Predicting Floods using Machine Learning and GIS, Case study of Greater Accra

Michael Nyoagbe^{1*} and John Ayer²

¹Department of GIS and Hydraulics Network Modeling Unit, Ghana Water Limited, Accra, Ghana ²Department of Geomatic Engineering, KNUST, PMB Kumasi, Ghana. *Michael Nyoagbe : Michael.nyoagbe@gmail.com

Keywords: Floods, Flood Risk, Geographic Information Systems (GIS), Machine Learning (ML), Rainfall Runoff

ABSTRACT

Floods in the Greater Accra Region of Ghana occur on an annual basis, causing havoc and the loss of lives. Flooding is considered one of the most destructive natural hazards. One of the most devastating natural disasters is flooding. One reliable method of minimizing the impact of these occurrences on people and property is to predict them. In order to identify the locations that are susceptible to flooding and/or affected by it, this study created a prediction model for extreme floods utilizing a GIS and an artificial neural network. Additionally, it evaluated how well a few flood models performed in the Greater Accra Region. In order to predict floods in the study area, a Geographic Information System (GIS) and a machine learning technique (Long Short-Term Memory (LSTM)) using an Analytic Hierarchy Process (AHP) based on a multicriteria approach were used. These factors included distance to the river, Land Use Land Cover (LULC), lithology, drainage density, soil classes, rainfall, elevation, slope, and rainfall-runoff modeling. The model's output was verified by mapped historical floods. According to the model's results, flash floods could be predicted with great accuracy, and it was possible to geospatially identify flood-prone areas with an 80% accuracy rate. Additionally, it showed the several flood risk zones (high, medium, and low). The early warning system was highly sensitive since the rainfall prediction produced a correlation figure of 0.953, which was regarded as an excellent correlation between the prediction model. By taking into account data from more rainfall stations and shorter rainfall periods, the model could be enhanced for flood prediction.

Predicting Floods using Machine Learning and GIS, Case study of Greater Accra Michael Nyoagbe 1* and John Ayer 2

¹Department of Technology and Innovations, Ghana Water Limited, Accra, Ghana ²Department of Geomatic Engineering, KNUST, PMB Kumasi, Ghana.

GGS conference 2024. Geospatial Excellence for Digital Growth: Fostering Innovation and Collaboration to Unlock Ghana's Potential Accra, Ghana, 28-29 November, M.T. Addico Conference Hall, Ghana Shippers' Authority