Analysis and Prediction Model of Global Pandemic: COVID-19

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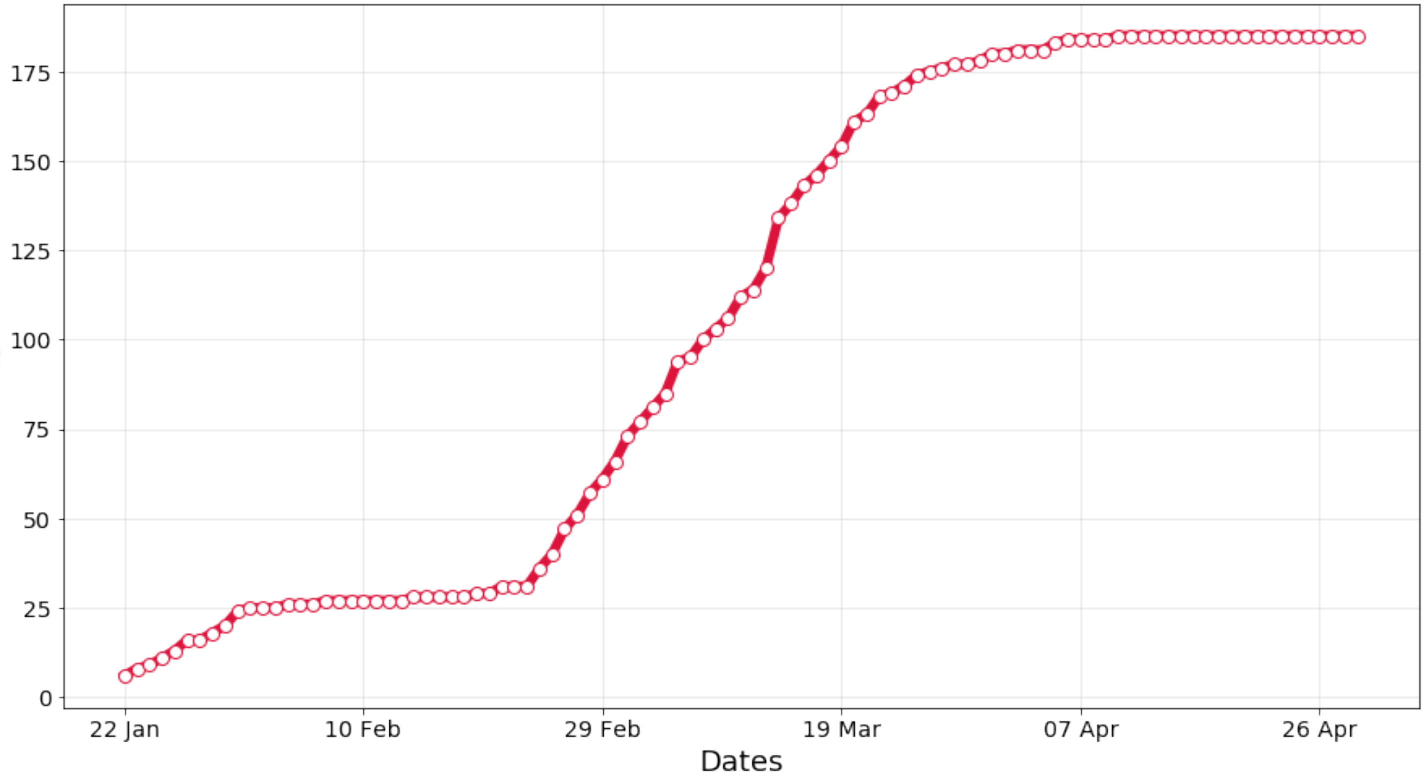
- Visualization and Data Insight
- Development of Deep Learning Model for Prediction
- Some Thoughts

