EGU2020-5429
https://doi.org/10.5194/egusphere-egu2020-5429
EGU General Assembly 2020

Forecasting Model of Short-term PM2.5 Concentration based on Deep Learning

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In order to improve the accuracy of PM2.5 concentration forecast in Beijing Meteorological Bureau, a deep learning prediction model based on convolutional neural network (CNN) and long short term memory neural network (LSTM) was proposed. Firstly, the feature vectors extraction was carried out by using the correlation analysis technique from meteorological data such as temperature, wind, relative humidity, precipitation, visibility and atmospheric pressure. Secondly, taking into account the fact that PM2.5 concentration was significantly affected by surrounding meteorological impact factors, meteorological grid analysis data was novel involved into the model, as well as the historical PM2.5 concentration data and meteorological observation data of the present station. Spatio-temporal sequence data was generated from these data after integrated processing. High level spatio-temporal features were extracted through the combination of the CNN and LSTM. Finally, future 24-hour prediction of PM2.5 concentration was made by the model. The comparison among the accuracy of this optimized model, support vector machine (SVM) and existing PM2.5 forecast system is performed to evaluate their performance. The results show that the proposed CNN-LSTM model performs better than SVM and current operational models in Beijing Meteorological Bureau, which has effectively improved the prediction accuracy of PM2.5 concentration for different time predictions scales in the next 24 hours.