The Prudent Trader:
Stock Market Price Prediction using technical analysis and price history

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What is technical analysis?

- Technical analysis is an analysis methodology for forecasting the direction of prices through the study of past market data, primarily price and volume.

- Prices move in trends.

- History tends to repeat itself.

Technical indicators that we used:

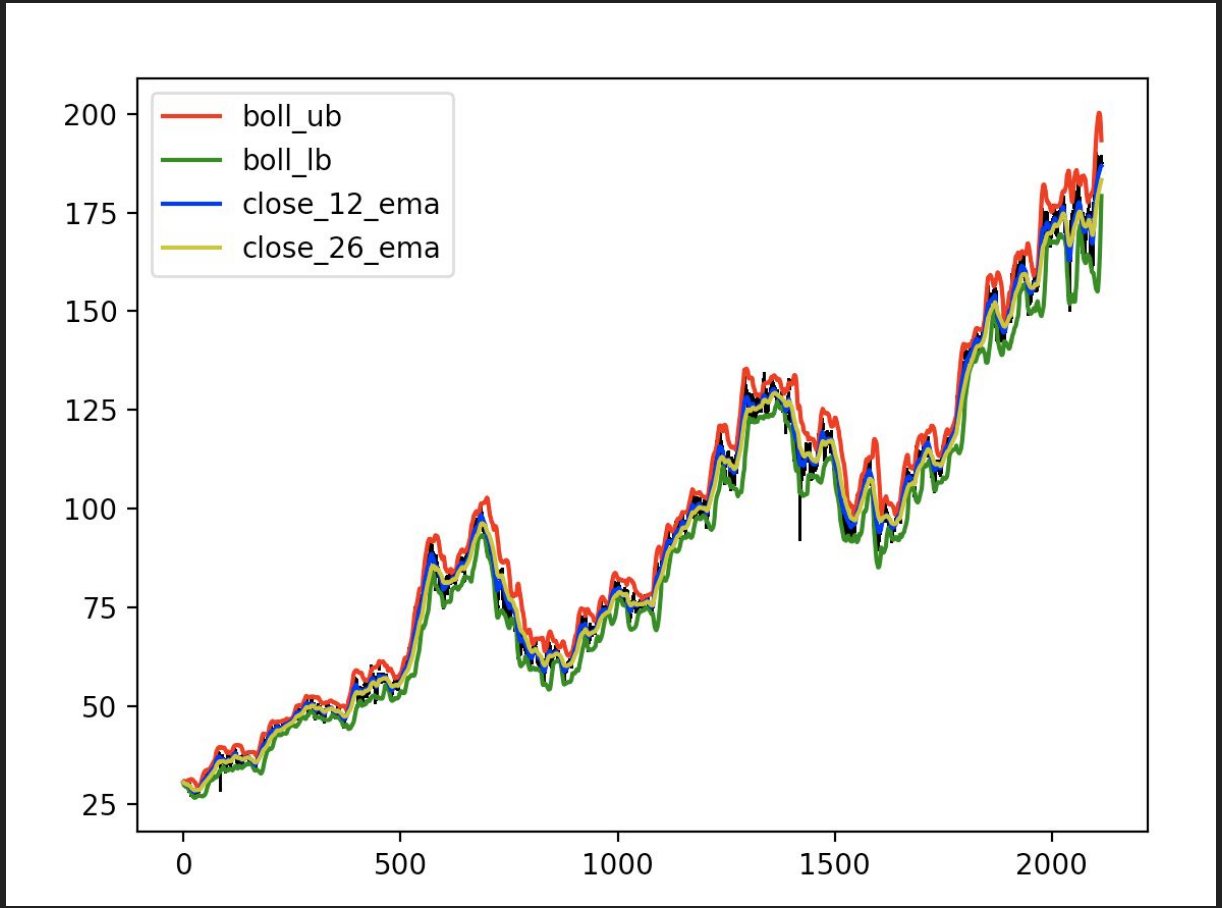
Trend indicators:

- Simple and Exponential moving average - mean with equal weights and mean with greater weights to recent values.
- MACD - Collection of three time series from closing price

Momentum indicators:

- CCI - relation of current price level with respect to the average price over a period of time. (-100 to 100)
- RSI - magnitude of recent gains and losses to check speed and change of price movements (0 to 100)

Volatility indicators: Bollinger Bands - creation of two bands (2 sd) away from the simple moving average. Wider bands, more volatility.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Setting up the technical analysis data

