INTRODUCTION

A $$y = wx + b$$

$$w = \frac{\sum_{i=0}^{\hat{\imath}}[(x_i - \overline{x})\,(y_i - \overline{y})]}{\sum_{i=0}^{\hat{\imath}}[(x_i - \overline{x})^2]}$$

$$b = \overline{y} - (w\overline{x})$$

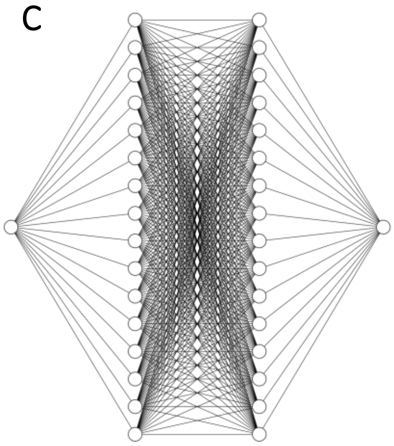
$$MAE(\widehat{y_\imath}, y_i) = \frac{1}{\hat{\imath}}\sum_{i=0}^{\hat{\imath}}|(\widehat{y_\imath} - y_i)|$$

B $$\vec{v} = (x_0, x_1, x_2 \ldots x_{\hat{\imath}})$$

$$\|\vec{v}\| = \sqrt{\sum_{i=0}^{\hat{\imath}}[x_i^2]}$$

$$w = \sum_{i=0}^{\hat{\imath}}[\overrightarrow{v_\imath}] = \sum_{i=0}^{\hat{\imath}}\left[\frac{d}{dx}[f(x_i)]\right] = \sum_{i=0}^{\hat{\imath}}[f'(x_i)]$$

C



D

$$\frac{\partial MAE(\hat{y}, \mathrm{y})}{\partial w} = \frac{\partial MAE(\hat{y}, \mathrm{y})}{\partial y}\frac{\partial \mathrm{y}}{\partial w} = \left[\frac{[x](\hat{y} - \mathrm{y})}{\hat{\imath}|(\hat{y} - \mathrm{y})|}\right]$$

$$w_i^+ = w_i - \epsilon\frac{\partial MAE(\hat{y}, \mathrm{y})}{\partial w} = w_i - \epsilon\left[\frac{[x](\hat{y} - \mathrm{y})}{\hat{\imath}|(\hat{y} - \mathrm{y})|}\right]; w_i = w_i^+$$

$$b_i^+ = b_i - \epsilon\frac{\partial MAE(\hat{y}, \mathrm{y})}{\partial b} = b_i - \epsilon\left[\frac{(\hat{y} - \mathrm{y})}{\hat{\imath}|(\hat{y} - \mathrm{y})|}\right]; b_i = b_i^+$$

Figure 1. (A) Set of mathematical expressions representing the Statistical Analysis (Simple Linear Regression) Machine. The first equation represents the basic line formula. The second shows the equations for computing the overall slope of the line (x_i represents the i th item ($\hat{\imath}$ is the max i value) of the x dataset (or that of computed for y), $\widehat{y_\imath}$ represents the expected i th item of the y dataset, $\overline{x}$ represents the mean of the x dataset; this is applicable for all variables). The third shows the bias-solving relation. The fourth shows the Mean Absolute Error function (used in all machine testing for evaluation).

(B) Set of mathematical expressions representing the Support Vector Machine. The first shows the basic definition/format of the vector. The second is a simplified vector magnitude formula. The third shows the weight calculation ($f(x)$ is the trend function, which is backpropagated to itself).

(C) Image showing basic structure of the neural network (note that the experiment's networks' 2 hidden layers contain 64 nodes, the figure has 16).

(D) Set of mathematical expressions representing the Neural Network (has the same forward propagation as other machines). The first shows the sensitivity of the Mean Absolute Error Loss to the weight. The second and third show the updating of the weights and biases respectively (ϵ is a reduction factor).

