Chapter 9
Machine Learning Algorithms for Natural Disasters

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ABSTRACT

Natural disasters require quick and precise reactions for preparedness, mitigation, and response activities because they pose serious risks to infrastructure, human lives, and the environment. The incorporation of machine learning (ML) algorithms has become a viable strategy to improve natural disaster management in a number of ways in recent years. Early warning systems and risk assessment frameworks are made possible by predictive models that are able to identify patterns, anomalies, and risk factors from a variety of data sources thanks to techniques like supervised learning, unsupervised learning, and deep learning. The application of machine learning algorithms to natural disaster management poses a number of issues and concerns, notwithstanding its potential advantages. By combining various data sources, sophisticated analytics, and real-time decision support systems, machine learning (ML) algorithms enable stakeholders to more effectively and resiliently prepare for, mitigate, and respond to natural catastrophes.

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1. NATURAL DISASTER

A natural disaster is a massive, frequently disastrous event brought on by natural processes that seriously disturbs ecosystems, human settlements, and the environment. These occurrences, which include a variety of catastrophes that appear abruptly and have tremendously devastating power, are caused by forces without human control. Natural disasters can take many different forms, including landslides, droughts, volcanic eruptions, storms, floods, tornadoes, wildfires, and intense heatwaves.

According to (Kathiresan, C., & Sayana, V. B. M., 2023) human activity or natural disasters are the main causes of flooding. Several flood management techniques can either prevent or lessen the effects of flooding. In order to help with flood control, advanced techniques such as image processing and machine learning have been applied. Their study is focused on using machine learning for flood control in disaster management. Satellite image processing can be used to gather and evaluate data, which aids in the analysis of data to take action against flood management. Change Detection is the method employed in this machine learning process. This technology reduces the risk of flooding, offers hope for the detection of flood nuisances, and uses satellite photography to help with transportation and infrastructure planning and design.

The seismic energy of the Earth is released during earthquakes, which can result in tsunamis and ground trembling. Strong tropical storms with strong winds, copious amounts of rain, and storm surges are produced by hurricanes, typhoons, and cyclones. When water levels rise above average, towns and landscapes are submerged under floodwaters. Tornadoes are violent, whirling columns of air that have the ability to destroy entire areas. Volcanic eruptions affect the areas around them by ejecting gasses, ash, and molten lava. Uncontrollably spreading through the vegetation, wildfires are frequently made worse by dry weather. Long stretches of insufficient precipitation cause droughts, which cause problems for agriculture and a shortage of water. Rock and earth flow quickly down slopes in landslides.

According to Manral and Chaudhary (2023), earthquakes are among the most catastrophic natural disasters that can result in significant damage to infrastructure and casualties. It might be extremely important to identify earthquakes early in order to reduce damage and save lives. With the use of machine learning, which is a potent technology, earthquakes can be predicted using previous seismic data together with other geographic information. The feasibility of utilizing machine learning techniques, particularly the Random Forest regressor and Neural Network Model, to forecast earthquakes is investigated in this paper. Their research aims to forecast earthquake depth and size by utilizing time, location, and historical seismic activity data.