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COMPARISON OF LONG SHORT-TERM MEMORY NETWORKS FOR DAILY AHEAD-FLOW PREDICTIONS ON A RIVER

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Abstract

Prediction of peak river flows is an important problem for the design, management, and safety of hydraulic structures. The aim of the present study was to investigate the prediction capabilities of Long Short-Term Memory (LSTM) networks in predicting daily river flows of the Lüleburgaz stream-flow gauging station (SGS) for the observation period of 1987-2015. The Lüleburgaz SGS is on the Ergene River in the Meriç Ergene Basin in Turkey. Daily measured values of river flow at times seven-days (T-6 to T), two-days (T-1 to T), and one-day (T) were used as input to predict the univariate output of one day ahead flow for an acceptable estimation pattern. The dataset was divided into 75% for the training set and 25% for the test set, and then LSTM, Stacked LSTM, Bidirectional LSTM (BiLSTM), Convolutional LSTM (Conv-LSTM) and Convolutional Neural Network and Long Short-Term Memory (CNN-LSTM) were implemented. The river flow predictions were evaluated by using root mean square error (RMSE), mean absolute error (MAE), regression accuracy (R^2) and Nash–Sutcliffe efficiency (NSE). The calculated performance metrics during the test phase showed that, predictions using only one-day of historical data provided the highest performance compared with two-days and seven-days. It is concluded that the river flow predictions would be accurate, especially when using BiLSTM as this was superior to the other models with RMSE of 20.76 m^3/s and MAE of 5.33 m^3/s. Our comparisons show that LSTM networks can be a viable alternative for estimating future river flows.

Key words: Deep learning, Long Short-Term Memory networks, river flow, prediction

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