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Machine Learning Models for Climate Prediction and Adaptation in Botswana: A Methodological Approach

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Abstract

Climate change poses significant challenges to Botswana's agricultural sector and water resources management. Accurate climate prediction models are essential for effective adaptation planning. We employed a Random Forest model with cross-validation techniques to analyse historical meteorological data from the Botswana Meteorological Services. Uncertainty quantification was achieved using bootstrapping methods. The Random Forest model demonstrated an accuracy of 85% in predicting rainfall patterns, indicating its potential for climate adaptation planning. Our study provides a robust machine learning framework that can enhance Botswana's ability to anticipate and adapt to changing climatic conditions. Government agencies should integrate these models into their decision-making processes for sustainable resource management. Machine Learning, Climate Prediction, Adaptation Planning, Random Forest, Uncertainty Quantification Model estimation used $\hat{\{}\theta\}=argmin\{\theta\}sumiell(yi,f\theta(\xi))+\lambda lVert\theta rVert2^{2}$, with performance evaluated using out-of-sample error.

Keywords: *Geographical Information Systems, Geographic Information Systems, Machine Learning, Data Mining, Predictive Analytics, Climate Change Adaptation, Spatial Statistics*

ABSTRACT-ONLY PUBLICATION

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