Data Detectives Project

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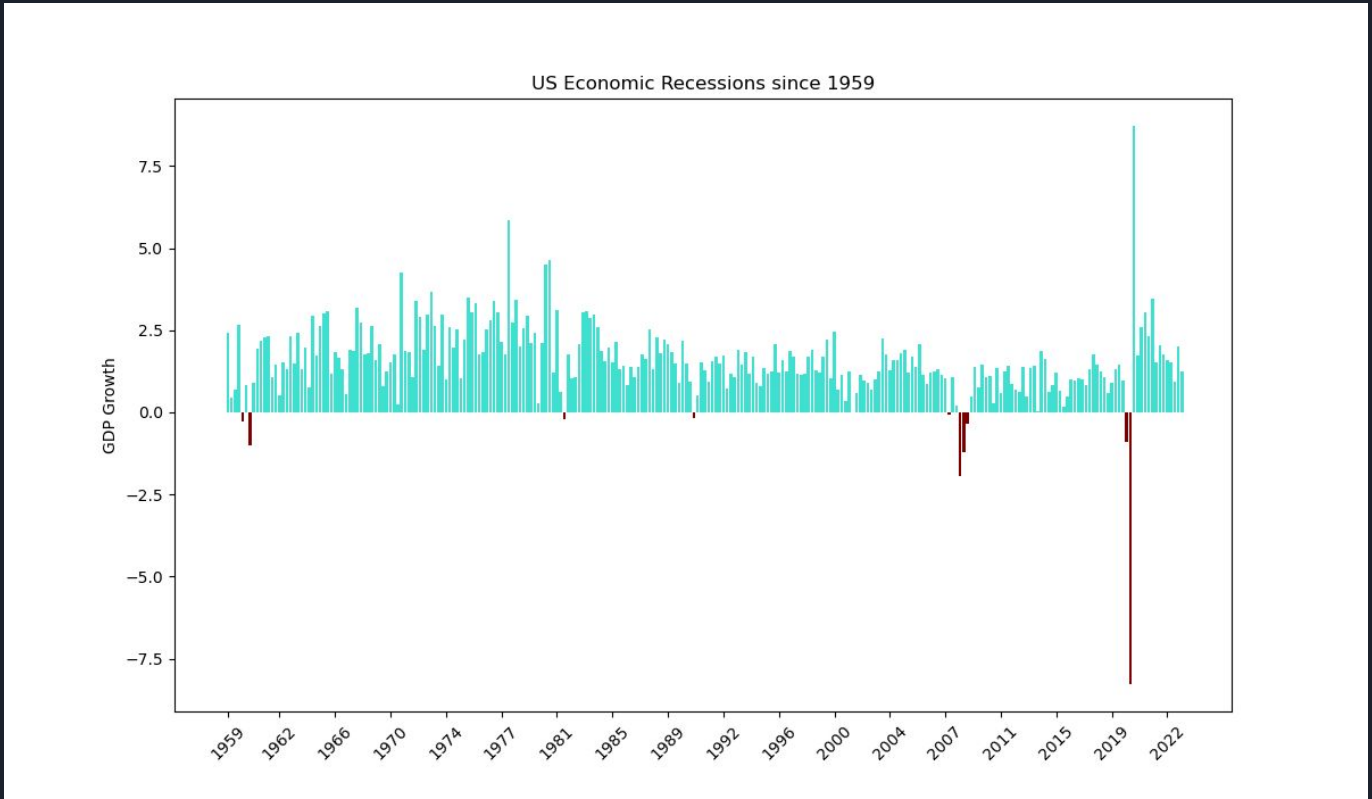
Can We Predict a Future Recession?



Overview

The generally accepted definition of a recession in the U.S., according to Forbes, is when GDP shrinks in two consecutive quarters. The National Bureau of Economic Research traditionally follows a more vague definition:

> “A recession involves a significant decline in economic activity that is spread across the economy and lasts more than a few months.”

While GDP results typically define recession conditions, we want to know if ML can detect trends in quarterly results and predict a recession ahead of time.

Team AEJJ is seeking to discover relationships between U.S. Gross Domestic Product (GDP) and overall economic health. Can machine learning predict a recession, with better than 75% accuracy, by analyzing historical GDP data?

