



The financial crash of 2020 and the retail trader's boon: a correlation between sentiment and technical analysis

Aurthur Vimalachandran Thomas Jayachandran¹ 

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Abstract

The American stock market passed a critical phase during 2020. The CBOE volatility index had spiked from a little over 20 to a little over 50 and returned flat to 16% year on year basis. This paper presents a novel model to measure the engagements of retailer trading through public perception and forced media messages. The markets have proved to be resilient on the expected returns in the long term however the short-term spot markets were unpredictable. Even though the Dow Jones fell from 29,100 points to 19,180 points the big investment banks made huge trading profits. Bank of America's trading revenue grew from \$3.8 billion to \$5.3 billion whereas the retailers went for the bankrupt companies such as Macy's and Hertz. The paper discusses the prediction with help of neural networks and NLP models to analyze retailer's favorite stocks and helps to predict their future expected returns of the stocks. The results of the research create a new key performance index for asset-level risk management using this correlation.

Introduction

The global markets had significant changes and fluctuations in 2020 due to the outbreak of the novel COVID-19 in December 2019. The global markets shrugged off the news and continued to run higher as it had predicted the government would be able to contain them as it was in the case of severe acute respiratory syndrome (SARS), the Middle East respiratory syndrome (MERS) (Wu et al. 2020). However, the market panicked by mid-March 2020 when Europe had become the epicenter of the epidemic forcing the market to crash resulting in the deepest oil futures crash in centuries. In the past costs of pandemics and epidemics had been analyzed for HIV/AIDS, obesity and diabetes, and Ebola (Bloom et al. 2018). Lockdown was never considered adding uncertainty to the equity markets as many researchers proposed for future agendas in this area (Goodell 2020). Along with it FED or ECB

✉ Aurthur Vimalachandran Thomas Jayachandran
aurthur01@gmail.com

¹ Samara University, Samara, Russia

induced volatility fueled the volatility (Bongini et al. 2019). The market crash was correlated concerning air crash disasters (Bosch 1998) and exactly Boeing led the crash of the stock market from \$350 to \$95. Lot of research related to disruptions in finance and COVID-19 could be found, interesting investigation of oil, price risk exposure of financial and non-financial industries (Akhtaruzzaman et al. 2021a), gold as a hedge and safe-haven asset in different phases of the pandemic (Akhtaruzzaman et al. 2021b), financial contagion (Akhtaruzzaman et al. 2021c) and dynamic changes between COVID-19 media coverage index (MCI) and ESG leader indices (Akhtaruzzaman et al. 2021d).

There has been little research on creating patterns or correlations with the retailer's trading. Data and information about companies are widely available to the public. Gamification of trading apps and zero brokerage has induced over-trading among the retailers. Tesla had been the number one choice for retailers, following assumptions made the stock in a strong uptrend (1) heavy short selling due to COVID-19. (2) Addition to Index heavily bought both by retailers and Mutual funds. (3) Splits of the shares. (4) Going green fund allocation by the USA government. Fair price discovery was difficult for machine learning-based models and its predicted returns were not related to the actual returns to the equity price. This research uses a machine learning model to solve such predictions in the future.

An ensemble model of two machine learning models LSTM and NLP was used to investigate and measure the retailer engagement to formulate a correlation for mitigating risks and optimizing portfolio with predicted volatility and expected returns (Fig. 1).

The hybrid machine learning model

This section would briefly explain the two machine learning models used in this to predict the stock performance. The ANN model uses artificial neural networks for studying patterns of technical chart analysis and the output is compared with Natural language processing and the results are correlated with each other concerning actual equity price.

In Fig. 2 a neural network model (ANN) was developed which has the following parameters as inputs, last traded price (LTP), 3-period Moving average (MA3), 15-period moving average (MA15), 50-period moving average (MA50), Elliott Wave Oscillator (EWO) and Commodity channel index (CCI). The output of the model would be a buy or sell. The model is similar to the many long short-term memory time series forecasting methods that employ deep learning for training the data sets to predict stock prices forecasting such as using LSTM. Numerous proposals and research about models are previously examined (Budiharto 2021; Shah et al. 2018; Chen et al. 2015; Bekiros 2007).

