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Deep Learning-based Prediction for Fine dust in Seoul, Korea

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Extended Abstract

Fine dust as known as Particulate Matter (PM) directly or indirectly affects climate change by changing the radiative forcing of sunlight. This is known to be harmful to the human body and affects industrial activities. In order to prevent damage to the health environment, society, and economy as a whole due to the increase in PM concentration, it is important to secure regional accurate PM concentration calculation and monitoring technology for it. In addition, due to problems such as rapid urbanization, industrialization, population growth, and changes in human life worldwide, the level of air pollution is intensifying and the concentration of fine dust is deteriorating. Through many previous studies, it was confirmed that the weather factor and the concentration of fine dust were related [1]. In addition, particulate matter emitted through human activities not only pollutes the air, but also cools the Earth by scattering shortwave solar radiation [2]. The fine dust prediction method can be largely divided into (1) numerical prediction modeling to predict fine dust concentration by mathematical equations and (2) statistical-based modeling to predict fine dust concentration by deriving statistical correlation with various causes. In addition, research on applying artificial intelligence techniques has been actively conducted recently. Unlike previous studies, this study aims to develop a fine dust prediction model using the S-DoT sensor installed in 2019. Since the S-DoT sensor provides meteorological data (temperature, humidity, wind direction, etc.) for fine dust prediction as well as fine dust data, it is consistent in time and space. In addition, fine dust and ultrafine dust can be considered to have higher accuracy because it also provides correction values calculated through self-made algorithms considering the surrounding temperature and humidity along with raw data. The LSTM used in this study is a model made by supplementing the shortcomings of RNN, a model used when analyzing time series data, and is suitable for analyzing time series data, fine dust concentration. In this study, the fine dust concentration was predicted and evaluated with a deep learning LSTM model using meteorological factors and fine dust as time-series data. Based on the LSTM model, fine dust and ultrafine dust prediction modeling was performed using data from devices with observed wind speed data among Gangseo-gu, Seoul, which has the much fine dust in spring. After that, cancer blindness evaluation was performed using verification data sampled from the modeled LSTM model in advance. The temperature, relative humidity, and wind speed, which have hourly average values of fine dust or ultrafine dust for 7 days, were used as input variables of the LSTM model, and the following time series of fine dust or ultrafine dust was designed to be output. The predicted results are MAE(z)=0.339 MSE(z)=0.210, RMSE=0.458, R2-score=0.710 for PM10, and MAE(z)=0.285 MSE(z)=1.51, RMSE=0.389, and R2-score=0.865 for PM2.5.

References

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