Effect of President's tweets on the S&P 500 index

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Summary

Can a machine be trained to predict the likely stock market index movement from President Trump's tweets? Here we build machine-learning models that predict the likely movement of the S&P 500 index-tracker SPY in response to a tweet released by President Trump. Models based on LSTM with word-to-vector encoder and on neural network with sentence-to-vector encoder are presented. We train the models on President Trump's tweet record from 2017 to late 2019 and find that the trained models yield no significant difference in their prediction errors compared to a baseline model which always predicts no change. The lack of accuracy improvement from the machine learning models likely stems from the weakness or non-existence of any direct relationship between Trump's tweet text and SPY movement.

Data & Features

Data sources:

1. Trump tweet archive: www.trumptwitterarchive.com
2. Wharton Research Data Services (WRDS): TAQ (consolidated trades) – raw SPY traded price history data

Apply resampling to the raw SPY price data by averaging trade prices over 1 minute.

Tweet and SPY data sets are combined and reformulated into input: tweet, output: SPY percentage change 15 min after tweet.

Train/Validation/Test : 1145/200/300

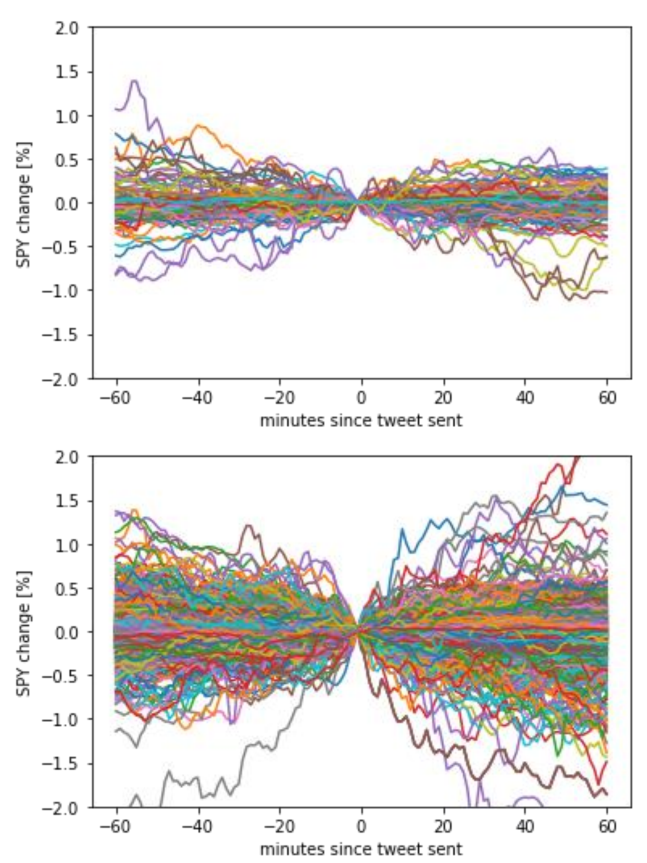


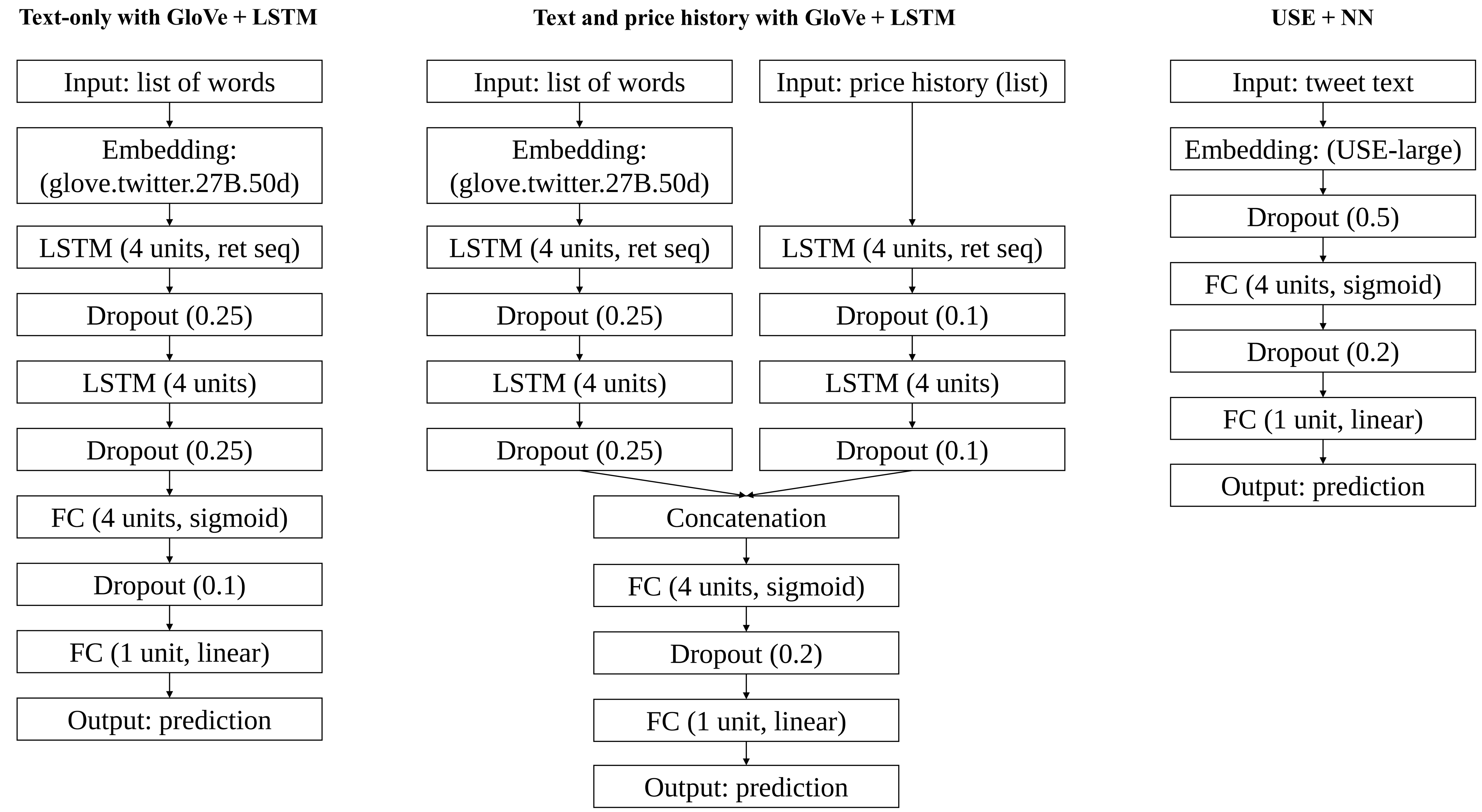
Figure 1: SPY changes relative to the time Trump tweets are released.
Upper: 100 random traces
Lower: all training

