State-wise timeline prediction if Covid 3rd wave occurs in India

CS460 – Midway Presentation

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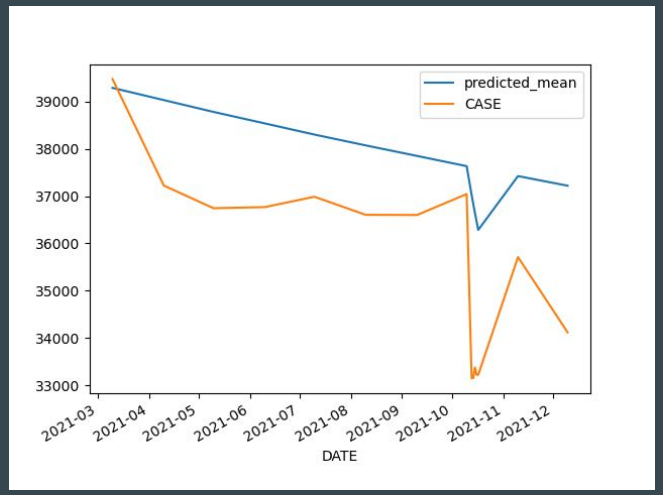
Using ARIMA to forecast for the following 15 days

- From the data we have collected from *covid19india* and following what has been done in one of our reference *Short-term forecasting of the Covid-19 outbreak in India*, we have been able to generate a prediction for the following 15 days.

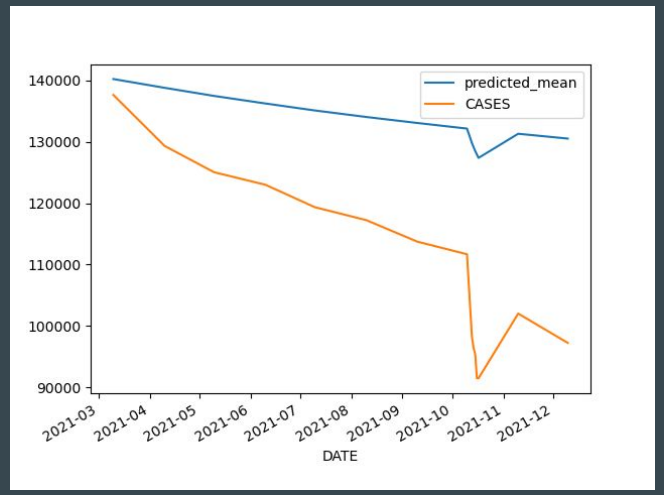
- For this we have used ARIMA, specifically *auto_arima* function from *pmdarima* library is used to find the best model and the using *ARIMA* from *statsmodels* we have trained and tested.

- First we tried on the dataset for India and checked if we can get satisfactory results then proceeded the same procedure with state datas.

