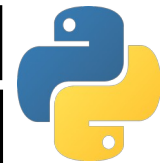




Improving Policy Making with Informed Covid-19 Case Prediction



By John Hurd
Class: CS4267 (Machine Learning)
Project Supervisor: Dr. Mohammed Aledhari

Introduction/Purpose

What?

A Predictive Model of New Daily Covid-19 Cases with the ability to predict the appearance of large dips and swells in cases

How?

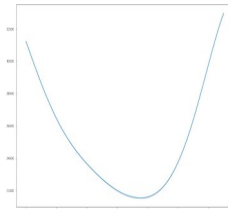
- Combine an LSTM RNN with a Regression ANN
- Incorporate more input data than typical time series models

Why?

- Improved ability to relate to data
- Better-informed policy making due to comparative modeling
- More "directional correctness" than existing models

Methods/Experimental Design

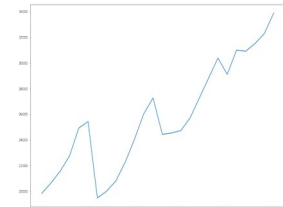
LSTM time series analysis was combined with regression



Estimated Daily Covid-19 Cases Over Time

	Predicted Cases	day	Driving	Transit	Walking
0	31216.230489	3	94.50	32.65	79.45
1	30685.804688	4	99.48	32.74	84.13
2	30159.291016	5	102.44	33.20	86.94
3	29639.000000	6	107.95	33.67	90.55
4	29126.039062	0	125.32	36.12	104.37
5	28629.283203	1	115.84	33.43	101.57
6	28153.341797	2	95.79	31.38	85.35
7	27698.808594	3	92.54	33.08	78.61
8	27264.914062	4	106.47	37.14	91.83
9	26851.412109	5	108.78	36.98	93.44
10	26459.140625	6	111.45	36.37	94.30

Training Data For Regression Model



Estimated Daily Covid-19 Cases Over Time

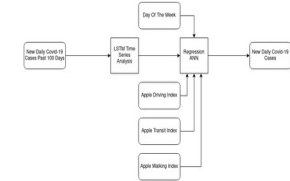
A RNN with LSTM Layers was used to estimate the data from April 22nd to June 26th using the prior data.

An ANN was trained for regression using the predicted data for April 22nd Through May 31st and other factors,

The ANN was used to estimate data from June 1st to June 26th using training data from April 22nd to May 31st

Summary

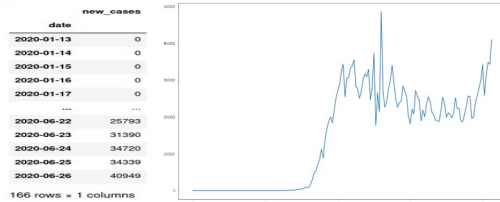
Why This Model?



- Comparable Accuracy
- More Reliable Data
- More Time-Specific Data
- More Input Metrics
- Improved Policy Making

Data

Covid-19 case data for 2020 and the Apple Mobility Index were used.



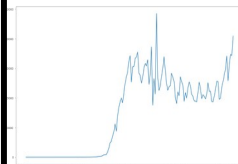
Covid-19 Data Table



Apple Mobility Index

Results

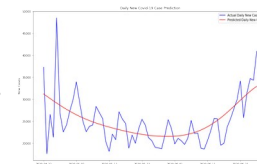
The ANN and RNN combined produced a trend line that contains peaks and troughs. The RNN alone did not



Raw Data



RNN



No Peaks Or Troughs



ANN



Peaks and Troughs

Minimal Change In Overall Error

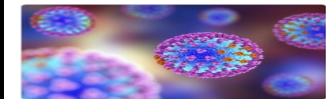
Error	As Cases	As Percentage
Average LSTM Error	2969	11.6
Average LSTM-Regression Error	3470	12.5

Future Directions

Economic Implications?



Influenza Model?



Improved Accuracy?



Data Sources

Covid-19 Data: <https://ourworldindata.org/coronavirus>

Apple Mobility: <https://www.apple.com/covid19/mobility>