Prediction of COVID-19 cases using the weather integrated deep learning approach for India

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Abstract

Advanced and accurate forecasting of COVID-19 cases plays a crucial role in planning and supplying resources effectively. Artificial Intelligence (AI) techniques have proved its capability in time series forecasting of the non-linear problems. In the present study, the relationship between weather factor and COVID-19 cases was assessed and also developed a forecasting model using long short term memory (LSTM), a deep learning model. The study found that the specific humidity has a strong positive correlation, whereas there is a negative correlation with maximum temperature and positive correlation with minimum temperature was observed in various geographic locations of India. The weather data and COVID-19 confirmed cases data (1st April-30th June 2020) was used to optimize univariate and multivariate LSTM time series forecast models. The optimized models were utilized to forecast the COVID-19 cases for the period 1st July 2020 to 31st July 2020 with 1 to 14 days of lead time. The results showed that the univariate LSTM model was reasonably good for the short term (1day lead) forecast of COVID-19 cases (relative error < 20%). Moreover, the multivariate LSTM model improved the medium-range forecast skill (1-7days) after including the weather factors. The study observed that the specific humidity played a crucial role in improving the forecast skill majorly in the West and northwest region of India. Similarly, the temperature played a significant role in model enhancement in the Southern and Eastern regions of India.

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Specific Humidity(kg/kg)

Maximum Temperature (°C)

Minimum Temperature (°C)

Mean Temperature (°C)

3

Correlation between COVID-19 cases and Specific humidity

Correlation between COVID-19 cases and maximum temperature

Correlation between COVID-19 cases and minimum temperature

Correlation between COVID-19 cases and mean temperature

4

Tamil Nadu (a)

Tamil Nadu (b) Lag-1

West Bengal (c)

West Bengal (d) Lag-1

Kerala (e)

Kerala (f) Lag-3

Relative Error (%)

Number of Cases

Lag (days)

Days (starting from 01ˢᵗ July 2020)

Potential Evaporation Rate (w/m^2)

April   May   June   July