A MACHINE LEARNING APPROACH FOR LANDSLIDE SUSCEPTIBILITY MODELING FOR RATHNAPURA DISTRICT, SRI LANKA

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Degree of Master of Science

Department of Computer Science and Engineering

University of Moratuwa
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Dissertation submitted in partial fulfillment of the requirements for the degree Master of Science in Computer Science

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DECLARATION OF THE CANDIDATE & SUPERVISOR

M.A.S Perera (189339R) hereby declare that this report was carried out by me under the supervision of Dr. Uthayasanker Thayasivam, in the Department of Computer Science and Engineering, University of Moratuwa. It has not been submitted to any other institution or study program by me for any other purpose.

UOM Verified Signature

14/11/2021

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M.A.S Perera

Date

I, Dr. Uthayasanker Thayasivam, certify that the above declaration made by the candidate is true & this report is forwarded for the purpose of evaluation.

UOM Verified Signature

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Abstract

In certain areas of the world, landslides are the most common and recurrent natural hazard, resulting in substantial human deaths and property damage. Landslides are extremely common in Sri Lanka, with landslides affecting approximately 30.7%of the country's land area. As the demand for human growth has increased, landslides have become a major problem in Sri Lanka's mountainous regions. As a result, detecting landslide potential associated with terrain data and remote sensing data is crucial for ensuring the long-term viability of projects while minimizing the risk of landslide disasters.

The aim of this study is to develop a susceptibility map for Sri Lanka using a novel data science approach. This study has been used the Rathnapura district in Sri Lanka as the study area. In this study, five ensemble machine learning algorithms: Random Forest, Bagged Decision Tree, AdaBoost, XGBoost, and Gradient Boost were used for landslide prediction and landslide susceptibility map modeling. Using the K-Means clustering algorithm, the class probability values from ensemble-based machine learning algorithms were used to reclassify the study area into susceptibility levels: Extreme Low (EL), Low (L), Moderate (M), High (H), Very High (VH), and Extreme High (EH). In addition, landslide susceptibility maps were generated using the Frequency Ratio technique. The Landslide Susceptibility Index (LSI) was generated using the Frequency Ratio values. The study area was then categorized into six landslide susceptibility classes based on the LSI value: Extreme Low, Low, Moderate, High, Very High, and Very High.

The F-Score, Accuracy, Precision, and Recall values were used to evaluate the landslide prediction results, while the Landslide Density value was used to evaluate the LSMs. Finally, a web application was developed to visualize landslide susceptibility maps, landslide locations, and landslide conditioning factor maps.

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