I. Prediction Model Evaluation Criteria

After getting the sentimental scores, we want to test whether they can help to improve the model to predict the TESLA stock return. We used four feature sets in this step. The four feature sets are:

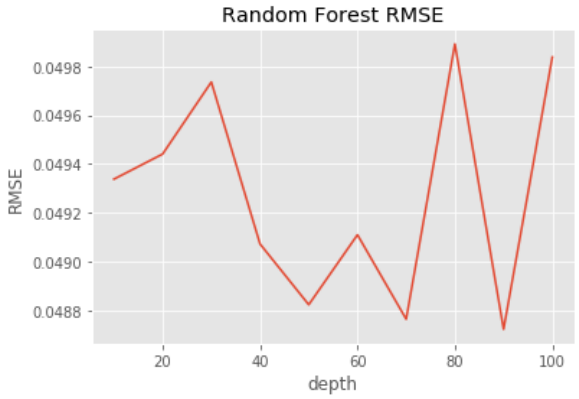
1. Base. Use last day volume and last day Nasdaq index return.
2. Vader. Add compound score to Base.
3. NB. Add positive, negative, neutral scores to Base.
4. All. All NB, Vader, Base features together.

In this project, we choose to use Root Mean Square Error (RMSE) as the criteria to evaluate the prediction. Root Mean Square Error (RMSE) is the standard deviation of the residuals (prediction errors). Residuals are a measure of how far from the regression line data points are; RMSE is a measure of how spread out these residuals are. In other words, it tells how concentrated the data is around the line of best fit.

$$\mathrm{RMSD}(\mathbf{v}, \mathbf{w}) = \sqrt{\frac{1}{n}\sum_{i=1}^{n} \|v_i - w_i\|^2}$$

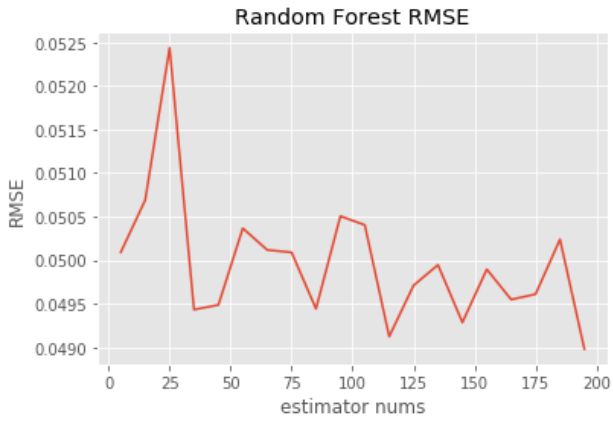
III. Random Forest Regressor Model

We also applied a Random Forest Regressor Model to examine whether using Twitter Sentiment Analysis is helpful for the prediction of Tesla stock return. For the Random Forest Regressor, we decided to tune two parameters, which are "*max_depth*" and "*n_estimators*". We tune the "*max depth*" because the "*max depth"* of a tree in Random Forest is defined as the longest path between the root node and the leaf node. Generally, as the max depth of the decision tree increases, the performance of the model over the training set increases continuously. On the other hand, as the "*max depth"* value increases, the performance over the test set increases initially but after a certain point, it starts to decrease rapidly. From the graph below, we are able to see that "*max_depth*" should be 90 since we want to make the RMSE as small as possible.

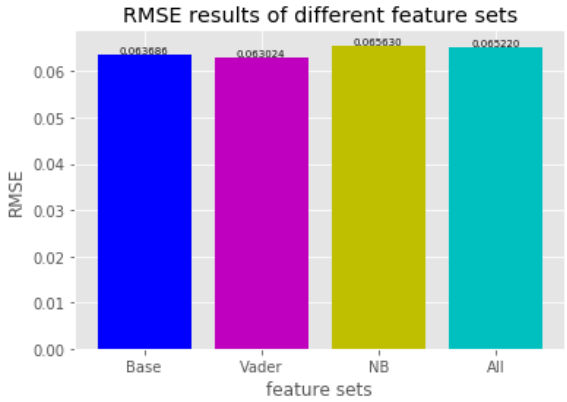


The second variable we tuned was the "*n estimators*" because This is the number of trees you want to build. Generally, a higher number of trees give a better performance. From the graph below,

we are able to see that "*n_estimators*" should be around 115 since we want to make the RMSE as small as possible.



In the next step, we used the tuned parameters to train our model at the training dataset, then we tested the results using the testing dataset. We got the RMSE results of our four feature sets as below:



By observing the RMSE results, we can see that:

1. Vader achieves a lower RMSE than Base, so the compound score using the Vader method does help to improve stock return prediction for TESLA.
2. NB and All get higher RMSEs than Base, so the positive, negative, neutral scores using the Naïve Bayesian method don't help to improve stock return prediction for TESLA.

VI. Model Selection

Both Ridge Regression and Random Forest Regression have a comparatively low mean square error from the evaluation diagram. Comparatively, Ridge Regression has lower RMSE than the Random Forest Regression.