Elliott Wave Theory and neuro-fuzzy systems have been investigated in various research (Atsalakis et al. 2011). This model helps in the buying and holding concept of investments and It is purely based on observation. The Elliott Wave Oscillator (EWO) chosen here has a difference between 35-period and 5-period simple moving average (SMA) based on the closing of the candlestick pattern. Positive EWO value inhibits longs trade which means weakening of downtrend or considered as strengthening of uptrend

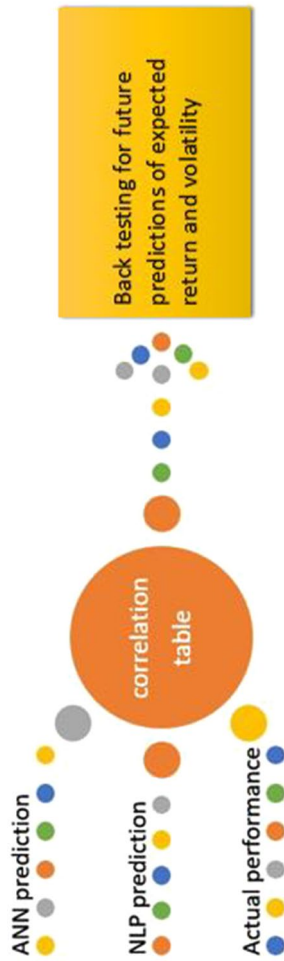


Fig. 1 Representation of this research overview in estimating a correlation between machine learning prediction model and sentiment analysis model

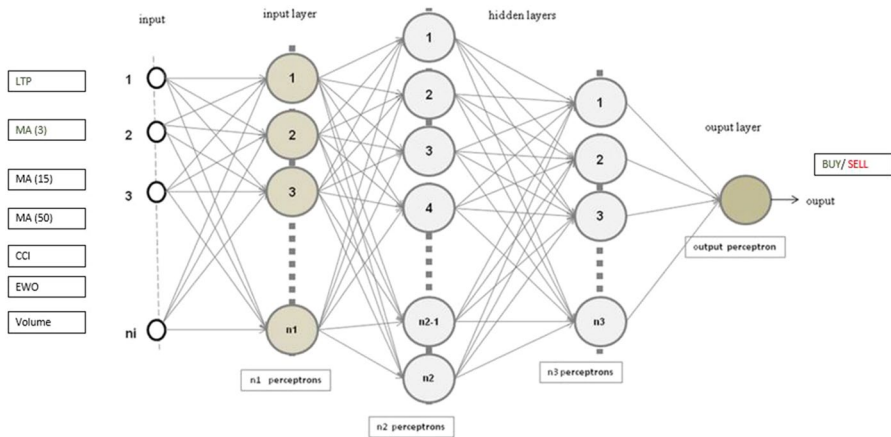


Fig. 2 Representation of the ANN model used in this research

whereas Negative EWO value means strengthening downtrend or may be considered as weakening uptrend (Poser 2003; Prechter and Frost 1998). Commodity Channel Index (CCI) oscillator when is above +100 means the Last traded price (LTP) is above the average and it is below the average price when it is -100. The sell and buy are initiated when the oscillator shows below -100 and above +100 respectively (Maitah et al. 2016).

Natural language processing (NLP) has advanced that it can process large amounts of unstructured data using algo-based processing. There are numerous stock market forums and financial news reports. NLP was modeled here to obtain the ratio of positive and negative sentiments about equity price movements and Fig. 3 shows a representation of the working principle based on the developed NLP model.