Number of Countries Affected

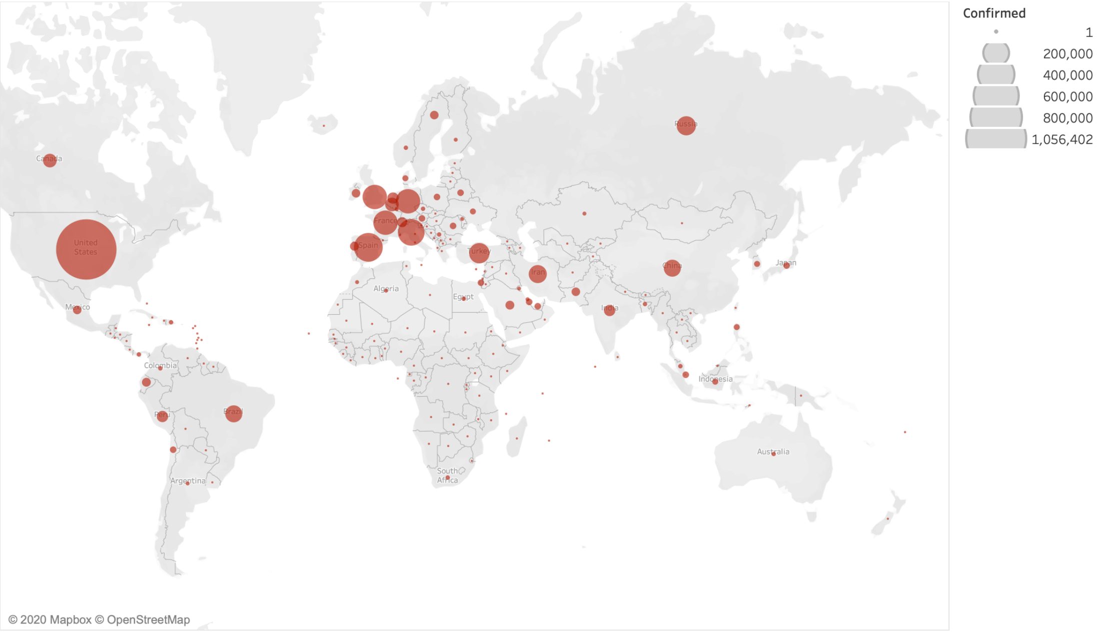


212 countries and territories

364 million + confirmed cases

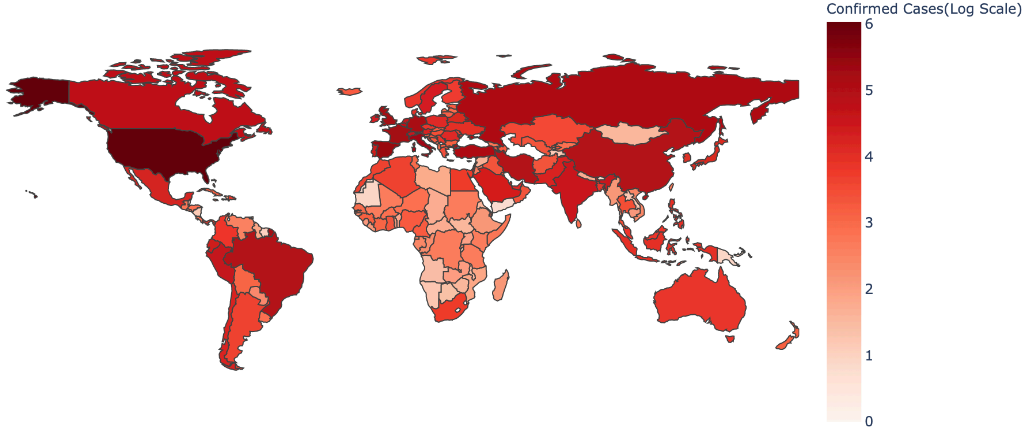
Global Confirmed Cases (By April 30th)

Global Confirmed Cases

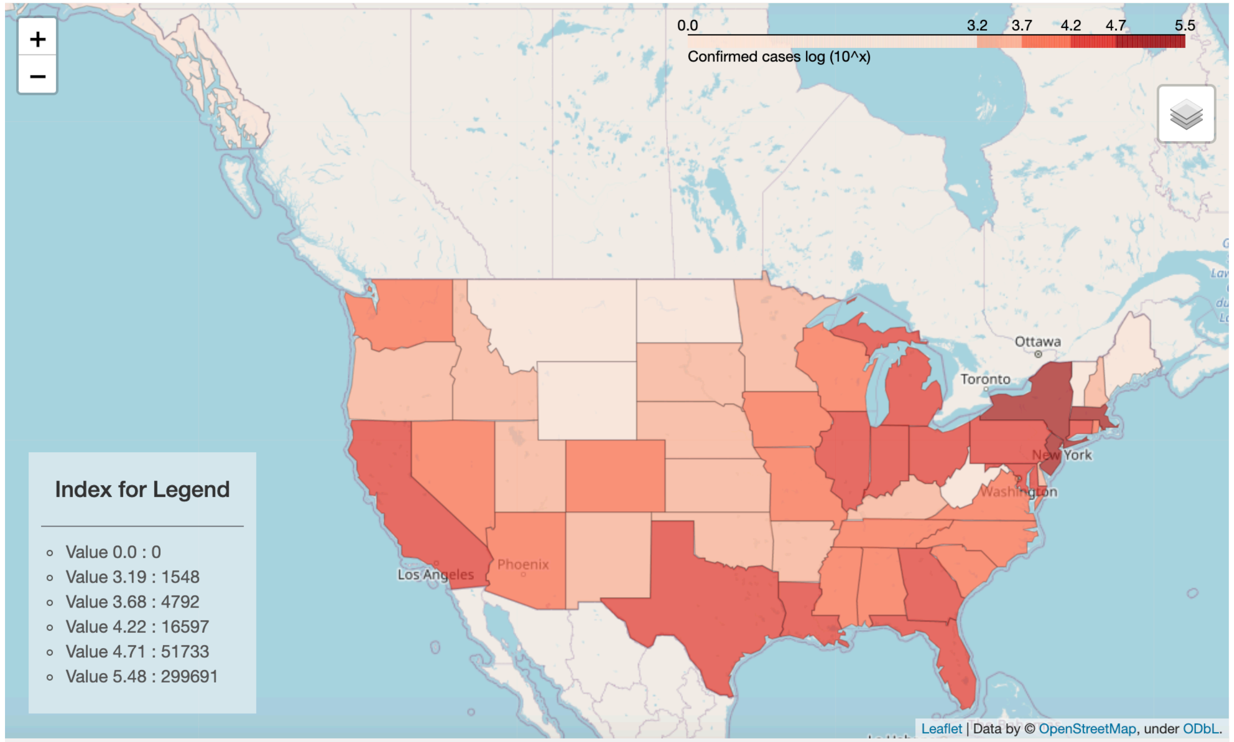


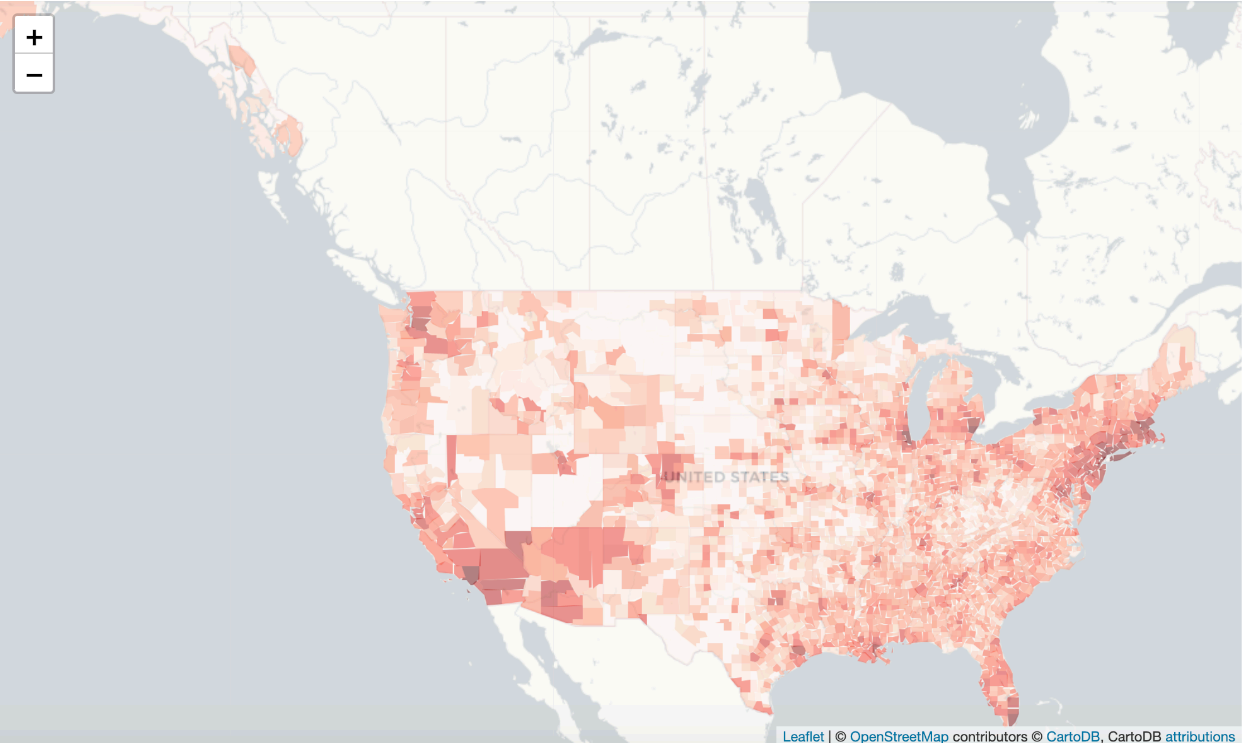
Map based on Longitude (generated) and Latitude (generated). Size shows sum of Confirmed. Details are shown for Country Region.

