

# **GIS-Based Automated Flood Forecast Modelling Application Using Climatic Data in Daduru Oya River Basin**

M. N. L. Bandara

189464U

Faculty of Information Technology

University of Moratuwa

Sri Lanka

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M. N. L. Bandara

189464U

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## **Declaration**

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

Name of Student

Signature of Student

M. N. L. Bandara

.....

Date:

Supervised by:

Name of Supervisor

Signature of Supervisor

Professor H. M. R. Premasiri

.....

Date:

Mr. B. H. Sudhantha

.....

Date:

## **Dedication**

To my loving parents for being the guiding light that illuminate the path of knowledge throughout my life.

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## **Abstract**

Flood is the most common and deadliest form of disaster that affects lives and properties all around the world. Predicting natural disasters is very complex due to lack of proper methods and resources in countries like Sri Lanka. But if there is an efficient prediction system it helps to save not only lives but the environment and infrastructure too. Therefore, the aim of this study is to pave the pathway to build an efficient and effective flood prediction system through analysing available flood modelling techniques and their applications to find their strengths and weaknesses. Then the result of the study could be used to put the foundation for the main requirement of building the system to predict natural disasters. To achieve this the GIS technology, Big data analytic and IoT with machine learning techniques, two-dimensional hydrodynamic flood models, statistical models, rainfall-runoff models, Fuzzy-neuro approach and data mining and data analysis applications were analysed by a thorough review of available recent literature.

A generic model was developed to take any DEM data and a pour point feature class layer for the specific DEM to generate outputs based on other variable that could input to the model. It gave model calibration capability as well as significant time saving on tasks. Use of special tools like 'Parse Path' tool, gave the capability to name outputs easily and quickly. And it also made saving so efficient because it automatically saves all the results to the file path of the DEM. Due to these factors, when it starts raining in upper catchment area, could forecast due inundation area in minutes.

Including the GIS technology could improve the data quality and availability while incorporating different data sources for more in-depth analysis could give more accurate predictions. Using GIS based hydrological model, a suitable system to implement in Sri Lanka could be developed.

## Abbreviations

2D – Two Dimensional

3D – Three Dimensional

AI - Artificial Intelligence

ANN - Artificial Neural Networks

API - Application Programming Interface

AWS - Automatic Weather Stations

CDMA - Code Division Multiple Access

CEB - Ceylon Electricity Board

CNN - Convolutional Neural Network

CRML - Convolution Regression based on Machine Learning

DDMCU - District Disaster Management Coordinating Units

DEM – Digital Elevation Model

DMC - Disaster Management Centre

DSTA - Dynamic Spatiotemporal Attention

ELM - Extreme Learning Machine

GIS – Geographical Information Systems

GUH - Geomorphologic Unit Hydrograph

GWO - Grey Wolf Optimizer

HEC-HMS - Hydrologic Engineering Centre's-Hydrologic Modelling System

HEC-RAS – Hydrologic Engineering Centre's-River Analysis System

HMM – Hidden Markov Model

ID – Irrigation Department

KNN - K-Nearest Neighbour

LSTM - Long Short-Term Memory

MAE - Mean Absolute Error

MAPE - Mean Absolute Percentage Error

MASL - Mahaweli Authority Sri Lanka

ML – Machine Learning



MWOA - Mutated Whale Optimization Algorithm  
NBRO - National Building Research Organisation  
NCDM - National Council for Disaster Management  
RH - Relative Humidity  
RMSE - Root Mean Square Error  
RNN - Recurrent Neural Networks  
SVM – Support Vector Machine  
SWAT - Soil and Water Assessment Tool  
UH – Unit Hydrograph  
WMO – World Meteorological Organisation

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