Various research has been done and explained in the working principle of NLP processing. The tools used are similar to the past researches (Xing et al. 2019; Ouyang et al. 2015). For online sentiment analysis convolution, neural network (CNN) outperformed long-short-term memory network (LSTM) and LSTM-CNN architectures (Haque et al. 2019).

The NLP techniques extract text data from Wallstreet bets, a Reddit community, and the stock forum of Investing.com to understand the sentiments of 16 stocks and 1 cryptocurrency. The data were extracted from the period of March 2020 to February 2021. The goal is to find statistical links to estimate the correlation for future research. The 16 stocks are classified such as value picks, IPO picks, marijuana (pot stocks) and bankruptcy picks as shown in Table 1.

Results and discussions

As soon as the market fell in March 2020 and April 2020, all the companies traded had SELL sentiments from NLP model and also SELL sentiments from technical signals thus volatility increased. From April 2020, the consumer segment and

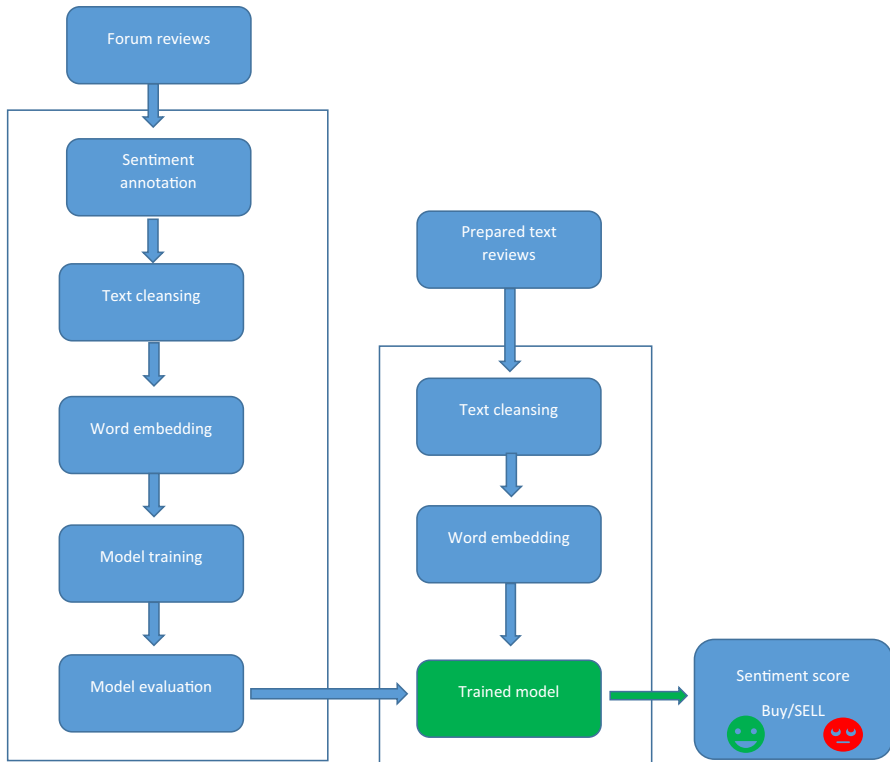


Fig. 3 A flow chart representation of the NLP model for sentimental analysis

Table 1 Grouping of retailers favorite stocks

Value stock picks by retailers	IPO stocks	Pot stocks	Bankruptcy companies preferred by retailers	Cryptocurrency
Bank of America	Palantir	Tilray	Royal Caribbean	Dogecoin
Disney	Doordash	Aphria	AMC	
Boeing			Macy	
Tesla			Occidental petroleum	
Appian corporation			Hertz	
Nikola			GMC	

technology stocks started to perform better whereas retailers were not interested in the buy-side. During this period Royal Caribbean, Macy, Occidental petroleum, and Hertz had highly negative sentiments from Media, forums, and YouTubers due to the concern with bankruptcy. From June, when oil prices were cruising upwards retailers were expecting the lockdown to end by Sept 2020 started investing. All these stocks bottomed out and started to perform better except hertz. Hertz had its fantastic rally from \$0.56 to \$5.3 at the beginning of June 2020 just a week after

