

Machine Learning-Based Rainfall Prediction: Unveiling Insights and Forecasting for Improved Preparedness

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Abstract:

Rainfall prediction plays a crucial role in raising awareness about potential risks associated with rain and enabling individuals to take proactive measures for their safety. Accurate rainfall forecasting mitigates the adverse effects of extreme weather events such as floods and droughts, which significantly impact both rural and urban communities. The complex nature of rainfall, influenced by various atmospheric, oceanic, and geographical factors, makes it a challenging phenomenon to forecast. To address these challenges, machine learning algorithms, including Naive Bayes, Decision Tree, Support Vector Machine, Random Forest, and Logistic Regression and Artificial Neural Network (ANN) are employed to develop accurate rainfall prediction models,. These models undergo testing using an Australian weather dataset, with data preprocessing techniques such as handling missing data, detecting outliers, performing correlation analysis, and selecting relevant features to enhance performance. Additionally, K-means clustering and Principal Component Analysis (PCA) analyze regional rainfall patterns and reduce data complexity, uncovering hidden insights not easily identifiable through traditional methods. To make these machine learning techniques accessible and practical for everyday use, a user-friendly web-based application system is developed using Flask, enabling real-time rainfall predictions and empowering individuals to assess weather risks effectively. This integration of advanced data preprocessing, machine learning, and clustering techniques demonstrates a comprehensive approach to rainfall forecasting, promoting proactive disaster preparedness and resilience in the face of extreme weather events.

Keywords: Rainfall prediction, Machine learning, Feature selection, Artificial Neural Network (ANN), k-means clustering, Principal Component Analysis (PCA), Australian weather data, Web-based application (Flask)

References:

<https://ieeexplore.ieee.org/document/10320349>

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(Guide)