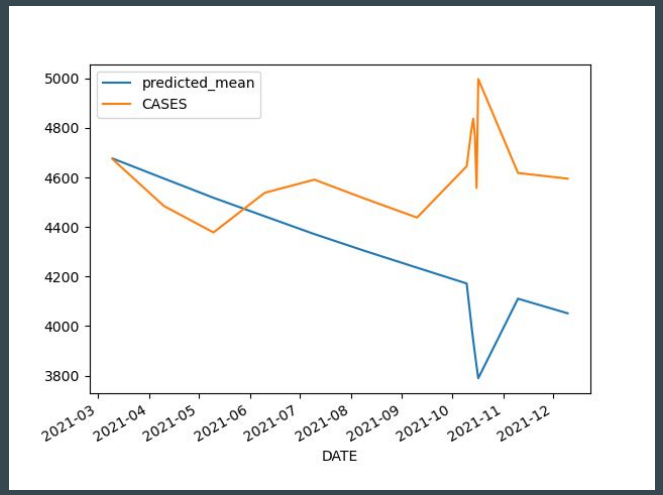
What we got



Maharashtra



Kerala



Odisha

Integrating COVID-19 compartmental models and DL models

An idea proposal

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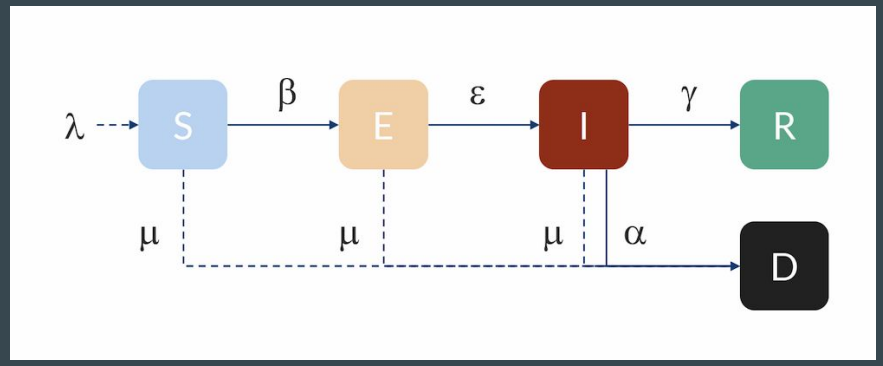
Why neural networks for COVID-19 modelling?

- Neural network is good at describing the characteristics of complex system with strong nonlinearity and difficult to be expressed by precise mathematical model
- adaptive ability
- COVID-19 dynamics within populations is a complex system:
  - random mutation of the virus
  - complexity of social mobility.
- LSTM layer: a type of Recurrent Neural Network (RNN) that utilizes learning from concurrent data.

