

Title: SAR-driven flood inventory and multi-factor ensemble susceptibility modelling using machine learning frameworks

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Abstract: Climate change has substantially increased both the occurrenceand intensity of flood events, particularly in the Indian subcontin-ent, exacerbating threats to human populations and economicinfrastructure. The present research employed novel ML models—LR, SVM, RF, XGBoost, DNN, and Stacking Ensemble—developedin the Python environment and leveraged 18 flood-influencingfactors to delineate flood-prone areas with precision. A compre-hensive flood inventory, obtained from Sentinel-1 SyntheticAperture Radar (SAR) data using the Google Earth Engine (GEE)platform, provided empirical data for entire model training andvalidation. Model performance was assessed using precision,recall, F1-score, accuracy, and ROC-AUC metrics. The results high-lighted Stacking Ensemble’s superior predictive ability (0.965), fol-lowed closely by, XGBoost (0.934), DNN (0.929), RF (0.925), LR(0.921), and SVM (0.920) respectively, establishing the feasibility ofML applications in disaster management. The maps depicting sus-ceptibility to flooding generated by the current research provideactionable insights for decision-makers, city planners, and author-ities responsible for disaster management, guiding infrastructuraland community resilience enhancements against flood risks

Keywords: Disaster management Flood susceptibility Google Earth Engine Machine learning Python

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