Topic of Investigation: Predicting probable flood drivers based on historical records and watershed characteristics.

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Brief Background: Floods are one of the most common natural hazards in Canada, with substantial effects on both ecosystems and communities. Gaining insight into flood drivers and their regional variations is crucial for enhancing flood prediction and managing associated risks. This study aims to classify watersheds by driver types, such as snowmelt, intense rainfall, or ice jams, to better understand the distinct flood dynamics across Canadian watersheds [1]. The dataset utilized for this analysis includes 1,339 watersheds, each characterized by 43 environmental and hydrogeomorphological attributes, and identifies 12 distinct flood drivers.

Motivation: As climate change intensifies, traditional flood prediction methods may no longer suffice. Regions with altered precipitation patterns and snowmelt timing face unique challenges, making it crucial to explore flood drivers specific to different regions. Classifying watersheds based on environmental and hydrogeomorphological attributes will support adaptive management approaches [2].

Brief Literature Survey: Recent studies highlight the importance of flood seasonality and driver classification across different geographic regions [1, 2]. These studies show that watershed attributes significantly influence flood behaviour, necessitating region-specific prediction models. Furthermore, advanced neural network techniques have shown substantial promise in accurately classifying flood drivers, providing a more precise tool for classifying watersheds by flood drivers [3, 4].

Outline of Data Analysis Methods: In this project, I will analyze historical flood event data, classifying watersheds based on driver types and watershed attributes. The analysis involves using machine learning models, particularly neural networks, to predict flood drivers in ungauged basins. To achieve high prediction accuracy with neural networks, I will first analyze all features and apply statistical column normalization for feature scaling. Next, I will use dimensionality reduction methods, such as Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), for feature selection. Finally, I will use this suitable dataset to train my neural network model [4].

References

[1] J. Singh, S. Ghosh, S. P. Simonovic, and S. Karmakar. Identification of flood seasonality and drivers across canada. *Hydrological Processes*, 35(10):e14398, 2021.

[2] L. Stein, M. P. Clark, W. J. M. Knoben, F. Pianosi, and R. A. Woods. How do climate and catchment attributes influence flood generating processes? a large-sample study for 671 catchments across the contiguous usa. *Water Resources Research*, 57(4):e2020WR028300, 2021.

[3] S. Sinsomboonthong. Performance comparison of new adjusted min-max with decimal scaling and statistical column normalization methods for artificial neural network classification. *International Journal of Mathematics and Mathematical Sciences*, 2022(1):3584406, 2022.

[4] H. McGrath and P. N. Gohl. Prediction and classification of flood susceptibility based on historic record in a large, diverse, and data sparse country. *Environmental Sciences Proceedings*, 25(1), 2023.