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Forecasting of overflow in riverside social infrastructures: Case study for Hangang River, Korea

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Flood is one of the most happened disasters in the world, becoming worse damaging human life and property. Recently, as the occurrence frequency of sudden urban floods due to climate change increased, the flood damage on riverside social infrastructures was extended so that there has been a threat of overflow. Therefore, a rapid prediction of potential flooding in riverside social infrastructure is necessary for administrators, stakeholders and the general public. However, most current flood forecasting models including hydraulic and hydrologic model have limitations which are the low accuracy of numerical results in certain conditions and longer simulation time to be expected for complicated domains. To alleviate such limitation, in this study, hydrological measurements and inundation data of social infrastructures were used and overflow forecasting model using TensorFlow, one of famous deep learning frameworks are developed to predict potential flooding in infrastructure located near the rivers with various neural network models (Recurrent Neural Network, Long Short Term Memory and so on). The study area is the Hangang River which is tidal river in South Korea, so the tidal effect is one of the most important factors for predicting potential flood. Station data for water surface elevations at Jamsu Bridge located in downstream of Hangang River was used to verify the flood forecasting model presented in this study. And it is confirmed that this model could accurately predict the water surface elevations as compared with measured data. The optimal parameters of neural network models were set up after performing sensitive analysis. And the various neural network models were trained based on 5 data sets having 1-hour temporal resolution which are Paldang dam discharge, water surface elevation, precipitation, tidal level, hourly mean discharge for 10 years (2009∼2018) and have been normalized to improve accuracy of prediction. Then models were asked to predict the potential flooding given the six leading times: 1, 3, 6, 9, 12, and 24 hours. Finally, the model evaluation statistics such as RMSE (Root Mean Square Error), NSE (Nash-Sutcliffe Efficiency) and MAE (Mean absolute error) were employed to compare the accuracy of neural network models for each leading time. In the future, it is expected that rapid and accurate flood forecasting information can be provided to the related agencies such as flood control stations and local governments if the more optimal neural network model would be applied considering more various factors.

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