The Assessment of Rainfall-induced Landslides Using Data Mining Techniques for Remote Mountainous Areas in Southern Taiwan

Yie-Ruey Chen (1), Chwen-Ming Chang (2), Yao-Lin Wang (3), Kuang-Jung Tsai (3), Shun-Chieh Hsieh (3), and Yi-Ching Lu (3)

(1) Department of Land Management and Development, Chang Jung Christian University, Tainan, Taiwan. (yrchen@mail.cjcu.edu.tw), (2) Department of Business Administration, Chang Jung Christian University, Tainan, Taiwan., (3) Department of Land Management and Development, Chang Jung Christian University, Tainan, Taiwan.

Three-quarters of Taiwan are slopes. Located at the boundary between Philippine Sea Plate and Eurasian Plate, Taiwan is subject to frequent seismic activity. Furthermore, the ongoing movement of flat terrain has caused a surge of slope development in recent years. Besides the global impact of extreme weather, typhoons and heavy rains have induced the landslide disasters and leaded to human causalities and property losses in Taiwan. With the advance of science and technology, massive volume of data is available nowadays. However, the data has become too large or complex for traditional statistical approaches to deal with. Accordingly, this research performs the assessment of rainfall-induced landslides using data mining techniques.

This study focused on the landslides of remote mountainous areas in southern Taiwan caused by typhoons from 2009 to 2013. Years of records such as landslide locations and land use changes in multi-year and multi-rainfall events were collected based on the classifications and interpretations of 20 satellite images via image texture analysis. Datasets of natural environment, land cover, and rainfall predisposing factors were constructed under the platform of geographic information system. Random Forrest, Classification and Regression Tree, and Classification and Regression Tree with Artificial Bee Colony were employed to develop the potential landslide assessment model. Variances, differences, and trends of influence factors of slope land disaster were explored as well. Potential Maps of rainfall-induced landslides were generated regarding rainfall intensity. Finally, the receiver operating characteristic curve and historical disaster locations were used to verify the assessment effectiveness of rainfall-induced landslides.

This study shows that our satellite image classifications reach a high degree of uniformity. The parameters in our data mining techniques are suitably modified to raise landslide producer accuracy and value of area under curve. Rainfall, slope, distance from water, density of bare land, and forest are the main disaster factors inducing landslides. Our results can provide government a basis to develop landslide hazard prevention and control programs in remote mountainous areas to help disaster prevention and resilience, especially in southern Taiwan.