and precipitous region during typhoon. To make the execution of the regulation of slope land development more efficiency, construction of evaluation model for sediment potential is very important.
In this study, the Genetic Adaptive Neural Network (GANN) was implemented in texture analysis techniques for the classification of satellite images of research region before and after typhoon or extreme rainfall and to obtain surface information and hazard log data. By using GANN weight analysis, factors, levels and probabilities of disaster of the research areas are presented. Then, through geographic information system the disaster potential map is plotted to distinguish high potential regions from low potential regions. Finally, the evaluation processes for sediment disaster after rainfall due to slope land use are established.
In this research, the automatic image classification and evaluation modules for sediment disaster after rainfall due to slope land disturbance and natural environment are established in MATLAB to avoid complexity and time of computation. After implementation of texture analysis techniques, the results show that the values of overall accuracy and coefficient of agreement of the time-saving image classification for different time periods are at intermediate-high level and above.
The results of GANN show that the weight of building density is the largest in all slope land disturbance factors, followed by road density, orchard density, baren land density, vegetation density, and farmland density. The weight of geology is the largest in all natural environment factors, followed by slope roughness, slope, and elevation. Overlaying the locations of large sediment disaster in the past on the potential map predicted by GANN, we found that most damage areas were in the region with medium-high or high potential of landslide. Therefore, the proposed potential model of sediment disaster can be used in practice.