Historical Prices of a stock is fetched

Technical indicator values are calculated

Redundant or useless data is thrown away

Data is normalised

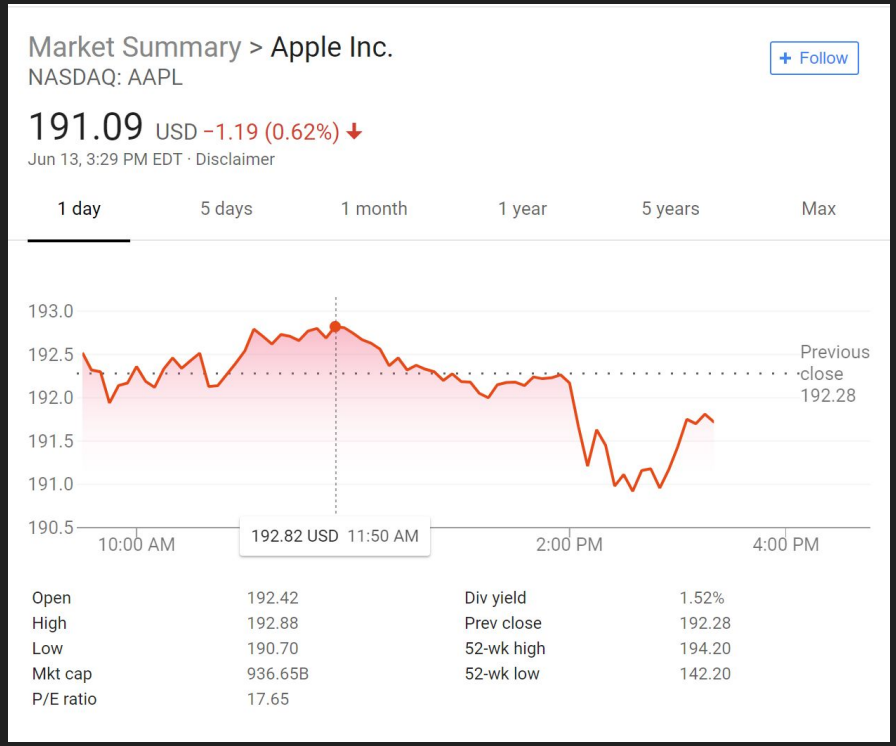
N/A values are replaced with average of its neighbour values

Technical indicator values are features for learning

Trend strength is calculated for prediction

Finding trend and trend strength using technical indicators data:

- Supervised approach
- Regression problem
- Classification won’t provide us trend strength
- Values near zero signify sidewise movement
- Algorithms used: Lasso, Linear Regression, Support vector Regressor, Ridge Regression, Bayesian Ridge.
- Predicted values: CCI, RSI, percent change of intraday values.



- Predicted CCI_20: 55.47 CCI_14: 69.97 RSI_12: 72.80 RSI_6: 69.03
- Predicted Trend Strength: -0.03
- Results indicate that trend strength is mildly negative and is in a mildly overbought region which matches the ground truth.

Results from technical analysis

Train accuracy: 96.3 %

Validation accuracy: 91.5%

- Accuracy on different predictors are calculated and hence average values are calculated.
- Validation set is used to fine tune learning algorithms and corresponding hyperparameters for different predictors.
- One test data point is used to predict trend and trend strength for the following day.

Prediction using price history

- Used features are Open, High, Low and Close values of stock
- Data is divided into train, validation and test set
- Each set is normalized.

Rolling Regression

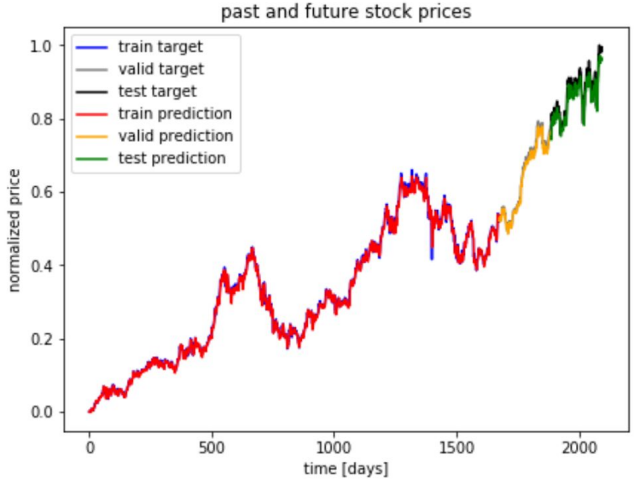
- Each day’s High and Low values are predicted from previous day’s Open, High, Low and Close values .
- Validation set is used to choose regressor along with hyper parameter
- Current day’s value is used to predict the next days Low and high values hence providing us information regarding buying and selling zones.

