Stocks and Machine Learning in a Time of Covid

UCSD DATA SCIENCE & VISUALIZATION

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Purpose:

To use machine learning to predict stock behavior had the March 2020 stock market crash due to the global pandemic not happened

SOURCE DATA: YAHOO FINANCE

Background:

- There was a large market crash in March 2020 due to fears surrounding the spread of Covid-19 and many countries around the world issuing stay at home orders
- Due to wild speculation about the market's recovery and low rates of return in typically "safe" investments like bonds, there has been an unprecedented rush of money into the market.
- Tech, online education, e-commerce, and grocery stocks have benefitted the most being for the most part unaffected by stay at home orders, however EV (electric vehicle) stocks like Tesla have also had an army of new investors rush in.
- Stocks that have also seen a lot of volatility and have yet to recover since the crash include travel-related stocks like airlines and cruises, as well as oil which at the same time had a price war between Russia and Saudi Arabia.

Using Machine Learning to Answer “What If”:

- We chose the LSTM Long-Short-Term Memory Recurrent Neural Network as our machine learning model.
    - Popular for time-series forecasting for classification, processing, and making predictions.
- We used two years of individual stock closing price data from July 2, 2018 – July 9, 2020.
- We trained and tested the LSTM model on data up to December 19, 2019.
- We predicted the stock prices after December 19, 2019 with the already-trained LSTM model.
- We plotted the predicted stock prices against the actual prices for that time period to visualize the model’s accuracy.

Training and Testing

Create and train the model

```
# Use train, test, split to training and testing data
from sklearn.model_selection import train_test_split

input_data = []
output_data = []

for i in range(60,len(model_data)):
    input_data.append(model_data.loc[i-60:i,"Close"])
    output_data.append(model_data.loc[i,"Close"])

X = np.array(input_data)
y = np.array(output_data).reshape(-1,1)

X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=42)
```

Training Loss

```
Epoch 1/5
8/8 - 1s - loss: 0.2060
Epoch 2/5
8/8 - 2s - loss: 0.0355
Epoch 3/5
8/8 - 2s - loss: 0.0230
Epoch 4/5
8/8 - 1s - loss: 0.0115
Epoch 5/5
8/8 - 1s - loss: 0.0125
```

Testing Loss

```
3/3 - 0s - loss: 0.0137
Loss: 0.013735244050621986
```

Predicting 2020 Stock Prices

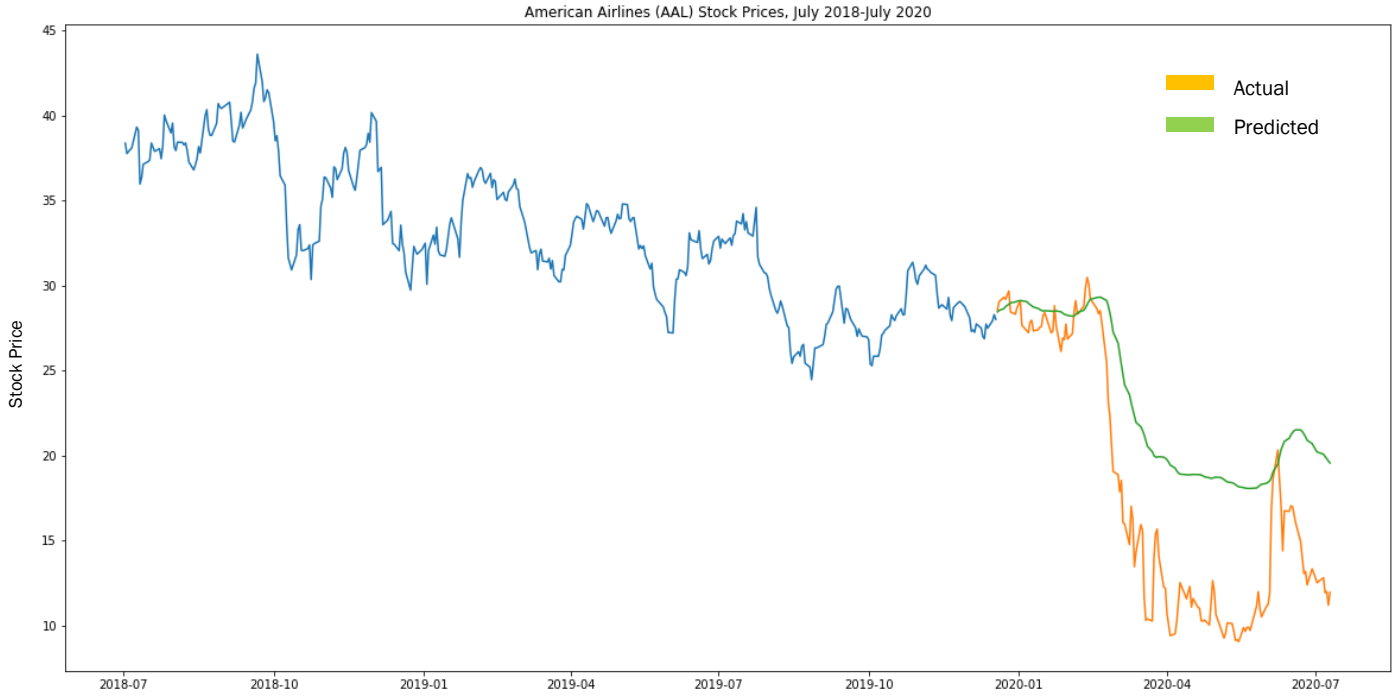
	Date	Close	Prediction
370	2019-12-19	1792.280029	1763.760742
371	2019-12-20	1786.500000	1765.202881
372	2019-12-23	1793.000000	1766.767822
373	2019-12-24	1789.209961	1768.249756
374	2019-12-26	1868.770020	1771.884033
...	...	...	...
505	2020-07-06	3057.040039	2296.062012
506	2020-07-07	3000.120117	2307.124023
507	2020-07-08	3081.110107	2319.689453
508	2020-07-09	3182.629883	2333.645752
509	2020-07-10	3200.000000	2347.820312