METHODS

Table 1. Dataset Structure

Datasets	Full Dataset Range	Training Dataset Range	Testing Dataset Range
Apple (AAPL)	(0, 1259); (0:)	(0, 1000); (:1000)	(1000, 1259); (1000:)
Microsoft (MSFT)	(0, 1259); (0:)	(0, 1000); (:1000)	(1000, 1259); (1000:)
Netflix (NFLX)	(0, 1259); (0:)	(0, 1000); (:1000)	(1000, 1259); (1000:)

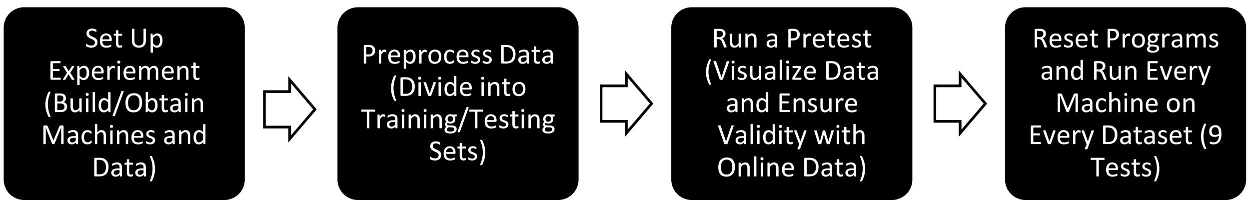


Figure 2. Basic outline of the experimental procedure. This consists of four primary steps: Setting Up the Experiment (which includes building the machines from scratch or attaining the machines from the experiment public google drive folder; this experiment consisted of machines created from scratch); Preprocessing the Data (which consists of attaining/downloading the data, dividing it into training and testing sets, and reshaping the arrays in preparation for the machine analysis); Running a Pretest (which is primarily just visualizing the datasets and ensuring their validity); and Resetting the Programs/Running the Testing (which you run each machine (Statistical Analysis, Support Vector Regression, & Deep Neural Network) against each dataset (Apple, Microsoft, Netflix), resulting in 9 total testing sessions).

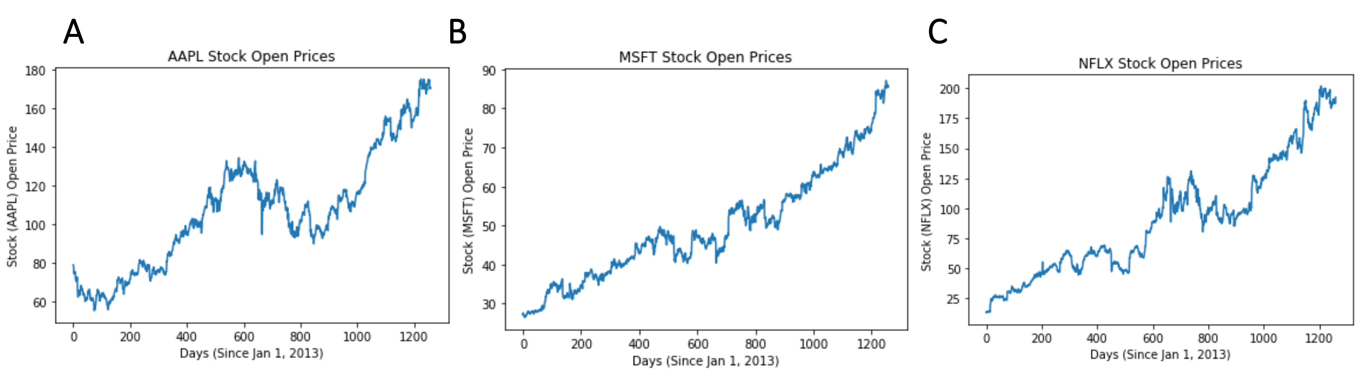


Figure 3. (A) Apple (AAPL) datasets used in experiment; consists of open stock prices from 2013 to 2018. (B) Microsoft (MSFT) datasets used in experiment; consists of open stock prices from 2013 to 2018. (C) Netflix (NFLX) datasets used in experiment; consists of open stock prices from 2013 to 2018.