Confirmed Cases Heat Map (Log Scale)

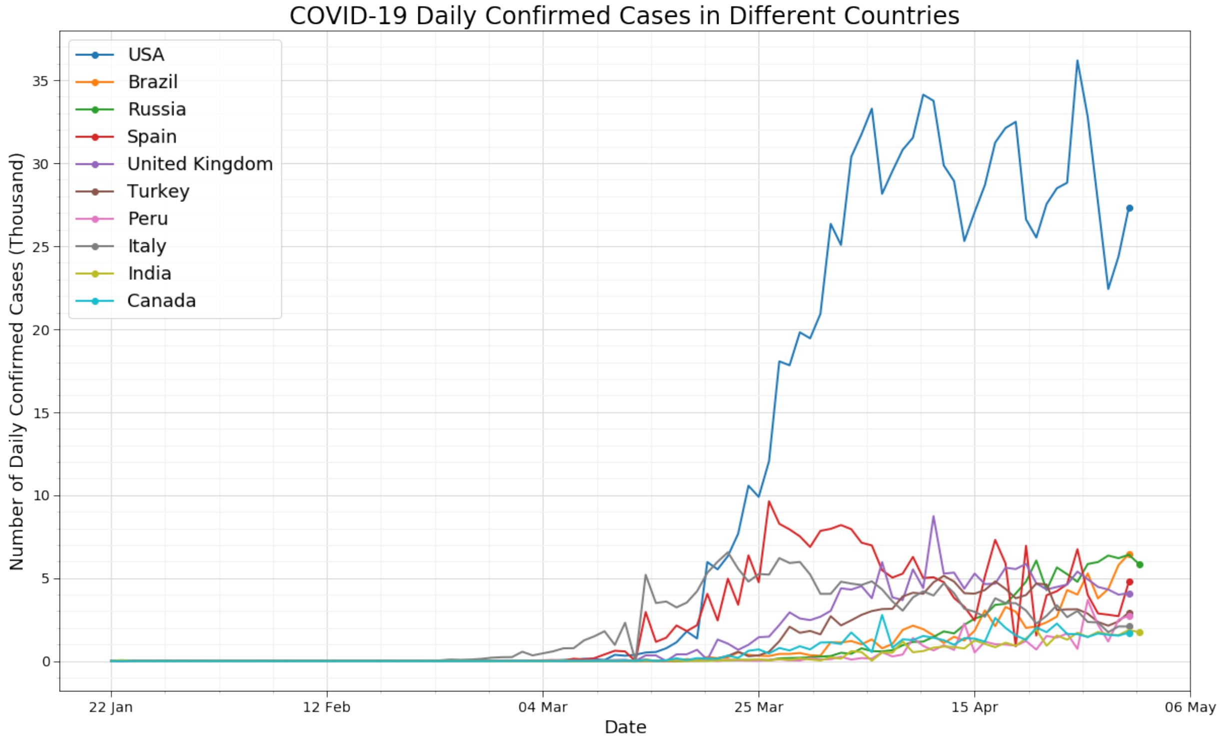


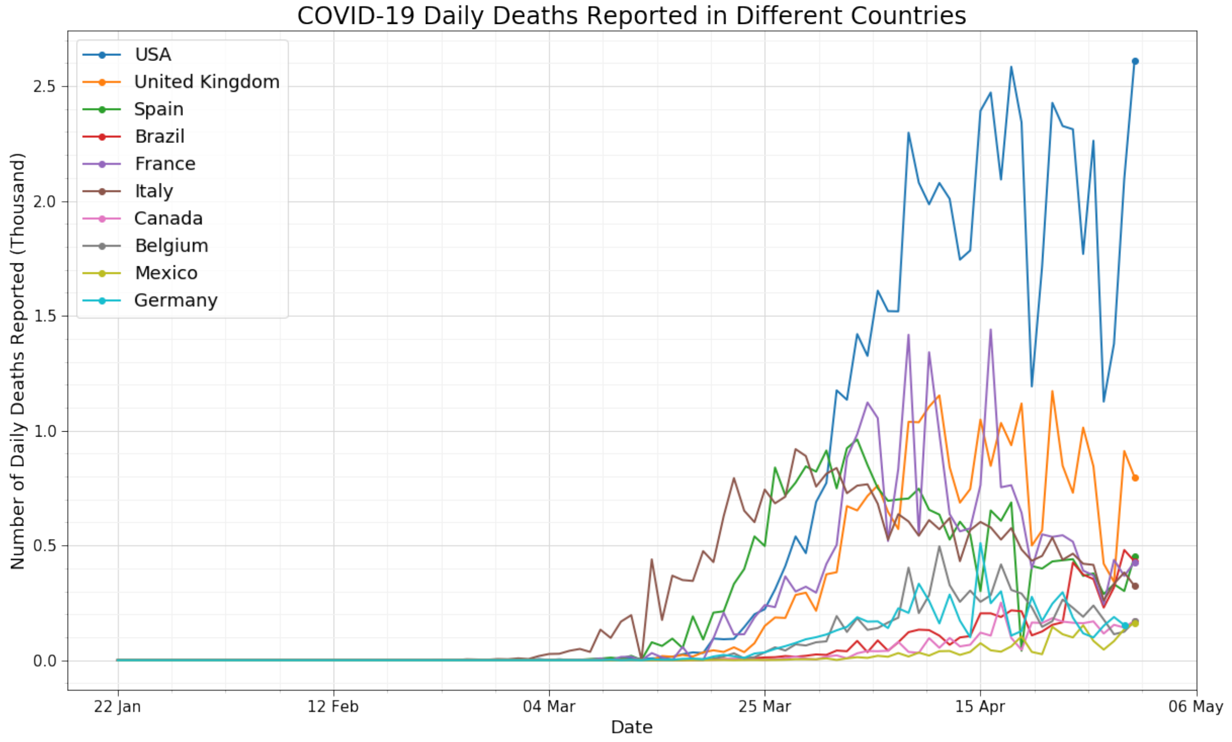
Heatmap of Confirmed Cases in the United States