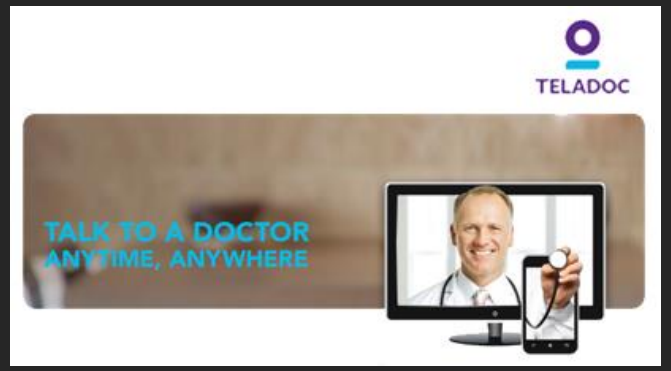
Our model did a good job of predicting the trends in stock prices.

One limitation is that we weren't able to predict stock prices without using the actual closing prices.

American Airlines

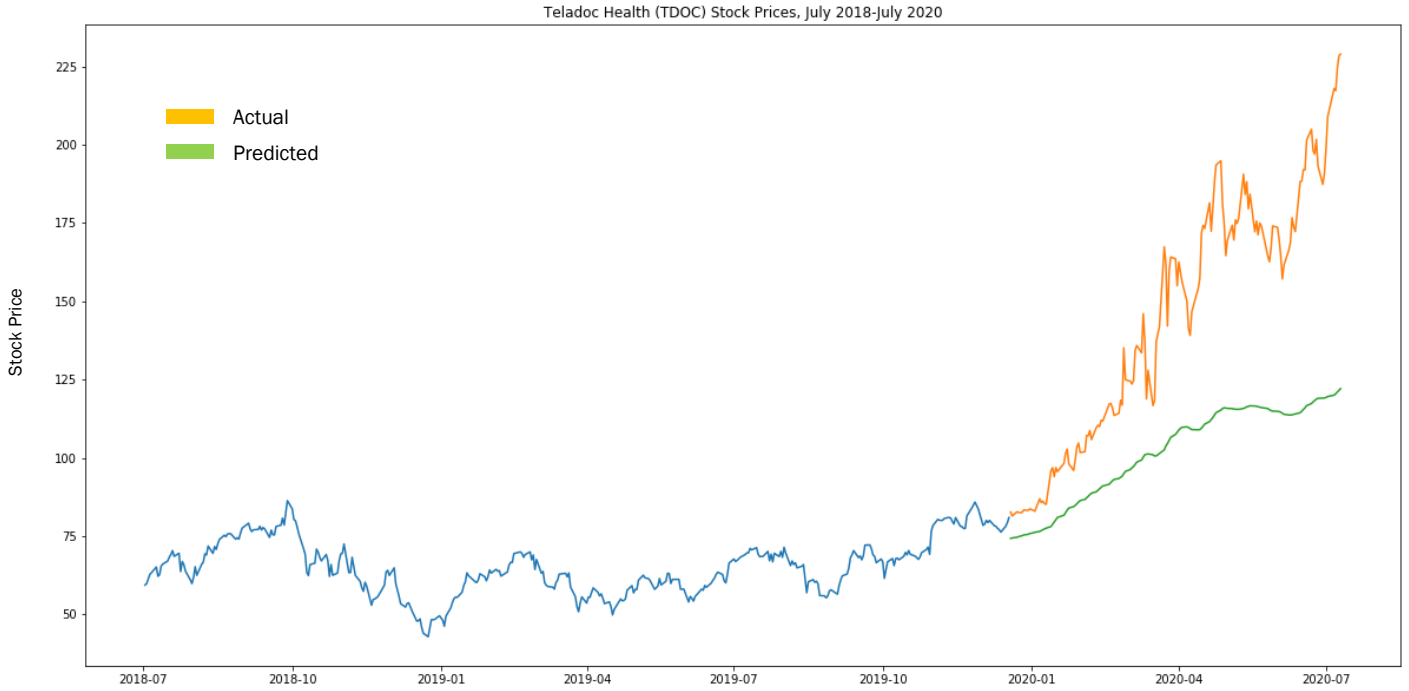
- The model was able to partially predict the sharp decline in price
- Daily trade volume increased significantly in correlation to the start of the pandemic
- Travel industry stocks in general were hit very hard and are still held down by uncertainty

