Identification of Flood Risk Areas using Artificial Neural Network: A Case Study of Rathnapura District in Sri Lanka

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Floods, among other natural disasters, pose severe threats to lives and properties. Accurate prediction and assessment are paramount for effective mitigation. Conventional flood risk mapping often involves resource-intensive field data collection, incorporating topographic, hydrologic, and meteorological data. However, these methods lack the capacity to predict flood probabilities based on various rainfall scenarios. This study explores the application of machine learning techniques to address these limitations, focusing on flood risk assessment of Ratnapura district in Sri Lanka. By leveraging a diverse dataset encompassing flood records, rainfall data, and satellite imagery sourced from institutions such as the Disaster Management Center and meteorological observations, we trained a neural network using Python. The network was executed on cloud computing platforms, Google Colaboratory, and Google Earth Engine. The results of this research exhibit considerable promise. The neural network achieved a test accuracy of 0.7667, indicating its potential for accurate flood probability predictions following training. Feature importance analysis revealed rainfall as the most influential factor in predicting flood probabilities, with a relative importance of 0.191. Other contributors included the normalized difference built-up index (ndbi), clay content, elevation, slope, and drainage density, each playing a significant role in the predictive model. Additionally, a positive linear relationship between build-up areas and flood probability was observed. Nonetheless, it is imperative to recognize that the limited availability of flood and rainfall data may affect the model's overall accuracy. Despite this limitation, our study demonstrates the potential for machine learning to significantly enhance flood risk assessment. This research serves as a valuable step towards more precise and efficient natural disaster mitigation strategies in the Ratnapura district and beyond, ultimately contributing to the safeguarding of lives and property in flood-prone areas.

Keywords: *Flood risk assessment, Machine learning, Natural disaster Mitigation, Neural network, Remote sensing*