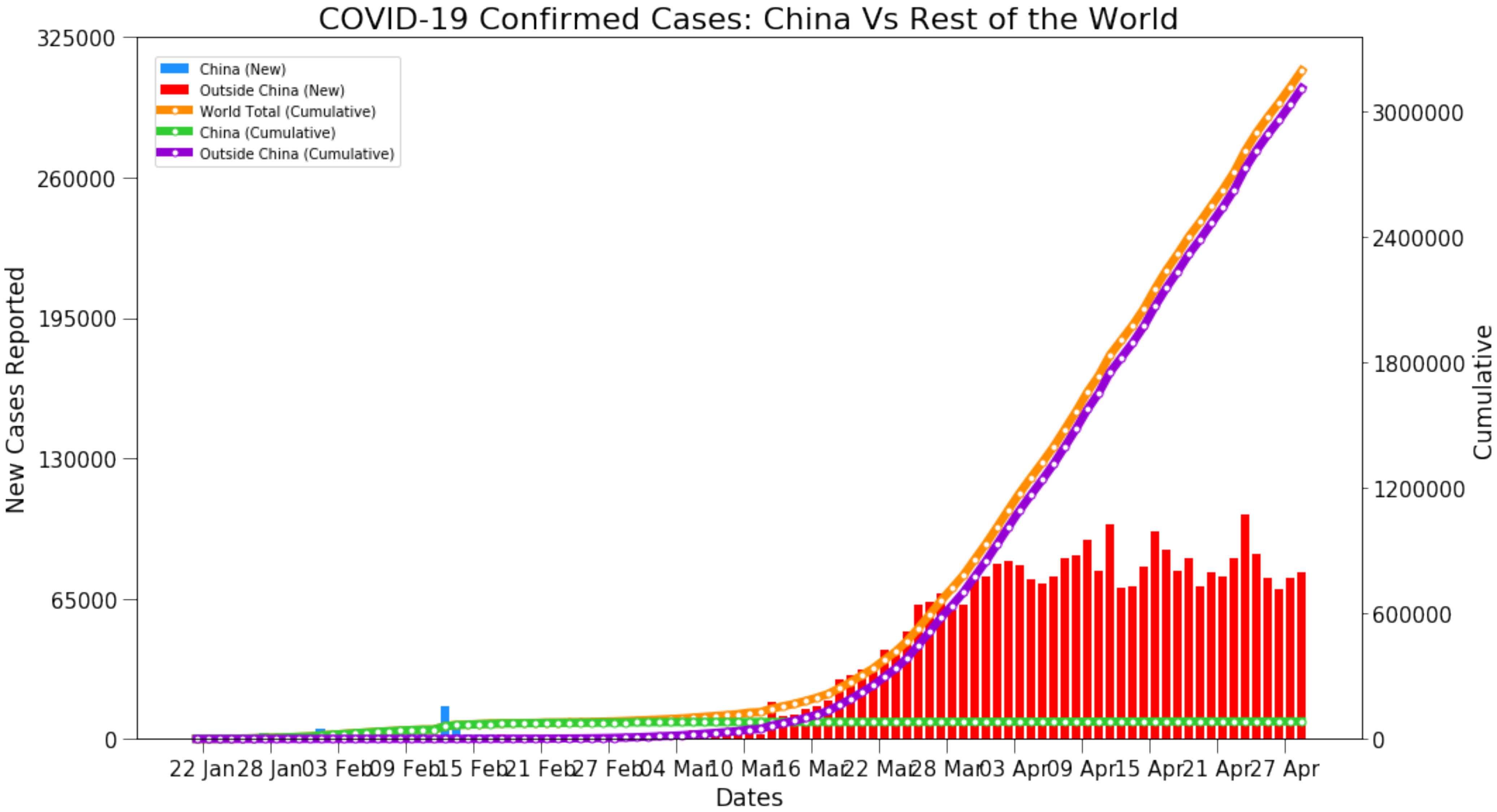


Developing Trend of Covid-19





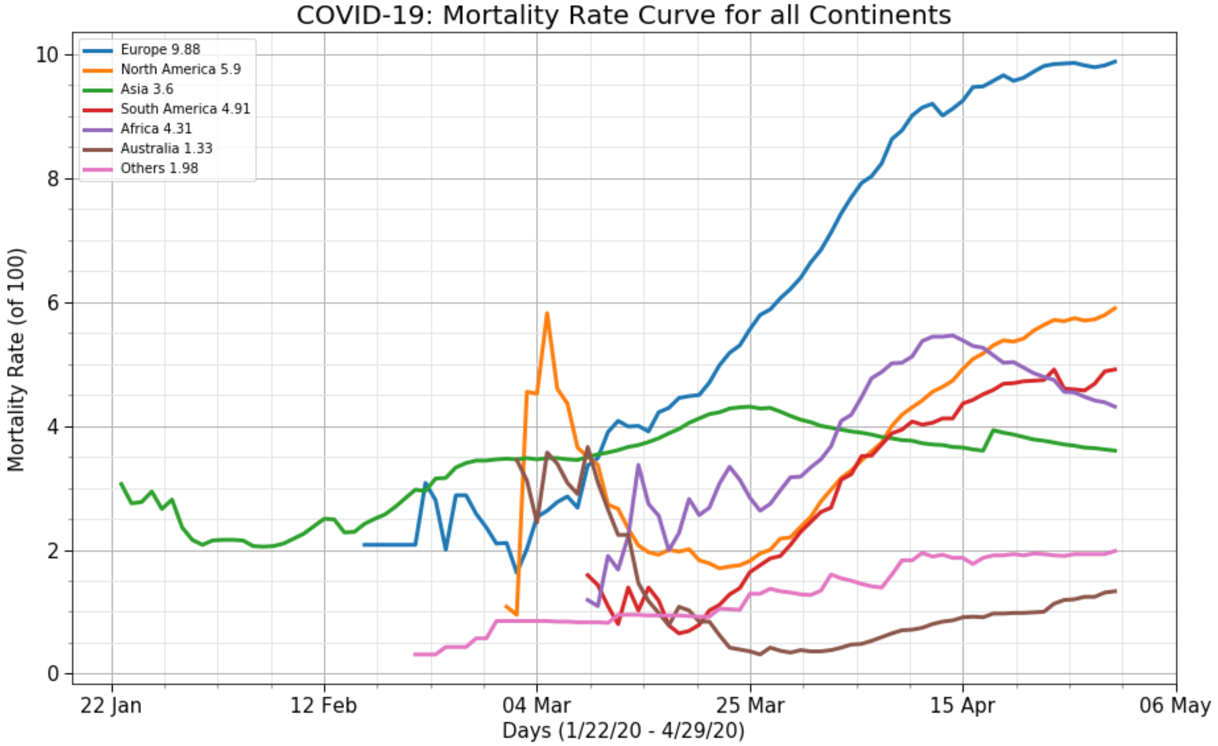
Cases in/outside China

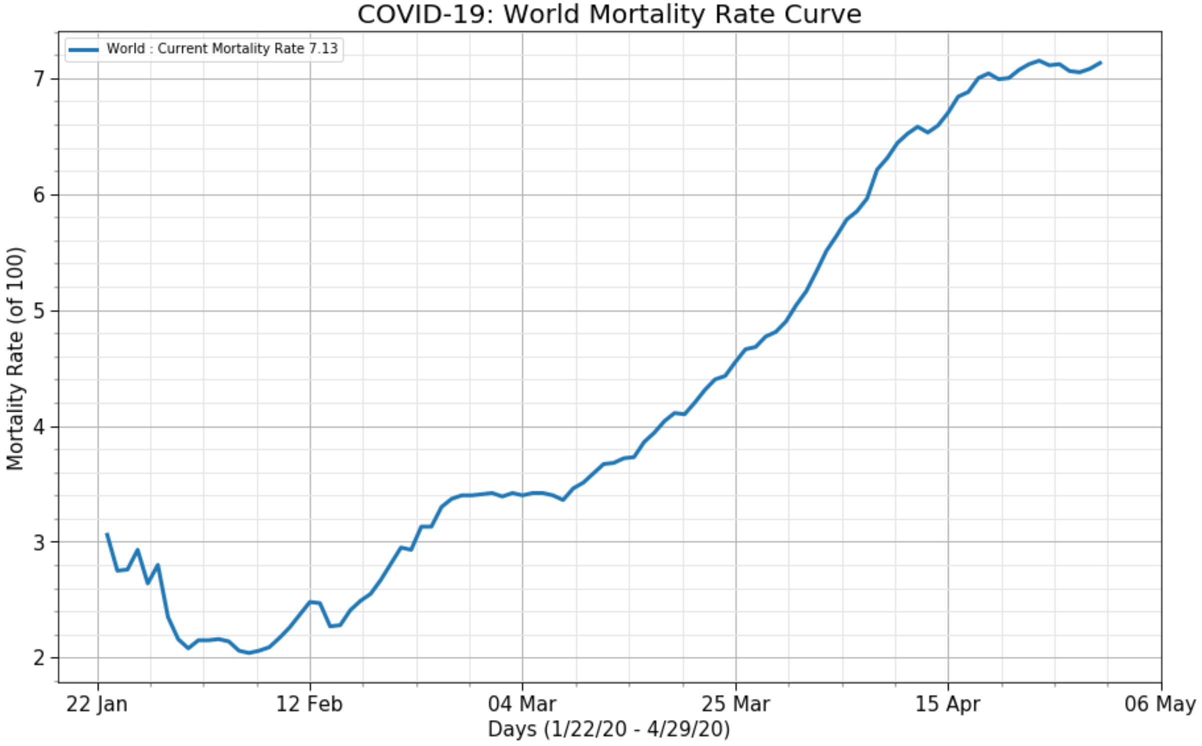


Analysis of Countries' Testing Ability

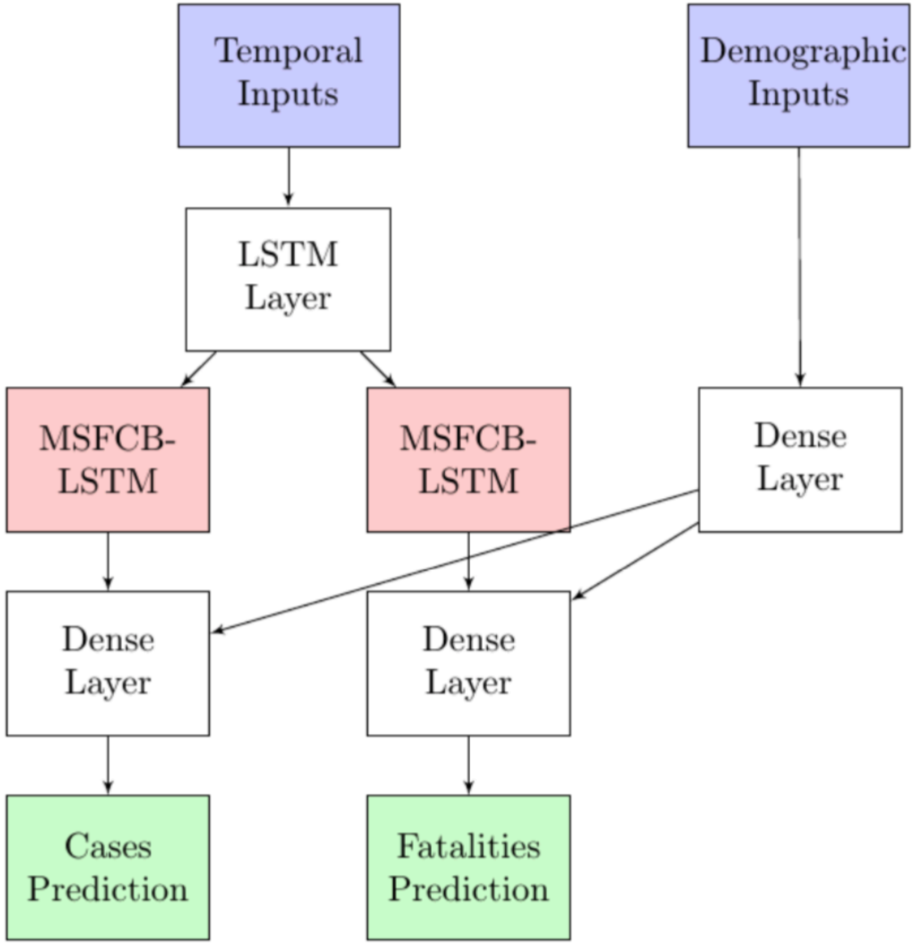
	country	Cumulative total	Cumulative total per million	confirmed	deaths	MR	Positive
0	Australia	261000	10276.3	6754	92	1.36	2.59
1	Austria	98343	11198	15452	584	3.78	15.71
2	Bahrain	37996	22380	3040	8	0.26	8
3	Belgium	62867	5410.25	48519	7594	15.65	77.18
4	Canada	256933	6832.74	53977	3268	6.05	21.01
5	France	224254	3412.2	166628	24410	14.65	74.3