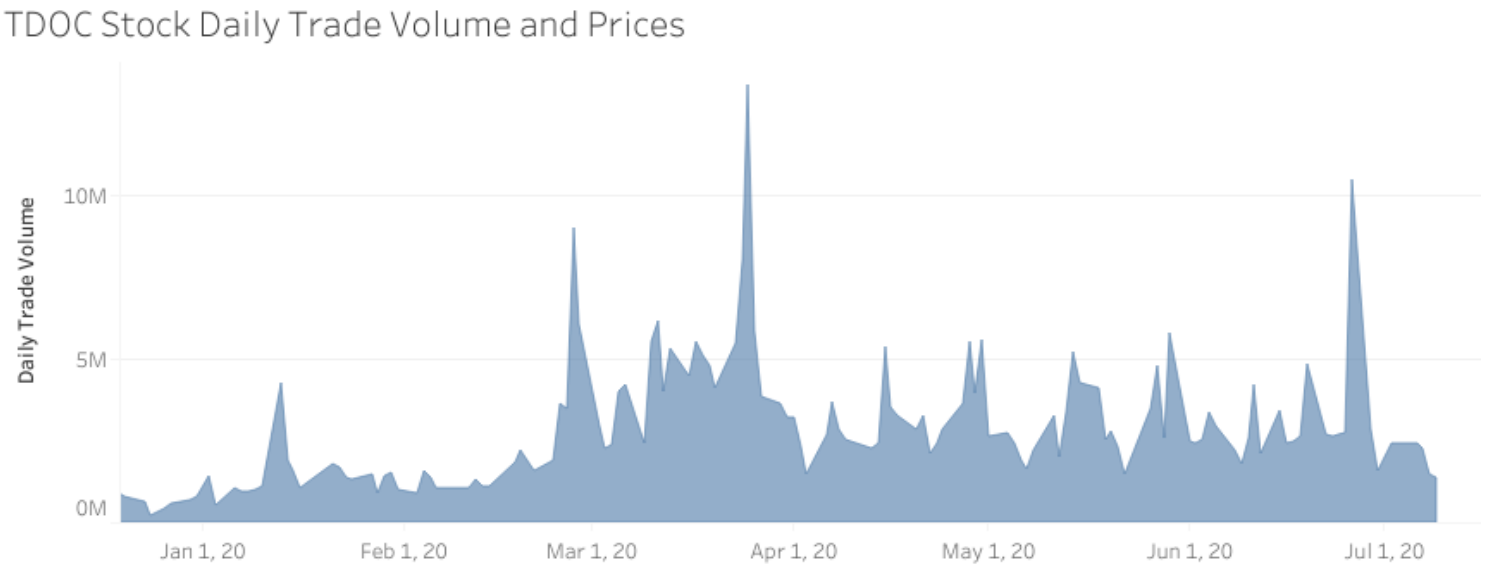




Teladoc

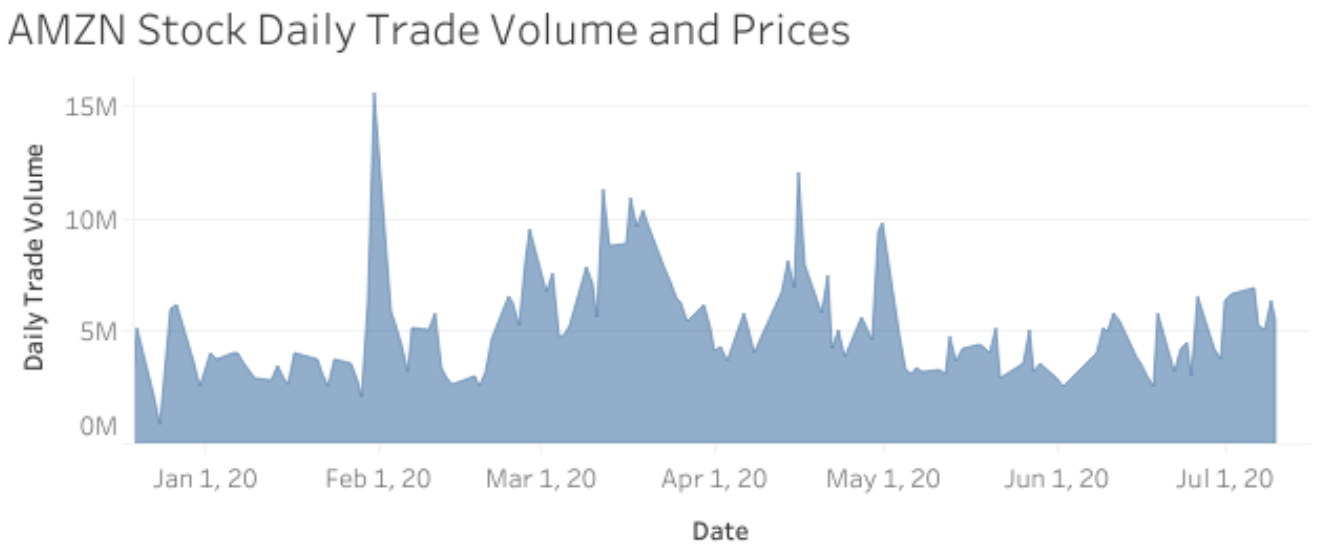
- The LSTM model is able to predict Teledoc's rise, but it is not nearly as steep
- Peak in trade volume during this time period was Mar 25, when states started issuing stay-at-home orders
- Teledoc has had major growth, but this could increase competition in the industry
- Despite its growth and surge in stock price, Teledoc has been in the red every year, so it may end up being an undesirable investment
- [Visualizing through Tableau]