RESULTS

Table 2. Experiment-Collected Data

Datasets	Statistical Analysis	Support Vector Regression	Deep Neural Network	Average
Apple (AAPL)	19.6	53.3	21.45	31.45
Microsoft (MSFT)	9.05	27.49	2.285	12.94
Netflix (NFLX)	33.14	92.65	23.51	50.16
Average	20.6	57.81	15.75	31.51

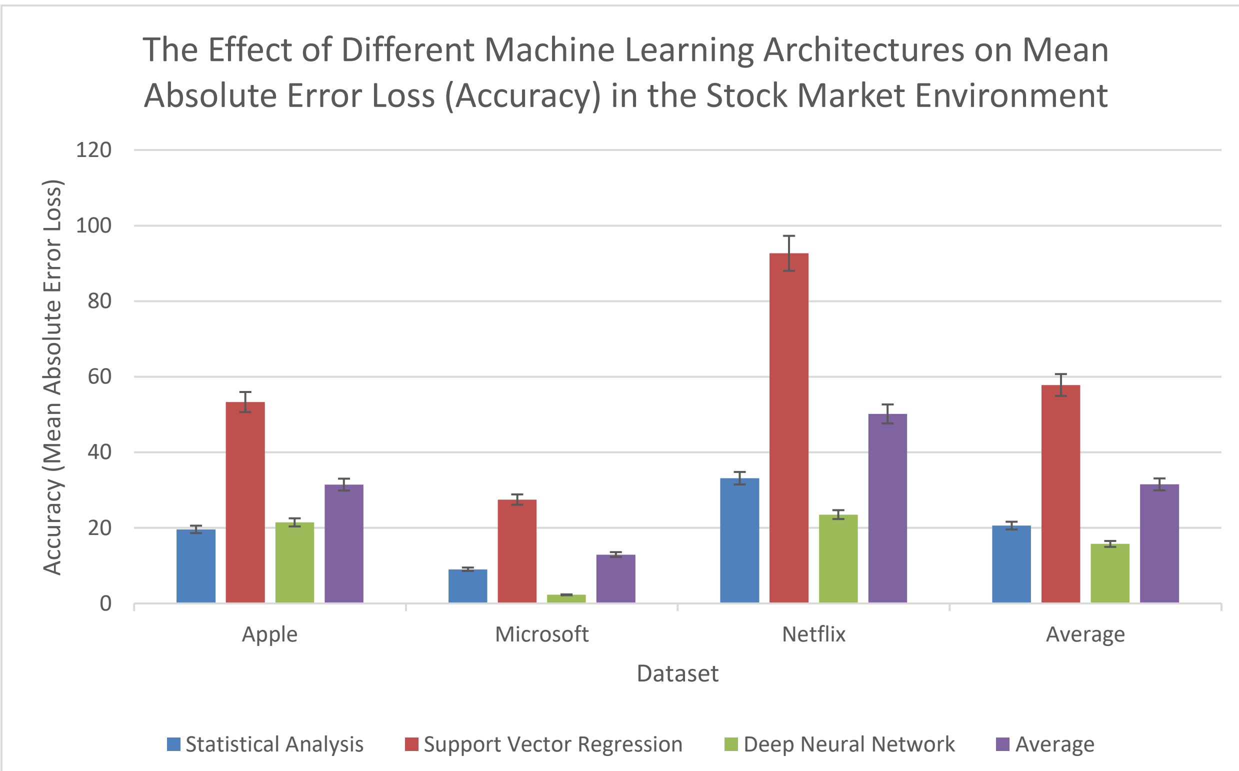
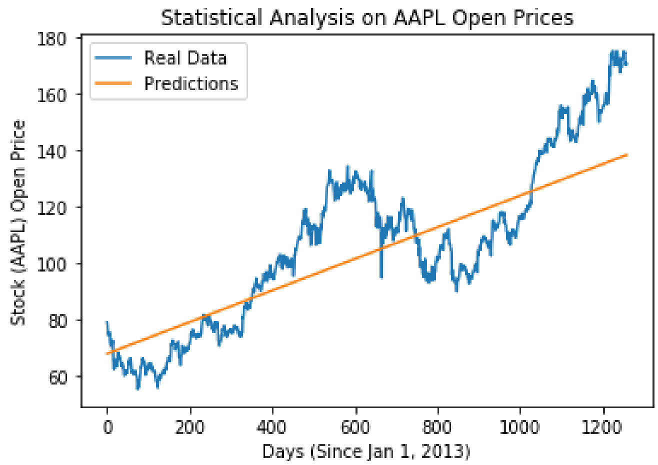
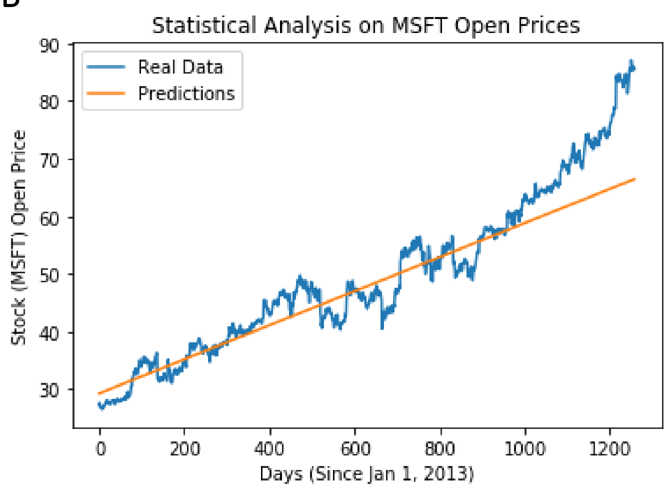


