



Machine Learning Models for Climate Prediction and Adaptation in South Africa

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Abstract

Climate change poses significant challenges to South Africa's agricultural productivity and infrastructure resilience. A hybrid ensemble of Random Forest and Support Vector Machines (SVM) was trained on historical climate data from the South African Weather Service. The ensemble model achieved an accuracy rate of 78% in predicting temperature anomalies across different regions, with a confidence interval indicating robust reliability. Machine learning models can significantly enhance climate prediction capabilities for South Africa's adaptation strategies. Adopted models should be integrated into government planning frameworks and shared among stakeholders to maximise impact. Climate Prediction, Machine Learning, Ensemble Models, South Africa Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \sum_{i=1}^n \ell(y_i, f_{\theta}(\xi_i)) + \lambda \|\theta\|_2^2 \}$, with performance evaluated using out-of-sample error.

Keywords: *African Geography, Climate Change, Ensemble Learning, Machine Learning, Random Forest, Support Vector Machines, Weather Forecasting*

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