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AI-Powered Community Flood Forecasting in Coastal Senegal: A Methodological Approach

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Abstract

Coastal communities in Senegal are vulnerable to frequent floods, threatening their livelihoods and infrastructure. Traditional forecasting methods have limitations in providing timely and accurate warnings. A hybrid machine learning model was employed, integrating a recurrent neural network (RNN) with Bayesian inference. The RNN was trained on historical precipitation data and extreme weather indices to predict flood onset times. Uncertainty quantification through likelihood-based methods provided robust confidence intervals for forecasts. The AI system successfully predicted flood events with an accuracy rate of 85%, achieving a mean absolute error (MAE) within ±1 day, indicating precise timing predictions essential for community response planning. This study demonstrates the efficacy of integrating advanced AI techniques into traditional forecasting methodologies to improve flood warning systems in coastal regions. Implementation of this system should be prioritised by local authorities and international development partners to ensure timely warnings reach vulnerable communities, thereby reducing flood-related damages and casualties. AI-Powered Forecasting, Coastal Senegal, Community Flood Warning System, Machine Learning, Bayesian Inference The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geographical Information Systems, Geographic Information System, Remote Sensing, Ensemble Forecasting, Machine Learning Models, Spatial Analysis, Predictive Analytics*

ABSTRACT-ONLY PUBLICATION

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