Time (ET)	Input (tweet)	Output (%)
2019-08-13 09:38:44	Thank you Steve! https://t.co/4qwvkUTg5t	+1.065
2019-08-01 13:26:10	buy agricultural product from the U.S. in large quantities, but did not do so. Additionally, my friend President Xi said that he would stop the sale of Fentanyl to the United States – this never happened, and many Americans continue to die! Trade talks are continuing, and during the talks the U.S. will start, on September 1st, putting a small additional Tariff of 10% on the remaining 300 Billion Dollars of goods and products coming from China into our Country. This does not include the 250 Billion Dollars already Tariffed at 25%	-1.267
2018-12-24 09:31:50	Virtually every Democrat we are dealing with today strongly supported a Border Wall or Fence. It was only when I made it an important part of my campaign, because people and drugs were pouring into our Country unchecked, that they turned against it. Desperately needed!	-0.7112
2018-11-27 14:05:39	Very disappointed with General Motors and their CEO, Mary Barra, for closing plants in Ohio, Michigan and Maryland. Nothing being closed in Mexico & China. The U.S. saved General Motors, and this is the THANKS we get! We are now looking at cutting all @GM subsidies, including for electric cars. General Motors made a big China bet years ago when they built plants there (and in Mexico) - don't think that bet is going to pay off. I am here to protect America's Workers!	-0.0281
2019-08-05 12:00:14	China is intent on continuing to receive the hundreds of Billions of Dollars they have been taking from the U.S. with unfair trade practices and currency manipulation. So one-sided, it should have been stopped many years ago!	-0.0218

Table 1: Sample look at the data sets

Models

Apply transfer learning from learned word and sentence encoders: glove.twitter.27B.50d and universal sentence encoder (USE)



Results

- None of the constructed models yield significantly lower prediction error than the baseline model for the test data set.
- All trained models output predictions that are typically within a ± 2 basis points.

Model	Prediction error ($\sqrt{MSE}$, basis point = 0.01%)		
	Train	Validation	Test
Baseline (no change)	15.13	15.25	15.26
Text-only LSTM	15.06	15.20	15.34
Text and price history LSTM	13.91	14.89	15.38
USE + NN	15.09	15.20	15.31

References

- See Github: github.com/physicszid/cs-230-2019-trump-tweet-spy-project
- J. Pennington et al. Glove: Global vectors for word representation. 2014.
- Daniel Cer et al. Universal sentence encoder. arXiv, 2018

Discussion & Future Work

- Our results suggest that the direct effect of Trump's tweets on SPY movements is limited to non-existent.
- Larger, more complicated models with additional inputs such as tweets and news from all sources could give lower prediction errors. However, it would be difficult to separate the effect belonging to Trump tweet for such a model.
- Select other stocks or indices as predictor output instead of SPY. The effect of president's tweets may show up noticeably in the movements of other stocks or sector-specific indices, such as manufacturing, which tend to be more volatile than the S&P 500.
- Data augmentation may help with training the models. Available data such as Trump's tweets outside market hours and tweets from other sources may lead to prediction improvement if one can realize a way to integrate these data into the training of the models.

Video link: https://youtu.be/lD31uveVypU