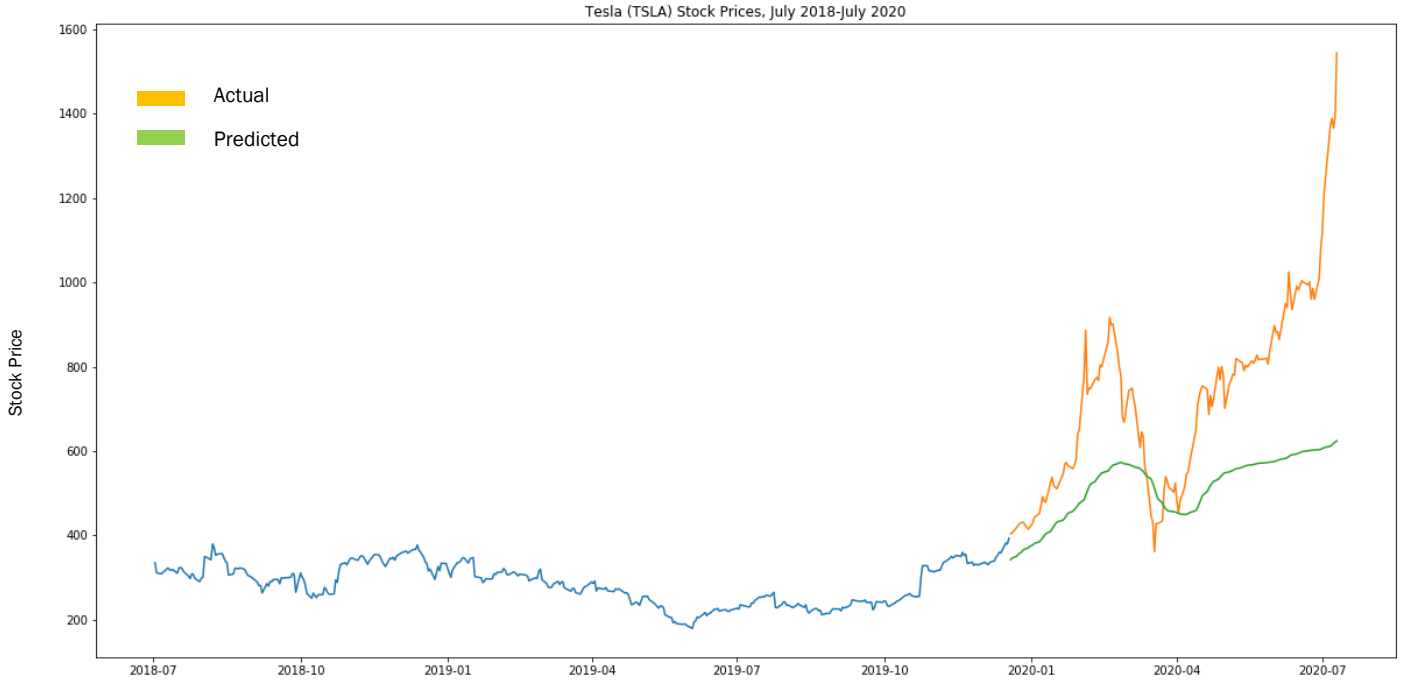
Amazon

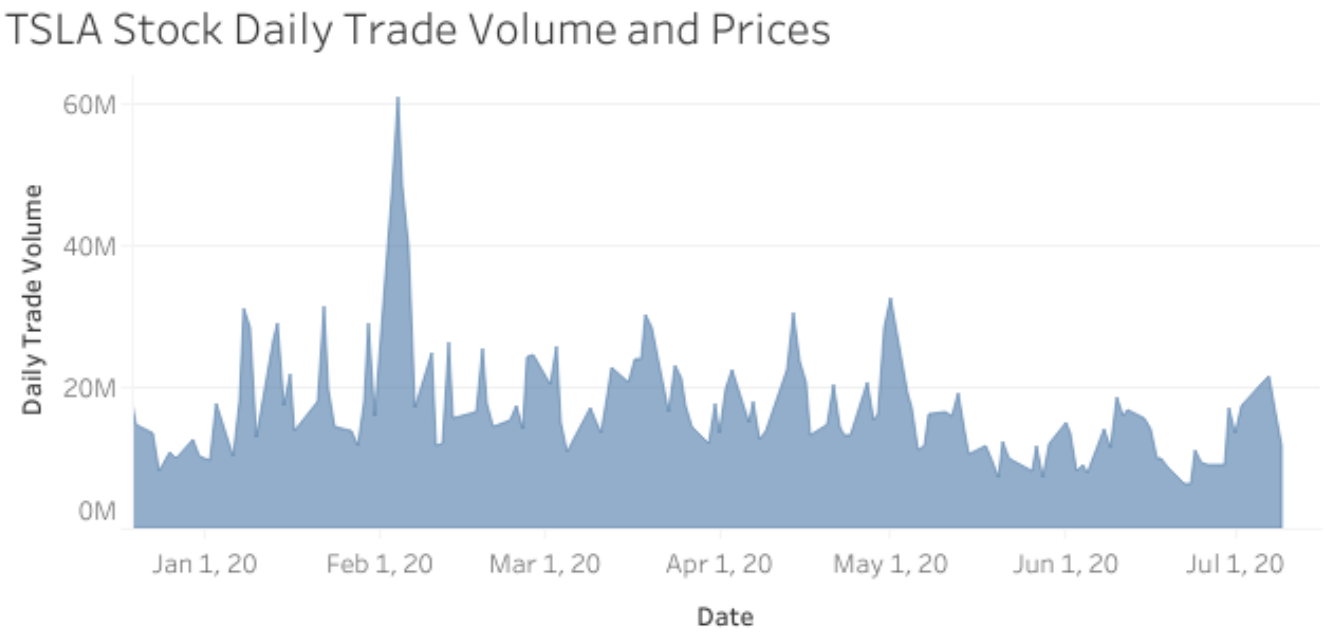
- The LSTM model is able to predict Amazon's rise, but it is not nearly as steep
- It also misses some of the volatility in February
- Anecdotally, e-commerce sites in general like China's Alibaba and JD.com have been seeing similar rises, but not nearly on the scale of Amazon

