**DATATHON – SYNCHRONY FINANCIAL**

From our analysis and regression, we have obtained an accuracy of around **87.23% (It sometimes fluctuates to 86.xx% while rerunning the same program in the same condition)** by using the **Random\_forest classifier**, using different combinations of features with the significant variables mentioned below that yields the best performance:

1. Mortgage Rate
2. New Family Homes for Sale in the United States
3. Total Vehicle Sales
4. Saving and investment-Disaster losses- Private Households and institutions

We also trained and tested the data using other classifiers like SVM Classifier, Baysian Classifier, Decision Tree Regressor and Gradient Boosting Regressor, getting an accuracy between 80-90% for each iteration. Each time we tried eliminating an insignificant variable, the accuracy kept variating.

Throughout the process, one thing we observed was that for all the algorithms, we got the same set of significant variables.

1. **SVM Classifier**- 86% -> Federal Funds, New Family Homes for Sale in the United States, total vehicle sales, Saving and investment-Disaster losses- Private Households and institutions
2. **Bayesian Classifier**- 84.7% -> Real Disposable income, Personal consumption expenditures, Saving and investment-Disaster losses- Private Households and institutions
3. **Decision tree Regressor**- 85.22% -> Mortgage, New Family Homes for Sale in the United States, vehicle sales, Personal consumption expenditures
4. **Gradient Boosting Regressor**- 86.59% -> Mortgage, New Family Homes for Sale in the United States, Real Disposable income, Consumer Price Index

We finally arrived at the highest accuracy of 87.23% above with an RMSE -> 0.12.

Thus, from our analysis, we conclude that the home improvement spending is not significantly affected by an increase in the Fed interest rates for this model. There is only one model (SVM) which gives us Federal funds as a significant variable. Thus, it might probably be positively correlated with home improvement spending, but our optimized model does not classify it as significant enough.

Below is the table representing our column names in the dataframe, and what their meanings are.

|  |  |  |  |
| --- | --- | --- | --- |
| **Column Names** | **Meaning** | **Units** | **Additional Explanation** |
|  |  |  |  |
| ASPNHSUS | Average Sales Price for New Houses Sold in the United States | Dollars |  |
| UNRATE | Civilian Unemployment Rate | Percent |  |
| USACPIHOUMINMEI | CPI (Consumer Price Index) | Index 2010=100 | Not Seasonally Adjusted |
| FEDFUNDS | Effective Federal Funds Rate | Percentage |  |
| CSUSHPINSA | S&P-Case-Shiller U.S. National Home Price Index | Index Jan 2000=100 | Not Seasonally Adjusted |
| MSPNHSUS | Median Sales Price for New Houses Sold in the United States | Dollars |  |
| MSACSR | Monthly\_Supply\_of\_Houses | Months |  |
| MORTGAGE30US | Mortgage | Percentage |  |
| NHFSEPUC | New Houses for Sale by Stage of Construction | Thousands | Under Construction |
| NHSDPC | New Houses Sold by Stage of Construction\_completed | Thousands | Completed |
| NHSDPNS | New Houses Sold by Stage of Construction\_not started | Thousands | Not Started |
| HNFSEPUSSA | New One Family Homes for Sale in the United States | Thousands | for Sale |
| HSN1F | New One Family Houses Sold | Thousands | Sold |
| DSPIC96 | Real disposable income | Billion |  |
| TOTALSA | Total Vehicle Sales | Millions |  |
| DATE | Date | “DD/MM/YY” |  |
| DIFSRC1Q027SBEA | Personal consumption expenditures:Financial services and insurance | Billions | Financial services and insurance |
| W774RC1Q027SBEA | Saving and investment-Disaster losses-Private Households and institutions | Billions | Quarterly |
| Sales in $MM | Total Sales | Millions |  |