6	Germany	918460	11127.4	162375	6563	4.04	17.68
7	India	26798	19.3739	34862	1154	3.31	130.09
8	India	47951	34.6668	34862	1154	3.31	72.7
9	Indonesia	7621	27.9954	10118	792	7.83	132.76
10	Italy	581232	9829.39	205463	27967	13.61	35.35
11	Japan	39446	311.837	13965	425	3.04	35.4
12	Malaysia	47723	1451.9	6002	102	1.7	12.58
13	Pakistan	30308	145.458	16473	361	2.19	54.35
14	Philippines	5265	47.993	8488	568	6.69	161.22
15	South Korea	443273	8606.08	10765	247	2.29	2.43
16	United Kingdom	173784	2580.92	172478	26842	15.56	99.25
17	USA	1267658	3824.8	1056402	61867	5.86	83.33

Covid-19 Mortality Rate





Using Hybrid Deep Learning Model to Predict



Temporal Features (In the past 13 days):

Number of confirmed cases

Number of fatalities

Restrictions applied or not

Quarantine applied or not

Schools opened or closed

Atemporal Features:

Population of each country

Density of each country

Number of hospital beds of each country

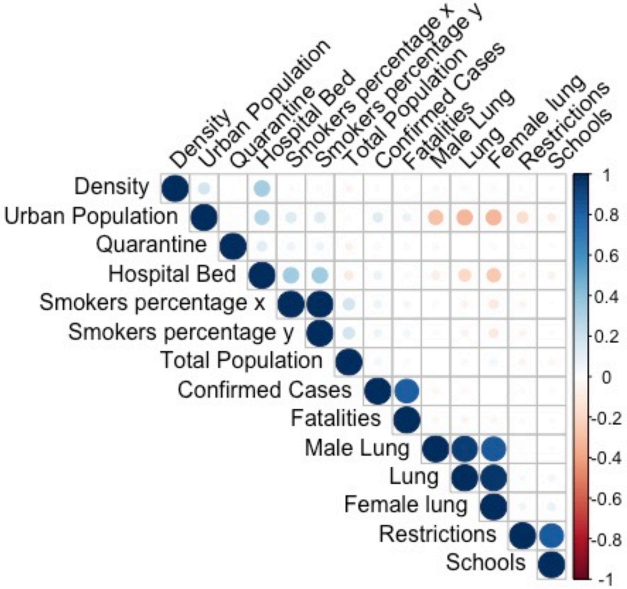
Lung measurement of female and male in each country

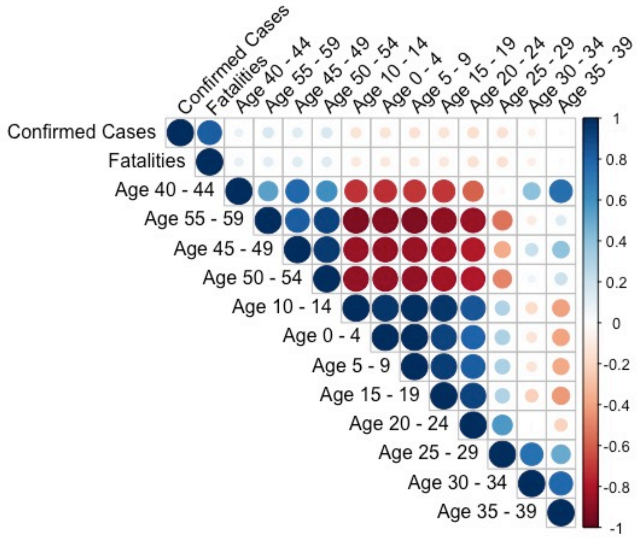
Model Output:

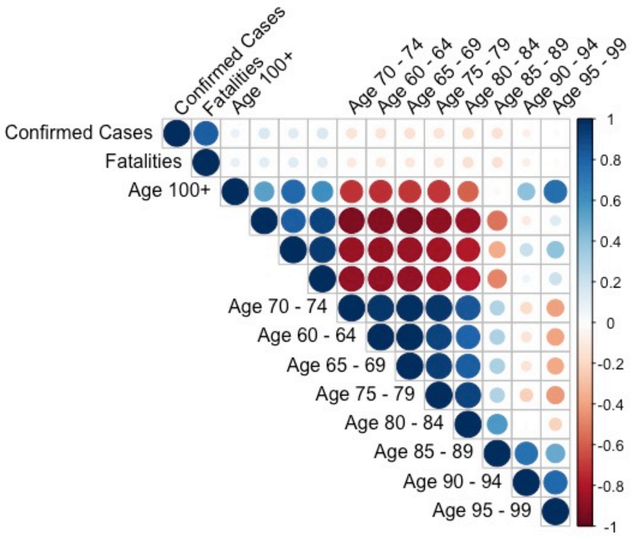
Number of confirmed cases for the 14th day