Table 2 Correlation between retailer's sentiment and computer-based trading for stocks with less than \$1.5 billion market cap

ANN (Technical analysis) output	NLP (sentiment analysis) output	Market direction back-tested	Expected return on the direction (3 months' time frame)
Buy	Buy	UP	+60 to +75%
Sell	Sell	Consolidation	± 15%
Buy	Sell	UP	+15% to +75%
Sell	Buy	UP	+100% to +200%

Table 3 Correlation between retailer's sentiment and computer-based trading for stocks with greater than \$5 billion market cap

ANN (technical analysis) output	NLP (sentiment analysis) output	Market direction Back-tested	Expected return on the direction (3 months' time frame)
Buy	Buy	Consolidation	± 5%
Sell	Sell	Consolidation	± 5%
Buy	Sell	UP	+15% to +45%
Sell	Buy	DOWN	+30% to +75%

filing for bankruptcy. In this correlation, it is found that when stocks are less than \$1.5 the retailers can squeeze and pump the stock in their desired direction which usually tends to be the upside. The rally of GMC and AMC was also related, both had less than a billion-dollar market cap and the retailers were able to push the prices to skyrocket gains. The stock price gain of AMC and GMC was not only due to retail investors but also by big investments from companies such as BlackRock Institutional Trust Company, The Vanguard Group, and Morgan Stanley Investment Management Inc. who had accumulated the stock December 2020 quarter.

Thus when the market cap is less than \$ 1.5 billion, retailers' sentiments and predictions are always true which are later verified with the POT stocks of Tilray and Aphria. An interesting correlation was found between Occidental petroleum and Macy's both underperformed along with Bank of America from March 2020 to September 2020 and the retailer's sentiments were positive because of the relief package. Whereas, Boeing, Tesla, and Disney outperformed while the retailer's sentiments on these stocks were low. This creates a new set of correlations which are shown in Tables 2 and 3. One of the research was performed using crowdsourced data and the results are similar to the Appian share analysis (Sheng 2021).

Appian had an interesting rally. The value of performance expectation was stronger among the employees and insider buyers gained confidence. Thus employee perception is an important sentiment for future analysis.

At lower market caps of less than \$1.5 billion, retailers are stronger in pushing the market to their required direction whereas in the higher market cap high-frequency computers can take control using their multiple small orders at faster execution times.

The research does not focus on the expected returns but rather tries to find an innovative correlation for identifying the times when volatility would increase in the market.

The advantage of this is NLP can understand retail traders from all over the globe as they all do have a similar pattern of trading styles.

The final model, as determined by experimentation was of 80% of the available data for training, with at least 250,000 repetitions during training (about 4 h 40 min). It was observed the prediction trend was that of the actual trades for all observations with RMSE of 1.79. The highest variance on any day of trade in the 50-day period was 4.3%. It was observed that the predicted price movements followed the trend of the actual prices on the respective dates.

Conclusion

A correlation between market sentiments and financial news was investigated by other researchers using data from October 2006 to November 2013 (Wan et al. 2021). The results showed that the Technology space had highly positive sentiments and banks were negative due to the 2008 crash. However, during this period, banks performed well whereas the technology went into long-term consolidation. This shows correct interpretation and correlation is required to understand media sentiment, market movements, and retailers perception. This research result proves the importance to study the correlation between retailer's sentiments as more and more new retailers are becoming market participants. It is expected that more researchers would follow in estimating or predicting the measure of retailer's performances. Sentiment analysis based on NLP has been used for independent analysis rather than being used in correlation to create graph-based market dynamics. This research would help portfolio managers in helping to beat their benchmark indices and allows them to be prepared with volatility deviations.

Author contributions Research.

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Availability of data and materials Available on request from the author.

Declaration

Conflict of interest The author declare that they have no conflict of interest.

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