Mathematical and Deep learning modeling for Mpox transmission Dynamics

Abstract: Mpox(formerly known as monkeypox) spread globally, surpassing previous outbreaks and raising severe public health concerns in 2022-2023 by spreading to many regions (112 countries) worldwide with 87875 confirmed cases as of May 31, 2023. In this study, we use mathematical model and deep learning techniques (1D-CNN, LSTM, bidirectional LSTM(BiLSTM), hybrid CNN-LSTM, and CNN-BiLSTM) to predict the number of individuals infected with Mpox from May 1, 2022, to May 31, 2023, on weekly (Sunday-Saturday) epidemiological data. Our mathematical model incorporates traditional compartmental models, and the deep learning techniques use the usual architecture of deep learning algorithms to improve the accuracy and reliability of our predictions for this infectious disease. We also analyze the spatial pattern of global Mpox data and apply statistical time series models (ARIMA and exponential smoothing) to forecast the transmission of Mpox globally. We finally implement data fitting to estimate the essential epidemiological parameters in a proposed mpox deterministic model.