Data Sourcing

- Data sourced from BEA's National Income and Product Accounts Metadata CSV files via the US Department of Economics.
  - Focused on last 65 years of GDP data, filtering for top 4 recession indicators since 1959.
  - Identified top 4 indicators: Personal Consumption Expenditures, Gross Private Domestic Investment, Net Exports of Goods and Services, Government Consumption Expenditures, and Gross Investment.
- Treasury rates for 65 years from FRED API

Data Model Implementation

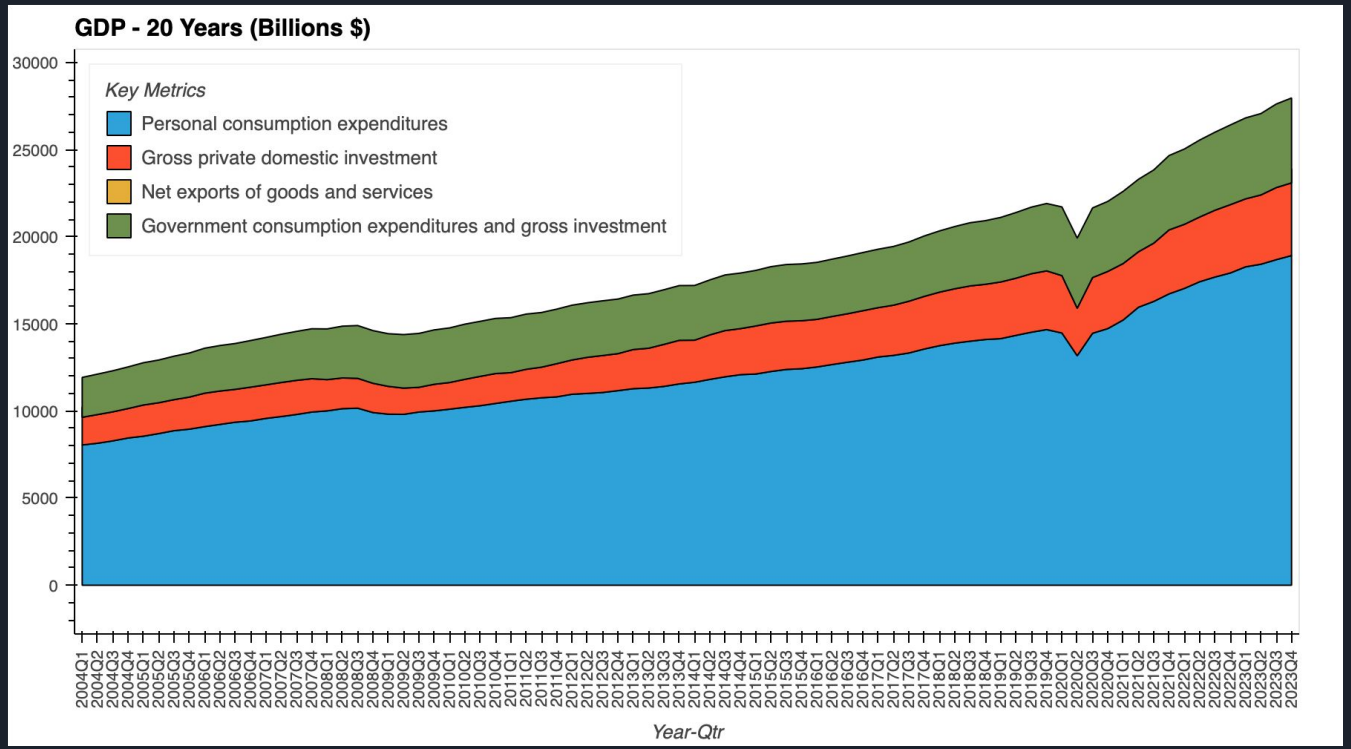
Logistic regression proved to be our most accurate model

- Comparing T-bill interest rates and GDP growth rate predicted recession with 95% accuracy