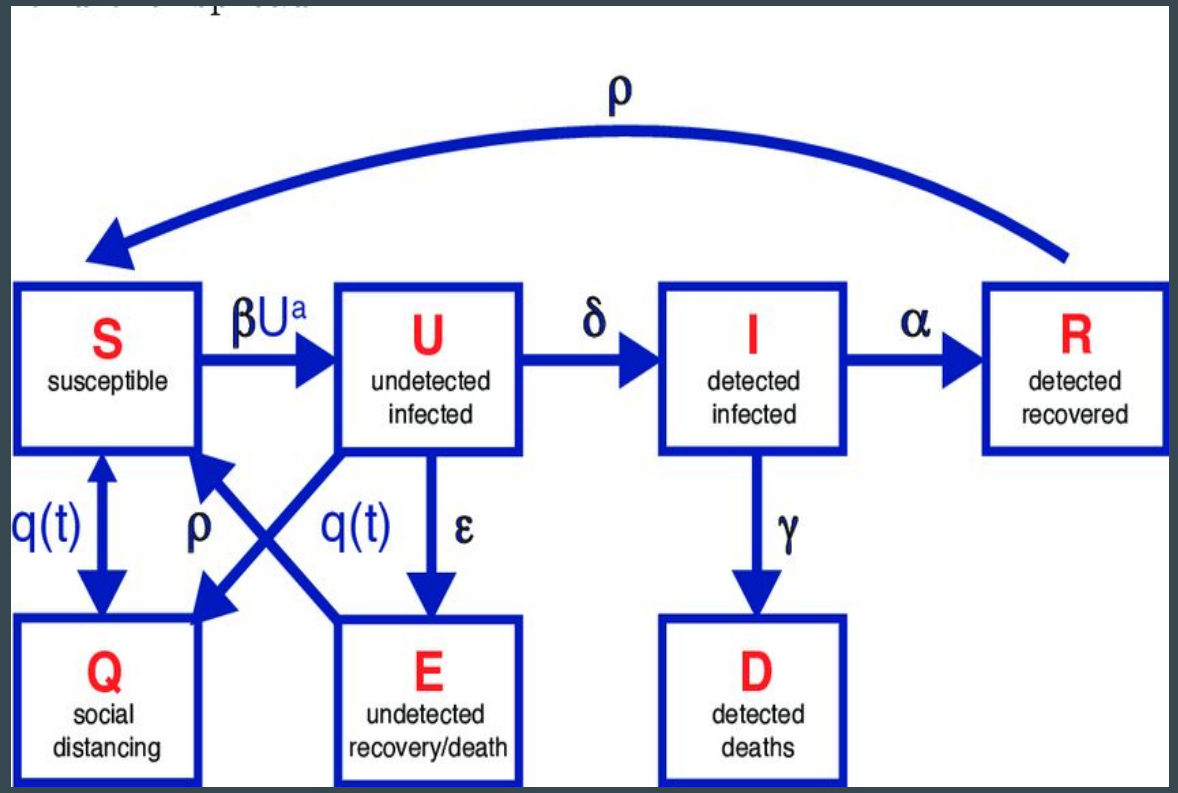
Compartmental modeling

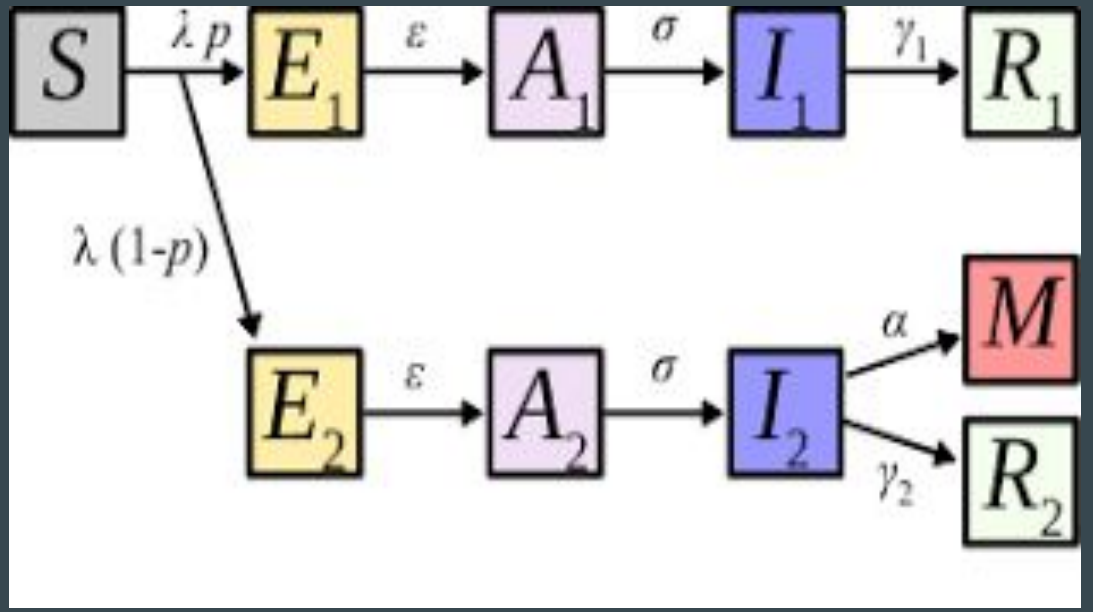
- SEIR:



$$\frac{dS}{dt} = -\beta S \frac{I}{N}$$
$$\frac{dE}{dt} = \beta S \frac{I}{N} - \epsilon E$$
$$\frac{dI}{dt} = \epsilon E - (\gamma + \alpha) I$$
$$\frac{dR}{dt} = \gamma I$$
$$\frac{dD}{dt} = \alpha I$$