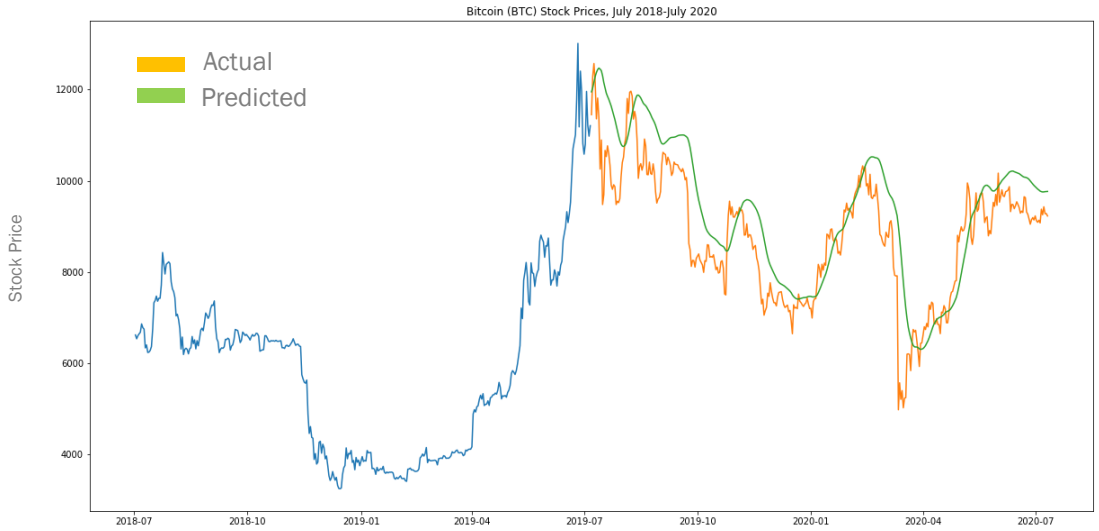


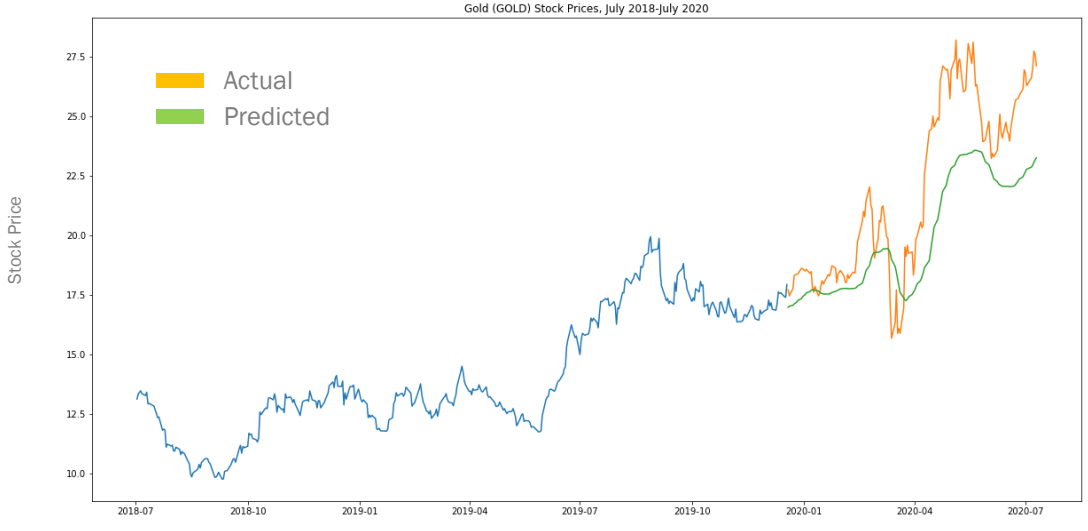
Tesla

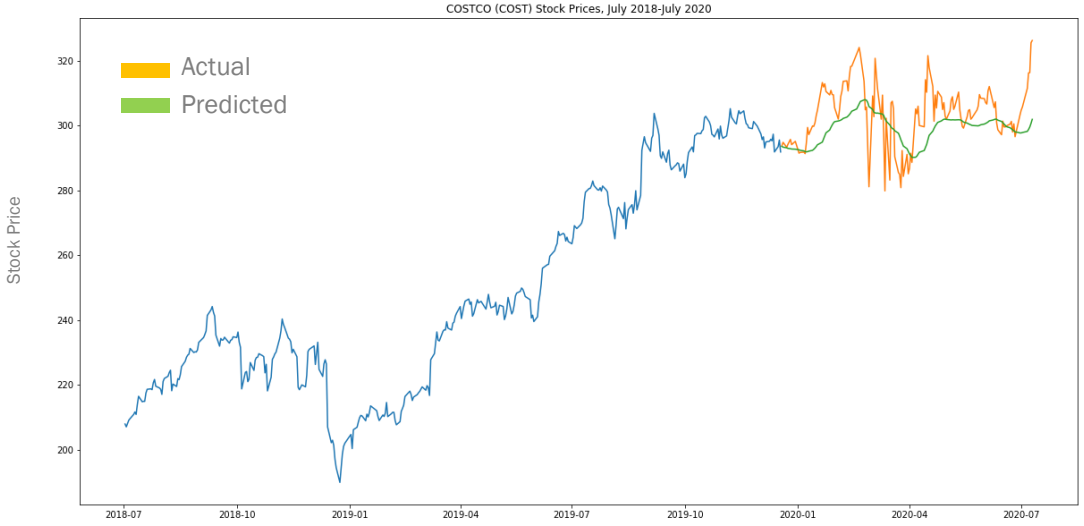
- LSTM model predicts slight increases but fails to capture how drastic the increases really are
- Pandemic expected to lull auto industry but ended up spiking the EV industry
- Robinhood – no-fee trading app
- TSLA shares have risen ~286% this year

