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Flood stage forecasting using support vector machines

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River stage is normally chosen as the variable in operational hydrology for flood warning. However, river stage is obtained from stage-discharge relationship, i.e. rating curve, after the discharge is simulated by using a suitable rainfall-runoff model. As the relationship between the discharge and the stage is not accurate enough, a certain error or uncertainty is always involved in the procedures of converting the discharge into the stage. Moreover, river stage can be directly measured. Therefore, this study aims to develop a flood forecasting model using the river stage as the forecasting variable.

The support vector machines, a novel and potential artificial intelligence method developed from the statistical learning theory, is adopted in the work to establish the stage forecasting model for Lan-Yang Bridge, which is the downstream station of Lan-Yang Creek in the Northeast Taiwan. Nineteen storm events were collected to provide the data base in this study. The forecasting model is to directly predict the water stage at the downstream station. The input variables are the observed river stage at the upstream station, Niu-Tou, and the observed rainfall records on the intervening area between Niu-Tou and Lan-Yang Bridge.

In the developing of the model structure, six favorable sets of parameters are applied to decide the optimal orders of the input variables using the root mean squared error as criterion. Then the grid search method was further applied to search the optimal values of parameters in the proposed learning machine. The sensitivities of parameters were also investigated in this work. Finally, the validation results from six flood events in the study area reveal that the proposed model can well predict the flood stage forecast one hour ahead. River stage forecasts more hours ahead are also studied.