

LSTM NEURAL NETWORK MODEL TO FORECAST TEMPERATURE

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In the past few decades, many urban areas worldwide have suffered from severe air pollution resulting in many health hazards and an increase in global temperature. Several studies investigated the effect of temperature changes that could lead to changes in the chemical composition of the atmosphere. Nevertheless, how an increase in temperature affects air pollution during heatwaves is still unclear. This study aims to identify whether the air pollution indicators could predict the temperature. Here we discuss two methods to forecast the daily temperature using air pollutant concentration levels such as ground level O₃, CO, NO_x, PM_{2.5} and PM₁₀ as exogenous predictors. Delhi, one of the top 30 cities in the world with the worst air pollution, is considered in the study. Daily temperature and air pollution data for more than five years since 2015 were considered. The temperature in Delhi displayed a cyclic pattern with more variations in recent years. The forecasting ability of traditional Auto-Regressive Moving Average (ARMA), a time series regression model, and a popular neural network model, Long Short-Term Memory (LSTM), were evaluated. The results indicated that the forecast errors of the LSTM model were very low compared to that of the ARMA model. The LSTM model with all the air pollutant concentrations was the best model to forecast the temperature in Delhi with a mean squared error of 6.91 and a mean absolute error of 3.28. Moreover, the LSTM model captured the extreme points and the deviating points more accurately than ARMA. Overall results indicated that the accuracy of forecasting the temperature could be improved by accommodating the air pollution indicators in an LSTM model. The findings would help the environmental and climate scientists study the combined contribution of air pollution and temperature in the global warming issue.

Keywords: ARMA, LSTM, Neural Network, Time Series Regression