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Climate change prediction based a long short-term memory neural network

Inyoung Park, Jiwon Lee, BumjoKim, Joon Ha Kim and **Hong Kook Kim**
Gwangju Institute of Science and Technology, South Korea

Climate change has been an important global issue since it threatens ecosystems due to its unpredictability. During decades, numerical prediction models, such as MM5, WRF, CALMET, UM, have been developed and popular to predict climate change of regions at which climate data cannot be observed. These numerical models first deal with world-sized terrestrial data, and then they predict regional climate by integrating analyzed data. However, such a numerical prediction model need to be used with caution in an area where has high terrain complexity. The purpose of this study is to design a climate change prediction model based a deep neural network by using real observed climate data for the local area. There are many different types of neural networks that can be applicable to this study. After a deliberate investigation on the structure of deep neural networks, the proposed prediction model is eventually constructed based on a long short-term memory (LSTM) network which is a type of recurrent neural network (RNN). This is because RNN is more proper to climate data than a simple DNN due to time-series characteristics of climate data. The proposed model can predict weather data in advance up to 24 hours. To this end, the model is trained using actual weather data that are collected on an hourly basis for 36 years (from 1981 to 2016). A preprocessing step is applied to select data that more influence weather prediction and to normalize them for the best-fit to LSTM. The performance of the proposed LSTM-based model is measured in terms of the root-mean-square error (RMSE) between the actual temperature and it is predicted one. Consequently, the RMSE is below 1.1 degrees for 24-hours prediction, which is lower or comparable to the DNN-based model. In this study, a recurrent neural network, LSTM, is incorporated to construct a prediction model. This approach is new because the LSTM network is suitable to climate data that has time-varying characteristics. Although the proposed model is evaluated on temperature data here, it can be applied to any kind of climate data such as humidity, wind speed, and rainfall.

Biography

Inyoung Park is a PhD student in School of EECS, Gwangju Institute of Science and Technology, South Korea. She received a BS degree in Computer Application from Bangalore University in 2015. Her current research focuses on speech signal processing and climate change modeling based on deep neural networks.

pinyoung@gist.ac.kr

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