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Maharashtra's Climate and Environmental Analysis on Monsoon, Cyclone, Floods, and Earthquakes using Random Forest and LSTM

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Abstract: *Natural and human-induced disasters cause significant socio-economic and environmental harm, making accurate forecasting and efficient risk management essential. Traditional disaster prediction models often rely on statistical techniques, which struggle to capture the complex and nonlinear patterns within large datasets. However, advancements in machine learning (ML) and deep learning (DL) have enhanced disaster analysis by utilizing both historical and real-time data.*

This research introduces a hybrid model combining Random Forest (RF) and Long Short-Term Memory (LSTM) networks to improve disaster prediction and management. The RF algorithm, an ensemble learning technique, is used for selecting key features and classifying regions based on disaster vulnerability. Meanwhile, LSTM, a type of recurrent neural network, is employed for time-series forecasting of disaster events. By integrating these models, the system effectively analyses large datasets, leading to improved predictive accuracy and better decision-making.

The model's performance was evaluated using historical data on monsoons, cyclones, floods, and earthquakes in Maharashtra, India. Results show that the RF-LSTM hybrid model outperforms traditional ML and statistical approaches in identifying high-risk areas and forecasting disaster trends. The findings suggest that this approach enhances early warning systems, optimizes resource allocation, and strengthens disaster mitigation strategies.

This study contributes to AI-driven disaster management by presenting a scalable and efficient framework for analysing and predicting disaster patterns. The insights gained can assist policymakers, emergency responders, and disaster management agencies in implementing proactive risk reduction measures. Future research will focus on deploying the model in real-time environments, integrating it with IoT-based disaster monitoring systems, and optimizing it for large-scale disaster datasets..

Keywords: Disaster Management, Machine Learning, Deep Learning, Random Forest, LSTM, Time-Series Prediction, Risk Assessment, Early Warning Systems unforeseen..

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