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AI-Powered Early Warning Systems for Flooding in Northern Ghana: Development and Evaluation

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Abstract

AI-powered early warning systems (EWS) have shown promise in reducing flood-related disasters globally. In northern Ghana, flooding is a recurrent challenge affecting communities' livelihoods and infrastructure. The methodology involved collecting historical meteorological data from multiple sources, applying machine learning algorithms to predict flood occurrences, and conducting user acceptance testing (UAT) with local communities. An accuracy rate of 85% was achieved in model predictions, indicating a significant improvement over traditional EWS methods. User feedback highlighted the system's real-time alerts as highly beneficial for evacuation planning. The AI-based early warning system demonstrates potential as an effective tool for mitigating flooding risks in northern Ghana, particularly when integrated with community engagement strategies. Communities and local authorities should be involved in system design and maintenance to maximise user satisfaction and operational efficiency. Further research is recommended to validate these findings across different flood-prone regions. AI early warning systems, machine learning, meteorological data, user acceptance testing, northern Ghana 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: *Sub-Saharan, GIS-based, machine learning, predictive modelling, spatial analysis, environmental informatics, sustainability assessment*

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