

Novel machine learning ensemble approach for landslide prediction

C. N. Madawala
Department of Computing and
Information Systems,
Sabaragamuwa University, Sri Lanka
cnmadawala@std.appsc.sab.ac.lk

B. T. G. S. Kumara
Department of Computing and
Information Systems,
Sabaragamuwa University, Sri Lanka
btgsk2000@gmail.com

L. Indrathilaka
National Research Building
Organization, Sri Lanka.
laksiriindrathilaka@gmail.com

Abstract

Haphazard development activities on mountain slopes and inadequate attention to construction aspects have led to the increase of landslides and consequently sustaining damage to lives and infrastructure. Nearly 3275 sq.km of area spread over the Ratnapura District, seems to be highly prone to landslides and mass wastage of 2178 sq.km. Landslides occur in many regions of Ratnapura district and nearly 90 deaths have been reported according to National Research Building Organization (NBRO) in 2017. Most landslides or potential failures could be predicted fairly accurately if proper investigations were performed in time. The primary objective of this study is landslide-hazard mapping and risk evaluation to determine the real extent, timing, and severity of landslide processes in Ratnapura district. Such knowledge will provide the most significant benefit to government officials, consulting engineering firms, and the general public in avoiding the landslide hazard or in mitigating the losses. Hybrid Machine Learning techniques can be used to develop prediction models using existing data. Ensemble approach based on Support Vector Machine (SVM), Naïve Bayes model were combined and implemented for the final prediction. This study possesses a strong capability to predict landslides by causative factors, slope, land use, elevation, geology, soil materials and triggering factor; rainfall was extracted and applied to the machine learning algorithms. This research introduces a novel architecture to produce a more relevant and accurate prediction of the landslide vulnerability within the study area. Moreover, it was revealed that all of the factors had relatively positive relationship with occurrence of landslides. An improvement in hazard monitoring, accuracy of early warning and disaster mitigation is documented.

Keywords: Landslide, Support Vector Machine (SVM), Naïve Bayes, Hydrological, Rainfall