Figure 4. This graph was the main graph representing the final collected data. It is grouped by data set due to the fact that it allowed for better comprehension of the machine performance while also representing the average "toughness" of the data sets.

A



B



C

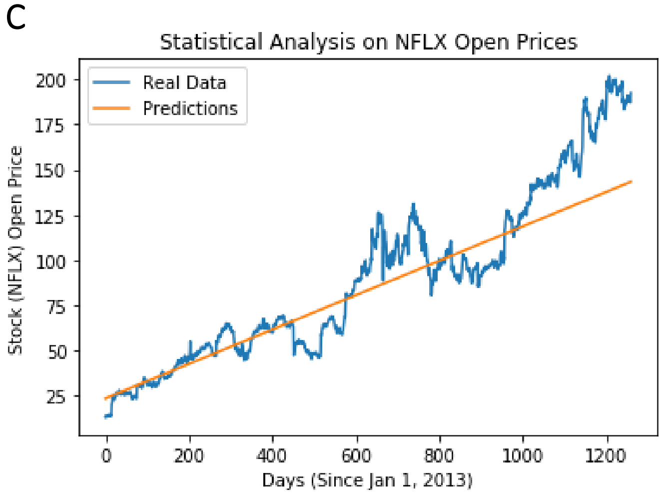
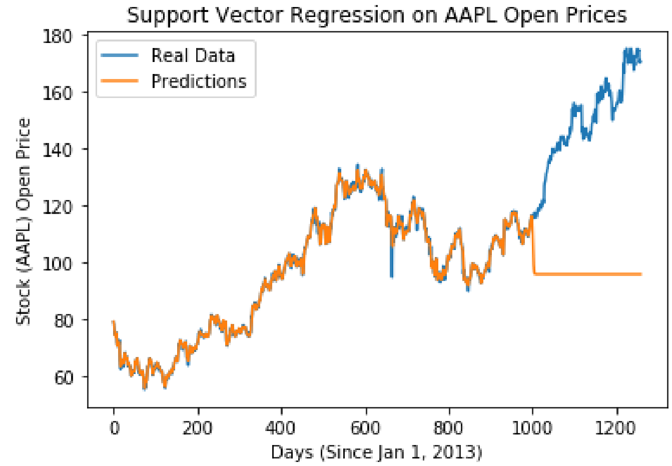


Figure 5. (A) This graph represents the statistical analysis's trend line and its predictions on the AAPL dataset. This machine had a loss of about 19 and was the most effective for this dataset. It was trained till day 1,000 and tested from then on.