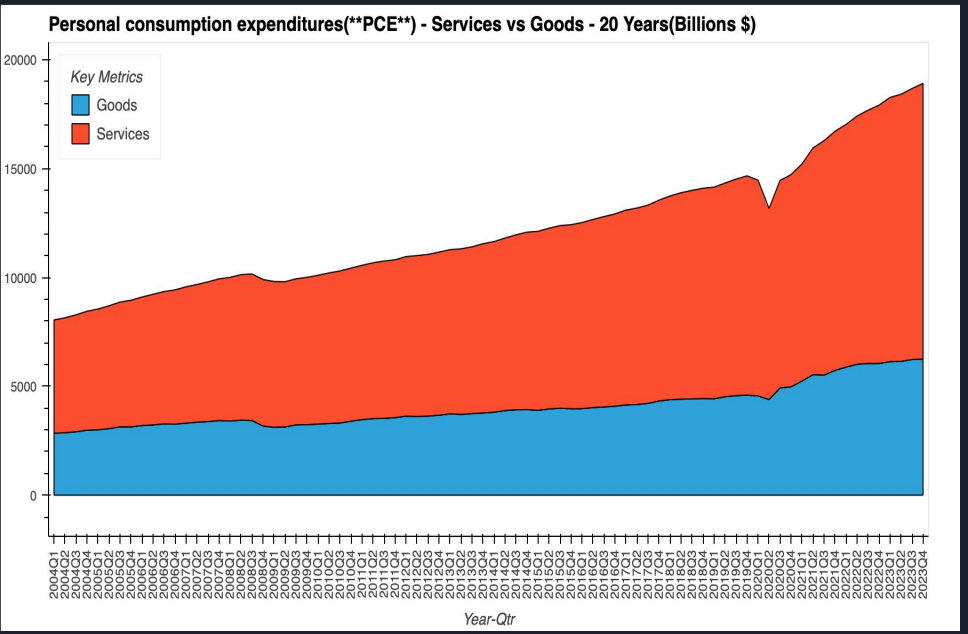
Other Methods Tested:

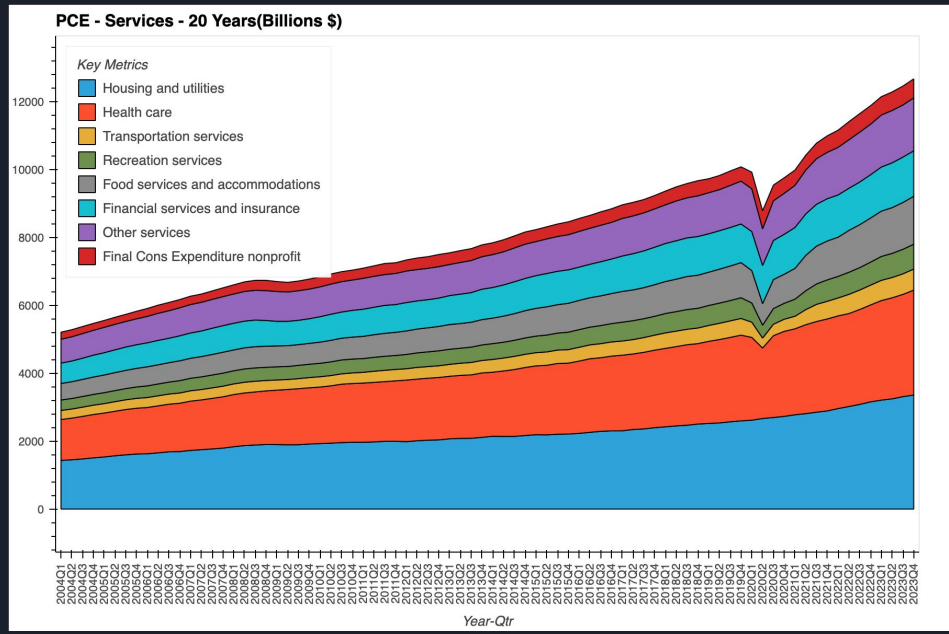
- Linear Regression
- Support Vector Regression
- Ensemble Model Learning

Findings:
Gross Domestic Product (GDP)