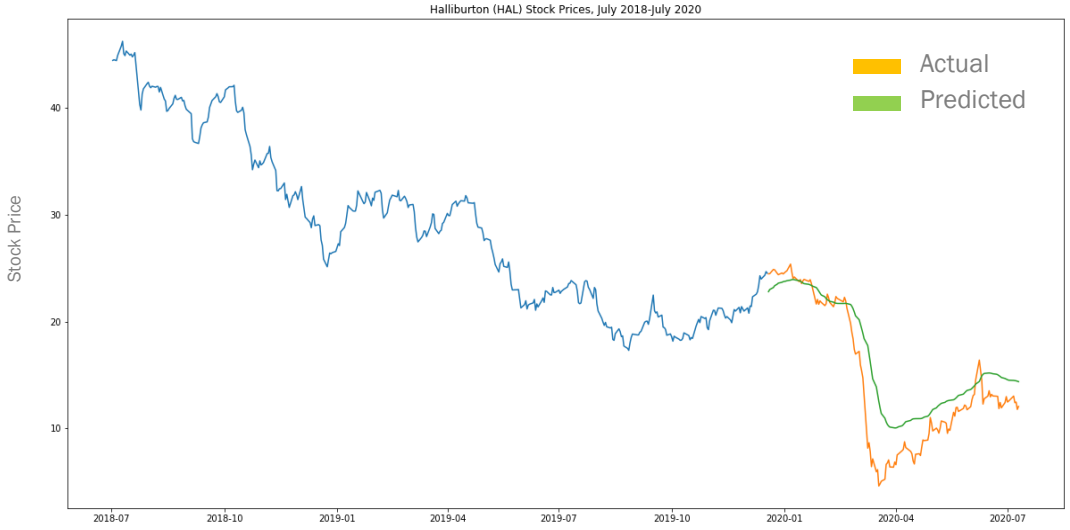












The model more closely followed other investments despite volatility

Summary

- Unable to get a total prediction using this model without it using existing data
- Would like to predict stocks from just before Covid through July “what would have happened”
- But also use the model to predict current data given the market crash out through at least the fall.

Questions?