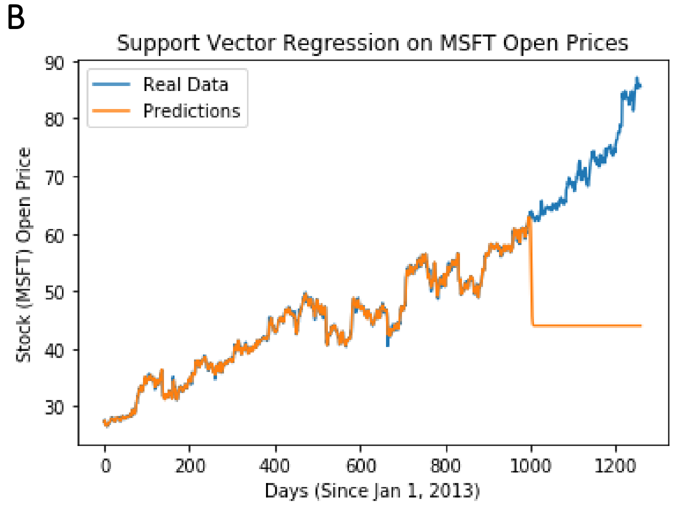
(B) This graph represents the statistical analysis's trend line and its predictions on the MSFT dataset. This machine had a loss of about 9 and was the second most effective for this dataset. It was trained till day 1,000 and tested from then on. It satisfied the engineering goal.

(C) This graph represents the statistical analysis's trend line and its predictions on the NFLX dataset. This machine had a loss of about 33 and was the second most effective for this dataset.

