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Construction of a Risk Assessment Model for Rainfall-Induced Landslides

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The unstable geology and steep terrain in the mountainous regions of Taiwan make these areas vulnerable to landslides and debris flow during typhoons and heavy rains. According to the Water Resources Agency, Ministry of Economic Affairs of Taiwan, there were 500 typhoons and over one thousand storms in Taiwan between 1897 and 2011. Natural disasters caused 3.5 billion USD of damage between 1983 and 2011. Thus, the construction of risk assessment model for landslides is essential to disaster prevention.

This study employed genetic adaptive neural networks (GANN) with texture analysis in the classification of high-resolution satellite images from which data related to surface conditions in mountainous areas of Taiwan were derived. Ten landslide hazard potential factors are included: slope, geology, elevation, distance from the fault, distance from water, terrain roughness, slope roughness, effective accumulated rainfall and developing situation. By using correlation test, GANN, weight analysis and dangerous value method, levels and probabilities of landslide of the research areas are presented. Then, through geographic information system the landslide potential map is plotted to distinguish high potential regions from low potential regions. Through field surveys, interviews with district officials and a review of relevant literature, the probability of a sediment disaster was estimated as well as the vulnerability of the villages concerned and the degree to which these villages were prepared, to construct a risk evaluation model. The regional risk map was plotted with the help of GIS and the landslide assessment model. The risk assessment model can be used by authorities to make provisions for high-risk areas, to reduce the number of casualties and social costs of sediment disasters.