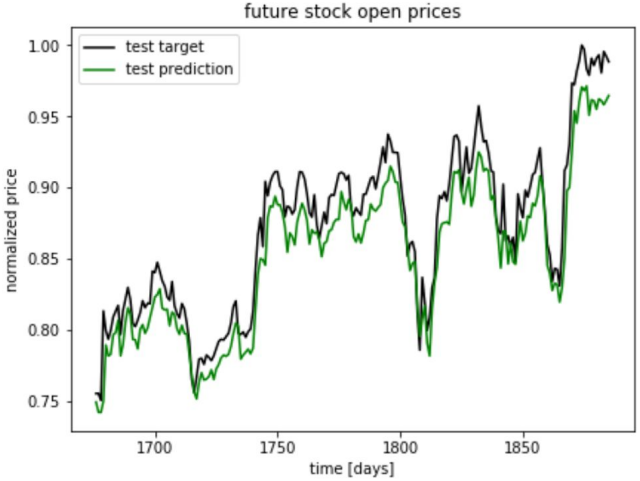
Recurrent Neural Networks

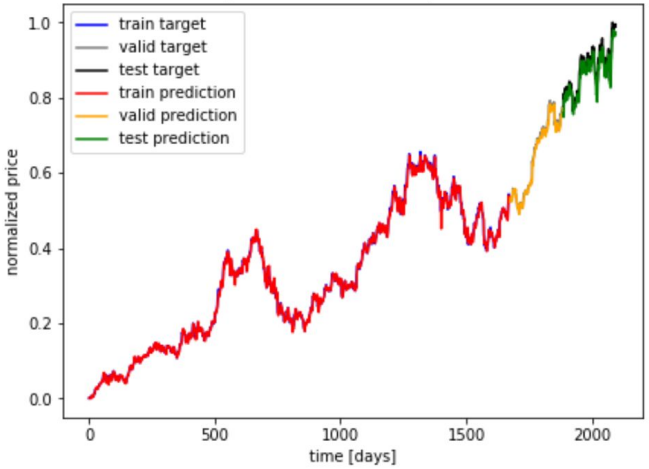
- Concept is similar to that of rolling regression
- Sequences of length 20 is taken.
- 19 data points is used to train and predict the values of the 20th data point values.
- All 4 values of a data point is predicted.
- Square loss used and is minimized with AdamOptimizer.
- Train square loss reduced from 0.3439 to 0.000058 and validation square loss reduced from 0.5279 to 0.000069

Results of price prediction

- Both High and Low values were predicted best by linear regression.
- Linear regression for both targets had an validation accuracy of around 98 percent.
- RNN results are more accurate compared to rolling regression. It has an average accuracy of 98.9 percent on all 4 targets using LSTM cells.
- Though Basic RNN Cells produce results around 96.7 percent accuracy on average which is relatively poor.
- We use the validation set to confirm no overfitting.
- LSTM and GRU cells take almost twice as training time compared to that of Basic RNN cells but produces better results.


past and future stock prices
train target
valid target
test target
train prediction
valid prediction
test prediction
normalized price
time [days]


future stock open prices
test target
test prediction
normalized price
time [days]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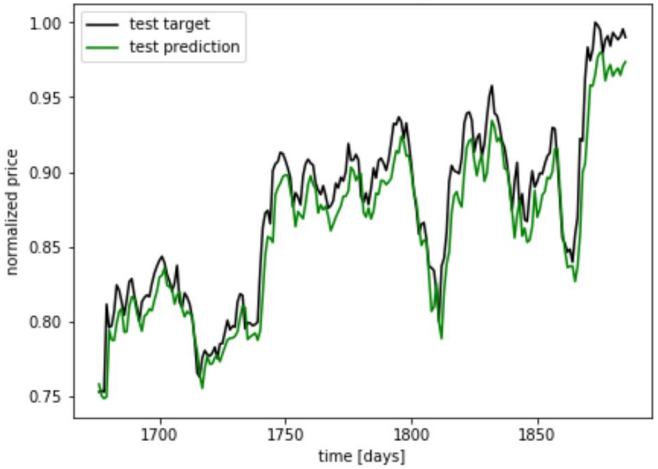
future stock close prices
test target
test prediction
normalized price
time [days]

How to utilize the results for trading (Prudent trading algorithm)

- Understand the trend and trend strength and hence know the movement strength before hand.
- Know the high and low values of the stock to understand the buying and selling regions even before the trading starts.
- Buy before selling in a support zone while the market has an predicted upterend and vice versa.
- One could be trade even safer with live indicator values and see if they match with the predicted trend.
- *P.S. I made 100 dollars investing 1000 dollars in just 5 days of trading. 4 profits and one loss. Probably beginner's luck! ;)*

Sample Results for trading

Predicted high and low values for “AAPL” for 6-13-2018 (today) are 192.91 and 191.13.

Ground Truth: High: 192.88 Low: 190.70

Predicted high and low values for “TSLA” for 6-13-2018(today) are 348.62 and 337.53

Ground Truth: High: 347.20 Low: 339.80

Also, the technical indicators prediction indicate a positive trend strength for “TSLA”.

Future Works

- Implementing sentiment analysis from twitter and other sources like stock market discussion forums.
- Take care of model susceptibility to high volatility.
- Implement ARIMA models and compare results.
- Automate live decision making using the already available information from the previous learning processes.

References

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- http://aclweb.org/anthology/U17-1001
- https://arxiv.org/ftp/arxiv/papers/1603/1603.00751.pdf
- https://ijcai.org/Proceedings/15/Papers/329.pdf
- http://ieeexplore.ieee.org/document/8212715/

Our code is available at https://github.com/ishaan95/PrudentTrader

Questions?

Thank you