Number of fatalities for the 14th day

Data Preprocessing, Correlation Analysis







Correlation among Confirmed cases, fatalities, and percentage of the population with ages larger than 60 years old

Correlation among Confirmed cases, fatalities, and percentage of the population with ages 0-59 years old

Correlation among Confirmed cases, fatalities and other features

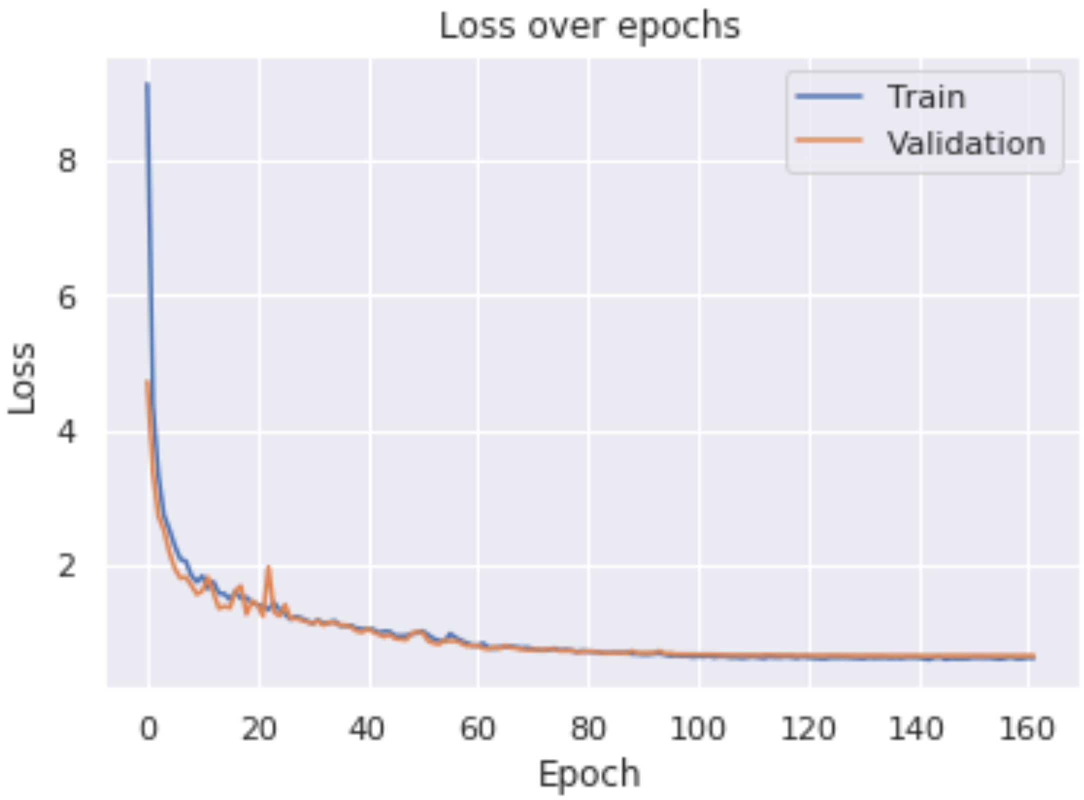
Model Evaluation

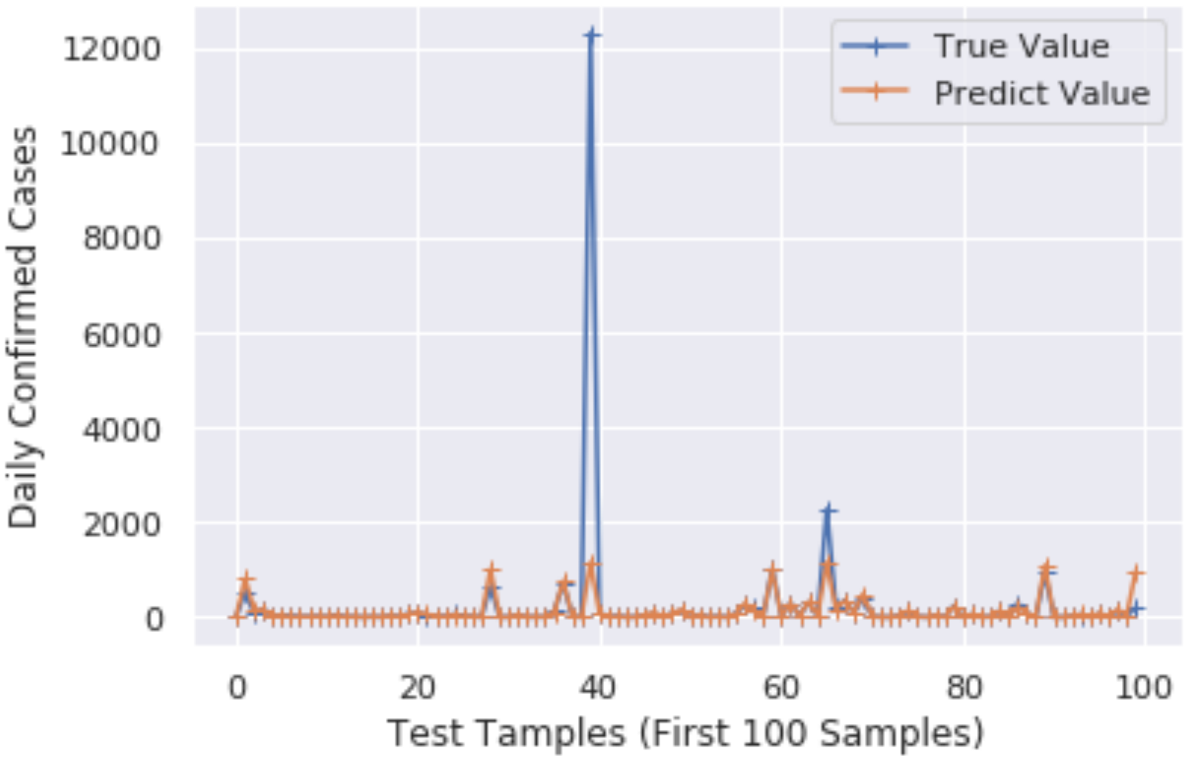
To evaluate the accuracy of the model:

