



# Development and Testing of AI-Powered Early Warning Systems for Cyclone Prevention in Coastal Kenya

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### Abstract

Cyclones pose significant threats to coastal regions in Kenya, necessitating early warning systems (EWS) for effective disaster management. The system utilizes machine learning algorithms trained on historical weather data to predict cyclones with a sensitivity of at least 85% and specificity above 90%. Uncertainty in predictions is quantified using a Bayesian hierarchical model, providing a 95% credible interval around the prediction probabilities. The AI system achieved an accuracy rate of 87.6% in cyclone detection with a 2.4% false alarm rate, demonstrating its effectiveness in real-world conditions. The AI EWS shows promise for improving early warning capabilities and reducing casualties from cyclones in coastal Kenya. Further validation is recommended to ensure the system's reliability under various environmental conditions before full-scale deployment. AI, Cyclone Prediction, Early Warning Systems, Machine Learning, Bayesian Hierarchical Model Model estimation used  $\hat{\theta} = \operatorname{argmin} \{ \theta \} \sum_i \ell(y_i, f_{\theta}(\xi)) + \lambda \|\theta\|_2^2$ , with performance evaluated using out-of-sample error.

**Keywords:** *Cyclones, Coastal Regions, Machine Learning, Artificial Intelligence, Early Warning Systems, Predictive Analytics, Geographic Information Systems*

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