Predicting general market trajectory via adaptive LMS algorithm

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*Abstract*—Background: The market is misunderstood as a largely unpredictable force that requires a deep understanding of economics and human psychology. We assert that while there is truth to this statement, it is still possible to predict certain components of how the stock market functions to supplement a more holistic picture of its behavior. Machine learning can be utilized to predict general trends in said behavior, and the identification of said trends can be used in conjunction with observations in the news to provide a more informed analysis of the possible futures of stock market behavior.   
 Methods: In this study, we deployed the adaptive LMS algorithm to predict the following day’s market close, volume, open, high, and low values for various stocks and cryptocurrencies.  
 Results: Here are our results. After 35 iterations of this and that, significant changes to accuracy of the model were displayed. This is only challenged by sudden reactions to twitter tweets posted by those of whom the market deems influential.  
 Conclusion: We conclude that since the this that and the other thing, these things hold true in a practical setting.

# Introduction

This study aims to identify useful parameters for determining the general trajectory of prices in the stock and cryptocurrency market. We consider historical quotes of varying time lengths and use the adaptive LMS algorithm to predict the closing price of each stock for the following day. This method is not enough to accurately predict the future prices of stocks and cryptocurrencies in a reliable manner but should be used in conjunction with other methods if practical results are to be obtained.

# Method Description

## Selecting a stock or cryptocurrency

First, the user chooses a stock or cryptocurrency to analyze. In this study, we provide three different options to choose from. These options are either Google, Apple, or Dogecoin. The user is then given the option to choose a one month, three month, or six month version of the historical quote for that particular asset.

## Implementing the LMS algorithm

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Next, the user is then prompted to enter the filter size to be used. Once the stock data and filter size are chosen, an array is filled with data from the sock excel sheet. The filter determines how many data entries will be used at a given to predict a subsequent data entry. For example, if a filter of size 2 is chosen then the first and second data entries are used to predict the value of the third data entry.

To predict the subsequent value the data entries that fit inside the filter are multiplied by a weight vector. This weight vector is designed to be a scalar that adjusts the values of data entries to predict the next data entry more accurately. This weight vector is updated throughout the process so that it can become more accurate. The wights are initially set to 1, and the size of the weight vector matches the size of the filter. The reason for this is that each index of the weight vector is multiplied against each corresponding vector of the stock data. For example, if we’re currently working with the 3rd and 4th indexes of the stock data and our filter is of size 2, then the first index of the weight vector is multiplied with the 3rd index of the stock array and the second index of the weight vector is multiplied against the 4th index of the stock array. Once all of the weight values are multiplied to their corresponding stock array values, all of the products are all added together, and the sum is the predicted value.

Next, we need to compare our predicted value to the actual stock value predicted by subtracting them. The difference will be used to update the weights so that they will be more accurate for the next set of data entries. The wights will be updated by subtracting a weight updater from them. To obtain the weight updater we need two things, a vector of the stock index values we just used to predict the next value and a scalar to multiply with.

The Scalar is a fraction, and its numerator is the difference of our predicted value and the actual stock value. The denominator is the sum of all the stock values squared that there were used to predict the current stock value in the filter. This scalar is then multiplied to an array of stock values inside the current filter. This becomes the weight updater.

Now that we have the weight updater, we subtract this from the current weights to obtain new weights that are more accurate to the stock dataset we are currently working with. This process is then repeated as our filter shifts through the entire stock dataset. As an example if our filter size is 3 then initially we’re going to predict the 4th dataset by using the LMS algorithm of the first 3 indexes, 1, 2, and 3. Then we’ll compare our predicted value with the actual value of the 4th index. Once we update out weights then we will shift the filter to work with the 2nd 3rd and 4th indexes to predict the 5th index using our updated weights. (1) this update continuous until we reach the end of our stock data

*w(n+1)=w(n) + 1 2 µ[−∇J(n)]* ()

# Experimental Results

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## Figures and Tables

#### Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in

1. Google Historical Quotes

| Filter  Size | Google Prediction Accuracy | | |
| --- | --- | --- | --- |
| 1 month | 3 months | 6 months |
| 2 | 96.83% | 98.32% | 98.74% |
| 3 | 94.99% | 97.27% | 97.73% |
| 4 | 93.78% | 96.76% | 97.23% |
| 5 | 92.46% | 96.51% | 96.86% |
| 6 | 91.27% | 96.38% | 96.67% |
| 7 | 90.00% | 95.80% | 96.28% |
| 8 | 88.57% | 95.60% | 96.17% |
| 9 | 87.24% | 95.40% | 96.01% |
| 10 | 85.94% | 95.10% | 95.73% |

1. Apple Historical Quotes

| Filter  Size | Apple Prediction Accuracy | | |
| --- | --- | --- | --- |
| 1 month | 3 months | 6 months |
| 2 | 97.07% | 98.31% | 98.54% |
| 3 | 95.23% | 97.11% | 97.48% |
| 4 | 94.48% | 96.52% | 96.81% |
| 5 | 93.54% | 96.07% | 96.40% |
| 6 | 92.88% | 95.90% | 96.12% |
| 7 | 92.10% | 95.40% | 95.77% |
| 8 | 91.71% | 95.10% | 95.57% |
| 9 | 90.84% | 94.60% | 95.30% |
| 10 | 90.24% | 94.27% | 95.14% |

1. Dogecoin Historical Quotes

| Filter  Size | Dogecoin Prediction Accuracy | | |
| --- | --- | --- | --- |
| 1 month | 3 months | 6 months |
| 2 | 89.57% | 90.10% | 92.93% |
| 3 | 83.88% | 89.98% | 91.28% |
| 4 | 77.91% | 86.56% | 88.32% |
| 5 | 73.43% | 84.99% | 86.38% |
| 6 | 70.01% | 82.94% | 84.77% |
| 7 | 66.82% | 80.84% | 82.82% |
| 8 | 62.78% | 79.78% | 81.09% |
| 9 | 60.63% | 78.24% | 79.11% |
| 10 | 57.97% | 76.60% | 77.54% |

1. Amazon Historical Quotes

| Filter  Size | Amazon Prediction Accuracy | | |
| --- | --- | --- | --- |
| 1 month | 3 months | 6 months |
| 2 | 97.03% | 98.39% | 98.69% |
| 3 | 95.32% | 97.33% | 97.79% |
| 4 | 94.29% | 96.65% | 97.17% |
| 5 | 93.55% | 96.26% | 96.87% |
| 6 | 92.83% | 95.87% | 96.67% |
| 7 | 92.09% | 95.47% | 96.51% |
| 8 | 91.68% | 95.22% | 96.37% |
| 9 | 91.32% | 95.00% | 96.28% |
| 10 | 90.73% | 94.76% | 96.14% |

# Conclusions

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

##### Contributions

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##### Appendix