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)^2} \tag{1}$$

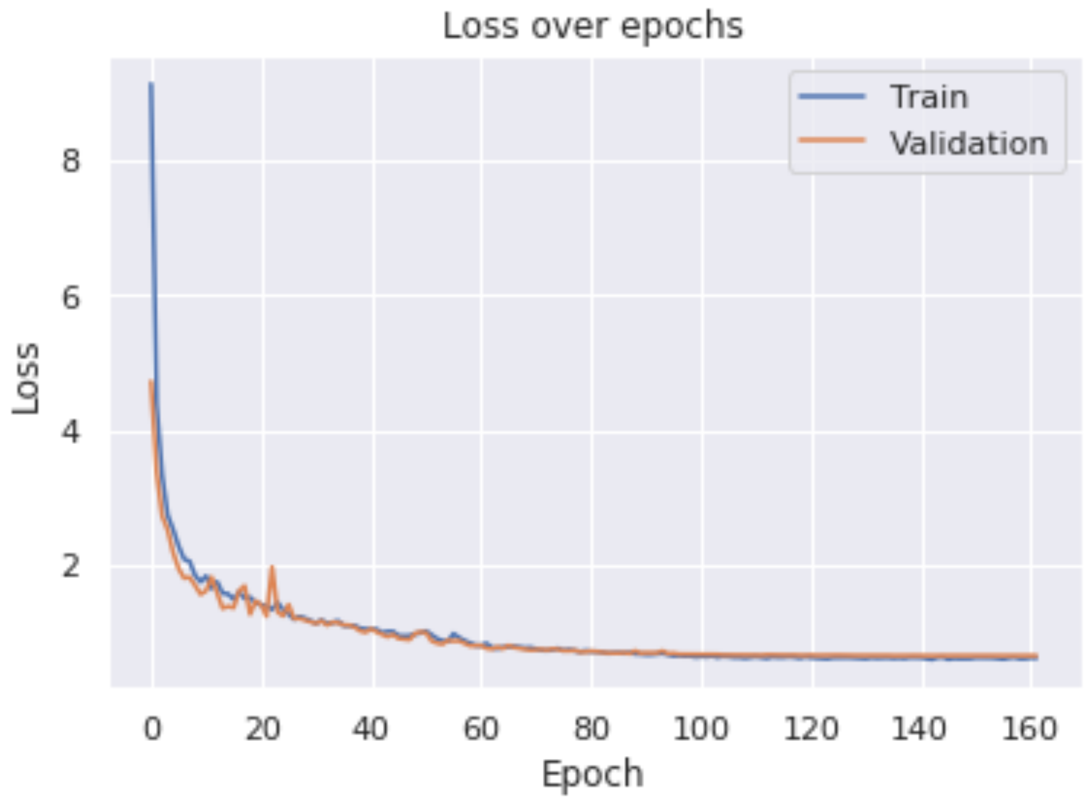
where $\hat{y}_i$ is the i^{th} predicted value, and y_i is the corresponding true value, where $i = 1, \ldots, n$.

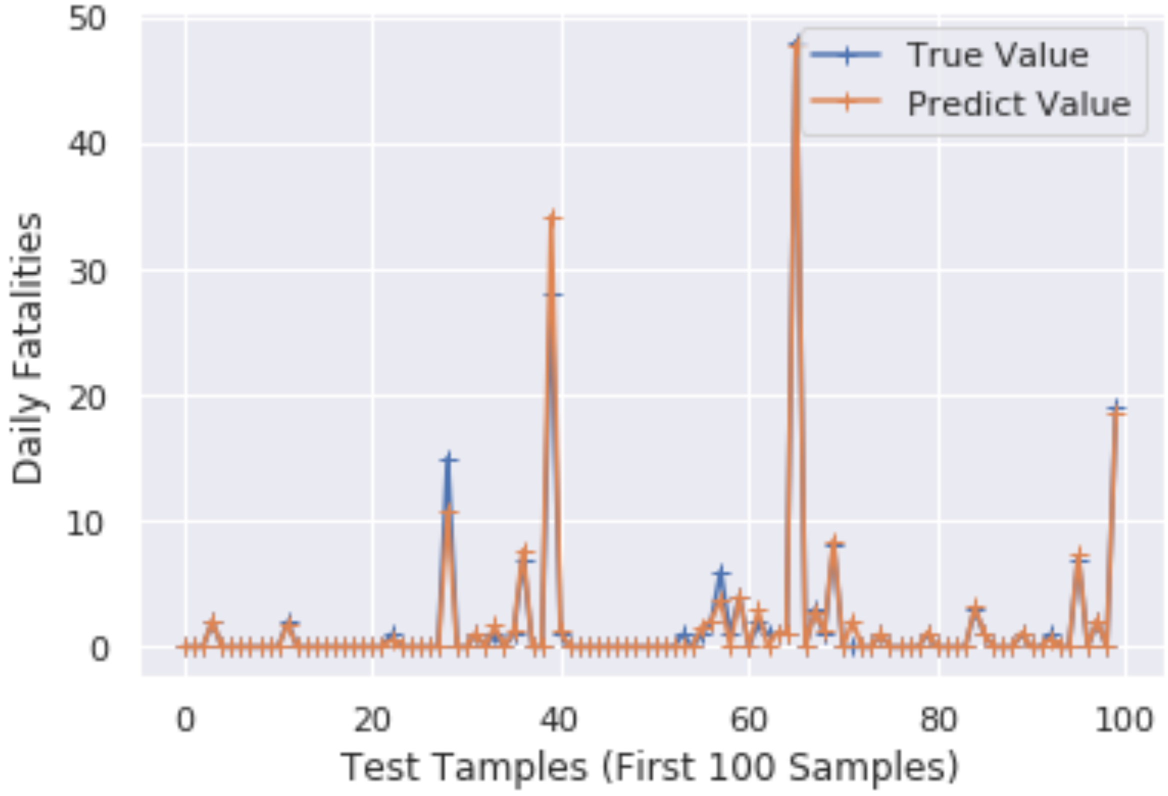
Confirmed Cases Prediction





Fatalities Prediction





Thoughts

- Whether deep learning can be used for disease prediction? (Compared with SIR/SEIR…
- How can it be applied?
- Flatten the curve/ End the curve?