Analyzing effect and importance of input predictors for urban streamflow prediction based on a Bayesian tree-based model

Duc Hai Nguyen*, Deg-Hyo Bae**

Abstract

Streamflow forecasting plays a crucial role in water resource control, especially in highly urbanized areas that are very vulnerable to flooding during heavy rainfall event. In addition to providing the accurate prediction, the evaluation of effects and importance of the input predictors can contribute to water manager. Recently, machine learning techniques have applied their advantages for modeling complex and nonlinear hydrological processes. However, the techniques have not considered properly the importance and uncertainty of the predictor variables. To address these concerns, we applied the GA-BART, that integrates a genetic algorithm (GA) with the Bayesian additive regression tree (BART) model for hourly streamflow forecasting and analyzing input predictors. The Jungrang urban basin was selected as a case study and a database was established based on 39 heavy rainfall events during 2003 and 2020 from the rain gauges and monitoring stations. For the goal of this study, we used a combination of inputs that included the areal rainfall of the subbasins at current time step and previous time steps and water level and streamflow of the stations at time step for multistep-ahead streamflow predictions. An analysis of multiple datasets including different input predictors was performed to define the optimal set for streamflow forecasting. In addition, the GA-BART model could reasonably determine the relative importance of the input variables. The assessment might help water resource managers improve the accuracy of forecasts and early flood warnings in the basin.

Keywords : Bayesian Additive Regression Trees, Input predictor, Streamflow forecasting, Urban floods.

Acknowledgements

This Research has been performed as Project No. 21-AW-001 and supported by K-water. This work was also supported by the faculty research fund of Sejong University in 2022.

* Member · Postdoctoral researcher, Dept. of Civil and Environ. Eng., Sejong University· · E-mail : haind@tlu.edu.vn

** Member · Professor, Dept. of Civil and Environ. Eng., Sejong University· · E-mail : dhbae@sejong.ac.kr