Machine Learning Models for Climate Prediction and Adaptation in Uganda Context

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Abstract

Climate change poses significant challenges for agricultural productivity in Uganda, where smallholder farmers are particularly vulnerable to unpredictable weather patterns. A comparative analysis was conducted using Random Forest and Support Vector Machine (SVM) models for climate prediction in Uganda's AEZs. Model performance was evaluated based on Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R-squared values. Data from the National Agricultural Information Service (NAIS) were used, covering a period of 20 years. Random Forest models exhibited lower MAE (1.5%) compared to SVM (3.0%), indicating superior predictive accuracy for climate conditions in AEZs. The study identified maize suitability zones based on soil moisture availability and rainfall patterns. The Random Forest model outperformed the SVM, demonstrating its potential as a robust tool for climate prediction and adaptation planning in Uganda's agricultural context. Further research should explore the integration of machine learning models with socio-economic data to inform farmers' decision-making processes. Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Uganda, Geographic Information Systems (GIS), Remote Sensing, Ensemble Forecasting, Climate Modelling, Data Mining, Predictive Analytics*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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