A



B



C

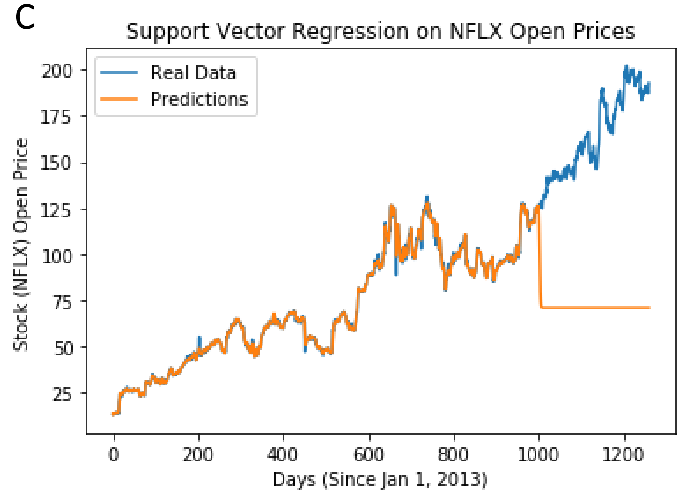


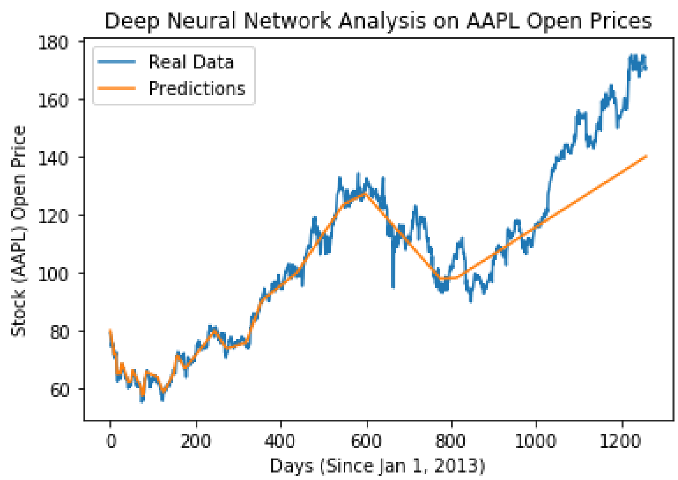
Figure 6. (A) This graph represents the support vector regression's trend line and its predictions on the AAPL dataset. This machine had a loss of about 53 and was the least effective for this dataset. It was trained till day 1,000 and tested from then on.

(B) This graph represents the support vector regression's trend line and its predictions on the MSFT dataset. This machine had a loss of about 27 and was the least effective for this dataset. It was trained till day 1,000 and tested from then on.

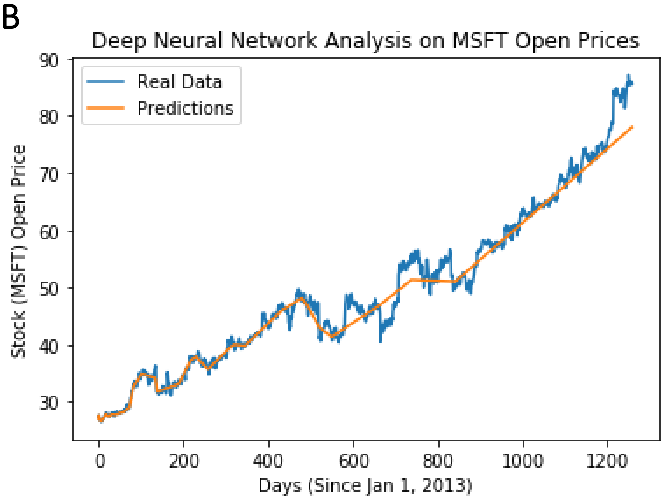
(C) This graph represents the support vector regression's trend line and its predictions on the NFLX dataset. This machine had a loss of about 92 and was the least effective for this dataset. It was trained till day 1,000 and tested from then on.

The effect of type of machine on accuracy

A



B



C

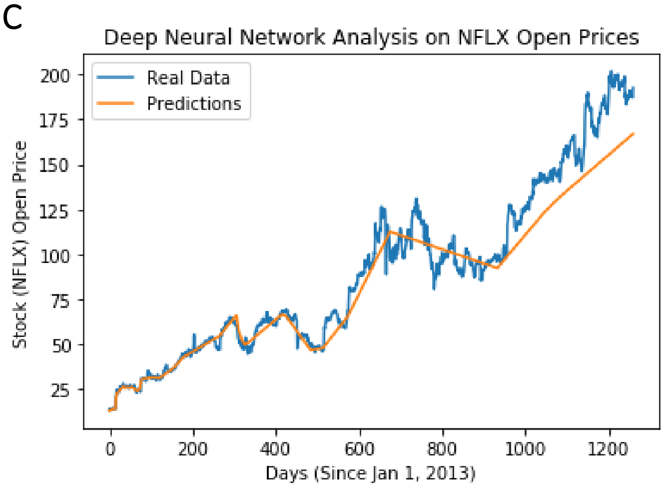


Figure 7. (A) This graph represents the deep neural network's trend line and its predictions on the AAPL dataset. This machine had a loss of about 21 and was the second most effective for this dataset. It represents the importance of big data for a more accurate trend summary line.

(B) This graph represents the deep neural network's trend line and its predictions on the MSFT dataset. This machine had a loss of about 2 and was the most effective for this dataset. This machine was the most accurate overall and shows the best data/machine combination possible.

(C) This graph represents the deep neural network's trend line and its predictions on the NFLX dataset. This machine had a loss of about 24 and was the most effective for this dataset. It represents the importance of big data for a more accurate final slope.