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Enhancing Rainfall Forecasting Accuracy: A Review of Current Models and Parameters

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Abstract

Rainfall plays a vital role in agriculture, water management, and disaster preparedness, yet accurate prediction remains a challenge due to the complex and non-linear nature of weather patterns. Traditional models like ARIMA and MLR often fail to address these complexities, while machine learning models, such as Random Forest and LSTM networks, offer higher accuracy but require extensive datasets and computational resources. This review identifies key models and parameters for rainfall forecasting and explores strategies to enhance prediction precision. Through a systematic review of studies from IEEE, ScienceDirect, Springer, and MDPI, models like stacking ensemble learning, LSTM, and ARIMA were analysed, alongside critical parameters such as temperature, humidity, and wind patterns. Techniques like particle swarm optimization and fuzzy rules were also reviewed for their ability to improve performance. Findings reveal that LSTM networks achieve the highest accuracy, up to 94%, effectively capturing long-term dependencies in weather data, while hybrid models combining traditional and machine learning methods address individual model limitations. This study emphasizes the need for scalable frameworks that integrate real-time data and diverse parameters to reduce forecast errors, offering reliable solutions for practical applications in weather-dependent sectors.

Keywords: *Rainfall, Prediction models, Forecasting parameters, ARIMA, Weather prediction.*