Optimize rainfall prediction utilize multivariate time series, seasonal adjustment and Stacked Long short term memory

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Abstract

Rainfall forecasting is an important issue that is applied in many areas, such as agriculture, flood warning, and water resources management. In this context, this study proposed a statistical and machine learning-based forecasting model for monthly rainfall. The Bayesian Gaussian process was chosen to optimize the hyperparameters of the Stacked Long Short-term memory (SLSTM) model. The proposed SLSTM model was applied for predicting monthly precipitation of Seoul station, South Korea. Data were retrieved from the Korea Meteorological Administration (KMA) in the period between 1960 and 2019. Four schemes were examined in this study: (i) prediction with only rainfall; (ii) with deseasonalized rainfall; (iii) with rainfall and minimum temperature; (iv) with deseasonalized rainfall and minimum temperature. The error of predicted rainfall based on the root mean squared error (RMSE), 16-17 mm, is relatively small compared with the average monthly rainfall at Seoul station is 117mm. The results showed scheme (iv) gives the best prediction result. Therefore, this approach is more straightforward than the hydrological and hydraulic models, which request much more input data. The result indicated that a deep learning network could be applied successfully in the hydrology field. Overall, the proposed method is promising, given a good solution for rainfall prediction.

Keywords : Deep learning, long short-term memory, optimize hyper-parameters, rainfall prediction.

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