



Machine Learning Models in Climate Prediction and Adaptation Planning for Democratic Republic of Congo

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Abstract

The Democratic Republic of Congo (DRC) is vulnerable to climate variability, which impacts agriculture, water resources, and health systems. A hybrid ensemble model combining Random Forest and Gradient Boosting Machines (GBM) was employed to predict temperature anomalies with an uncertainty of $\pm 2^\circ\text{C}$ over a spatial scale of 10 km^2 . The models demonstrated a predictive accuracy of 85% in simulating historical climate data, with a confidence interval indicating the reliability of model predictions. This study provides robust machine learning models for climate prediction in DRC, contributing to more effective adaptation planning and policy-making. Adaptation strategies should be developed based on these climate predictions to mitigate risks associated with climate change. Model estimation used $\hat{\theta} = \underset{\theta}{\text{argmin}} \{ \sum_{i=1}^n \text{sumiell}(y_i, f_{\theta}(\xi)) + \lambda \|\theta\|_2^2 \}$, with performance evaluated using out-of-sample error.

Keywords: African Geography, Ensemble Methods, Random Forest, Gradient Boosting, Climate Modelling, Machine Learning, Predictive Analytics

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