COVID specific models





Works already done

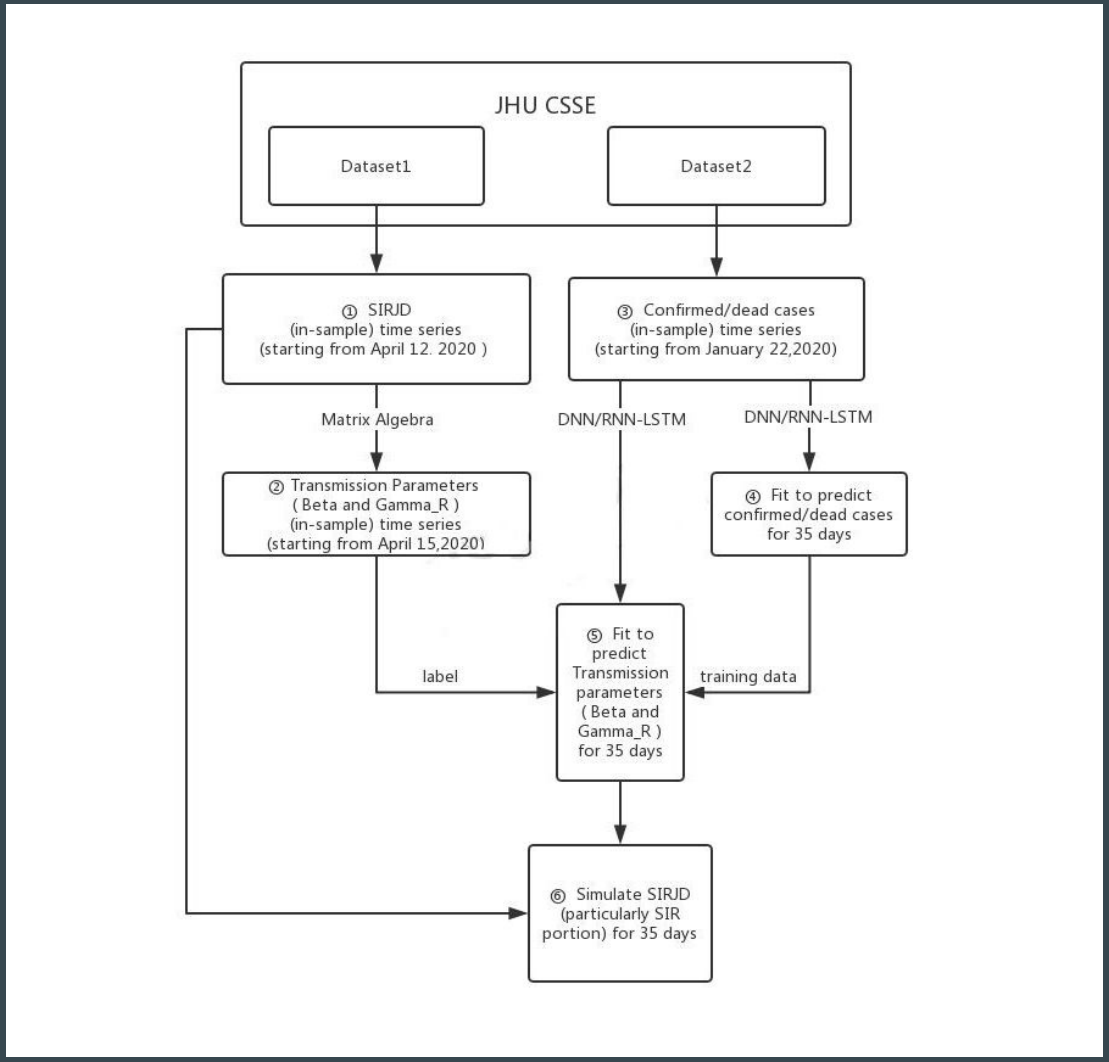
- Worldwide and Regional Forecasting of Coronavirus (Covid-19) Spread using a Deep Learning Model. Cem Direkoglu and Melike Sah
  - Done with deep neural network, which consist of LSTM (Long Short Term Memory) layer, dropout layer, and fully connected layers, to analyze the reported Covid-19 cases and predict the possible future scenarios for the spread in China, Europe, Middle East and worldwide
  - Predictions are done for the next 10 days given the actual time series data of Covid-19
  - Evaluate their approach on the last 3 days of actual data using Root Mean Square Error (RMSE) metric. They present results from the networks that give the minimum RMSE values.
  - As new data arise daily, the network can be re-train in order to adjust the real-time predictions. Further, they present the deep neural network used for forecasting and evaluate their approach with RMSE

Works already done

- Peipei Wang, Xinqi Zheng, Gang Ai, Dongya Liu, Bangren Zhu. Time se-ries prediction for the epidemic trends of COVID-19 using the improvedLSTM deep learning method: Case studies in Russia, Peru and Iran,Chaos, Solitons & Fractals,