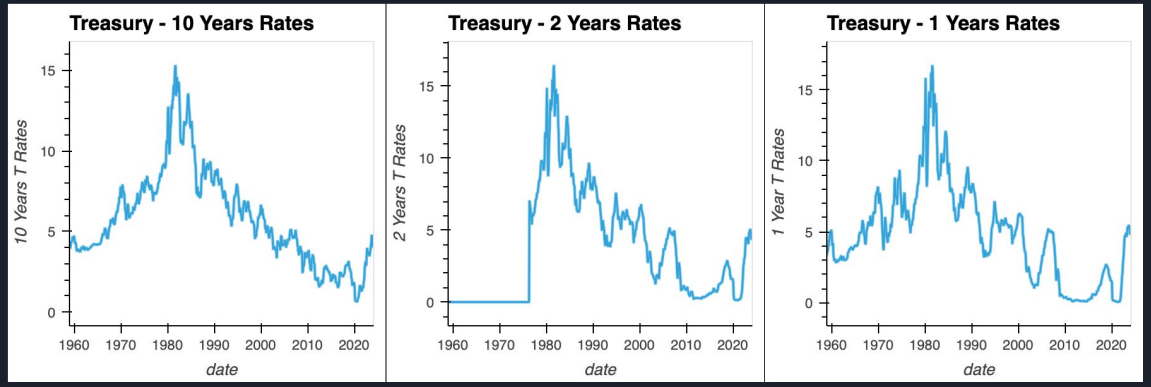


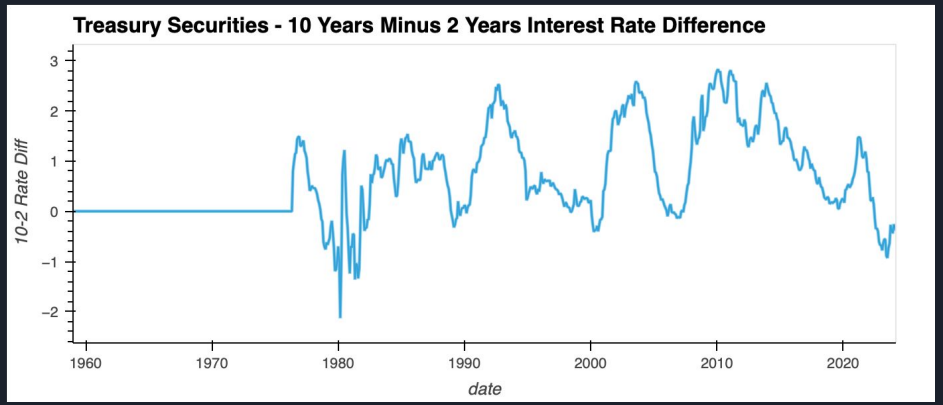
Findings:
Personal Consumption Expenditures (PCE)

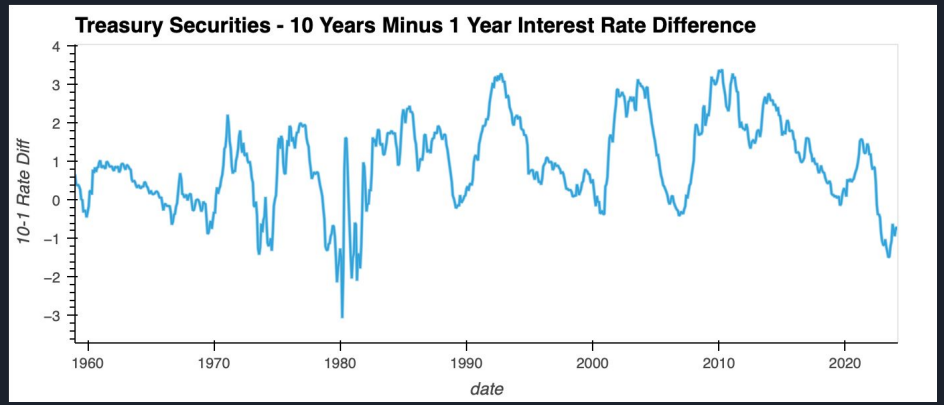




Findings: Treasury







Data Model Optimization

- We developed data optimization in Python, working toward optimum ML performance
- Multiple models were tested, GDP and Treasury data were utilized
- Logistic regression ultimately achieved 95% accuracy

Conclusion

Can machine learning predict a future recession, with better than 75% accuracy, by analyzing historical GDP and Treasury data?

- After using multiple models to test the accuracy of this prediction, we concluded that there is indeed a way to use MLM with a high accuracy to predict a future recession.
- The logistic regression model for predicting an economic recession based on difference in the interest rates of long term and short term treasuries is able to achieve an accuracy score of 95.38%

Resources

- U.S. Bureau of Economic Analysis, “Table 1. GDP and Personal Income,” apps.bea.gov/iTable/?ReqID=62&step=1#eyJhcHBpZCI6NjIsInN0ZXBzIjpbMSwyLDZdLCJkYXRhIjpbWyJQcm9kdWN0IiwiMSJdLFsiVGFibGVMaXN0IiwiMSJdXX0= (accessed April 9, 2024).
- Federal Reserve Bank of St. Louis and US Office of Management and Budget, "Treasury Rates," https://fred.stlouisfed.org/docs/api/fred/ (accessed April 9, 2024).
- Miller, David S. (2019). "Predicting Future Recessions," FEDS Notes. Washington: Board of Governors of the Federal Reserve System, May 6, 2019, https://doi.org/10.17016/2380-7172.2338