Runoff Prediction from Machine Learning Models Coupled with Empirical Mode Decomposition: A case Study of the Grand River Basin in Canada

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Abstract

This study investigates the possibility of coupling empirical mode decomposition (EMD) for runoff prediction from machine learning (ML) models. Here, support vector regression (SVR) and convolutional neural network (CNN) were considered for ML algorithms. Precipitation (P), minimum temperature (Tmin), maximum temperature (Tmax) and their intrinsic mode functions (IMF) values were used for input variables at a monthly scale from Jan. 1973 to Dec. 2020 in the Grand river basin, Canada. The support vector machine-recursive feature elimination (SVM-RFE) technique was applied for finding the best combination of predictors among input variables. The results show that the proposed method outperformed the individual performance of SVR and CNN during the training and testing periods in the study area. According to the correlation coefficient (R), the EMD-SVR model outperformed the EMD-CNN model in both training and testing even though the CNN indicated a better performance than the SVR before using IMF values. The EMD-SVR model showed higher improvement in R value (38.7%) than that from the EMD-CNN model (7.1%). It should be noted that the coupled models of EMD-SVR and EMD-CNN represented much higher accuracy in runoff prediction with respect to the considered evaluation indicators, including root mean square error (RMSE) and R values.

Keywords : Runoff prediction, Machine learning model, Empirical mode decomposition, Coupled machine learning

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