Deep Neural Prediction for Confirmed, Recovered, and Dead Cases of the COVID-19

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Summary

In the early 2020, the pandemic disease caused by the novel coronavirus, COVID-19, spread globally and rapidly. Some severe effects of COVID-19 include infecting over 11,500,302 people in the first six months, shutting down businesses, and trade and travel restrictions. Remaining in such a situation not only threatens a tremendous number of people's lives but also leads to enormous economic disorders and failures. Best decision making in this critical situation requires the highest level of foresight and knowledge ahead of time on the number and the pattern of the confirmed, recovered, and dead cases. The need for accurate daily prediction became the basis of our idea of using deep neural network models to draw out and suggest a fine model that can predict the confirmed, recovered, and dead cases of COVID-19 for the future 7-day and 14-day intervals. To this aim, we utilize three solid models, namely Long Short Term Memory (LSTM), Gated Recurrent Unit (GRU), Convolution Neural Networks (CNN), and four hybrid models from their combination, namely LSTM-CNN, CNN-LSTM, GRU-CNN, and CNN-GRU on separate sets of data from Italy, Iran, and China. We perform preprocessing and feature engineering on all our initial data with the XGBoost algorithm. By using the normalized Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) as the evaluation metrics, the hybrid models are resulted to be overall superior than solid neural network models. Furthermore, when adding the LSTM or GRU models, classified as Recurrent Neural Networks (RNN) to CNN, we obtain reliable representatives of the neural networks models on time series data that could be used to produce daily optimized predictions on infected cases of the troublesome COVID-19 disease.

KEYWORDS:
Artificial neural network, deep learning, disease prediction, COVID-19

1 | INTRODUCTION

The outbreak of the new coronavirus, named COVID-19 by the World Health Organization (WHO), has raised numerous health, social, and economic concerns on the global scale ever since its first detection in Wuhan, China, around December 2019. COVID-19, which is a member of the coronavirus family, affects individuals in all genders and ages but mostly leads to cases of deaths in elderlies and those with a weaker immune system. The chief spread of person-to-person transmission based on the knowledge of other coronaviruses is through respiratory droplets in coughs and sneezes