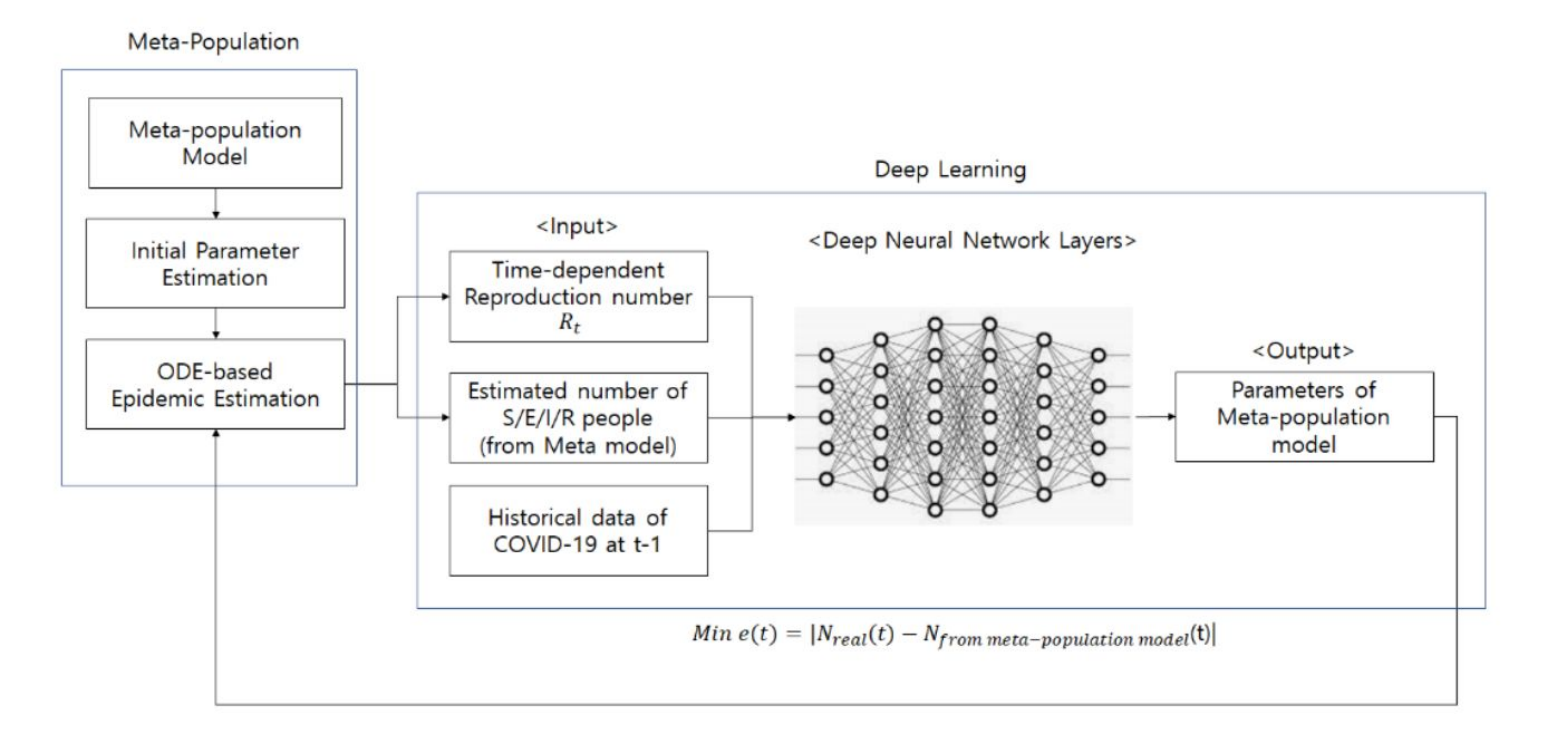
Works already done

- Dynamics and Development of the COVID-19 Epidemic in the United States:A Compartmental Model Enhanced With Deep Learning Techniques, QiDeng.



Works already done

- Hybrid Deep Learning-Based Epidemic Prediction Framework of COVID-19: South Korea Case, Firda Rahmadani and Hyunsoo Lee.



References

- [Kaggle] Shreyas P J, 2021, *Covid forecasting using DL and statistical models.* - Link
- [International Health] Sherry M, Ashok K. P., Md. Arshad & Ubydul H, 2021, *Short-term forecasting of the Covid-19 outbreak in India.* - Link
- [Youtube] Bharani Akella, Great Learning, *Predicting COVID-19 With Machine Learning.* - Link
- [Nature] Yazeed Zoabi, Shira Deri-Rozov & Noam Shomron, 2021, *Machine learning-based prediction of COVID-19 diagnosis based on symptoms.* - Link

Thank you