AI Boot Camp Project 2

Consumer Expenditure Links To Federal Reserve Interest Rate

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Project Overview

Project Purpose / Description

Project Overview: Predicting Fed Interest Rate Changes Based on Consumer Spending.

Goal: Develop a model to predict whether the Federal Reserve will increase, decrease, or maintain interest rates based on trends in consumer spending (Personal consumption expenditures (PCE).

Project Overview

Goals/Problem to be solved

- Can PCE lead to predictions of the Fed interest rates?
- Which optimization model had the best accuracy score?
- How could the ability to predict Fed rate movement be helpful to consumers and businesses?

Project Overview

Overview of data collection, cleanup and exploration process

Dataset Collection

1. https://apps.bea.gov/ This is the Personal Consumption Expenditures by month for 1959-2024 Nov.
2. https://fred.stlouisfed.org/series/FEDFUNDS This is the complete history of the federal reserve rate by month.

Dataset Exploration

1. Dataset data was reviewed by the team to insure we had an adequate amount of data to train our data model. An accessible API was also confirmed for each dataset.

Project Overview

Overview of data cleanup

Data Cleanup

1. Extract relevant rows from dataset and ignored all other rows.

2.Combine year and month to create a date column and Convert month names to numeric values using mapping dictionary.

3. Map months to numerical values and combine Year and Month into datetime format.

4. Combine years and months into date strings and Convert the date strings to datetime format.

5. Create a new DataFrame with columns 'Date' and 'PCE' and drop rows with missing data.

6. Save the cleaned data.

Project Overview

Approach taken to achieve goals

- Standard Deviation Classification
- Max Depth Optimization
- Time Series Random Forest Model
- Grid Search CV (min_sample_split, min_sample_leaf, min_weight_fraction_leaf)
- Extreme Gradient Boosting (XGBoost)

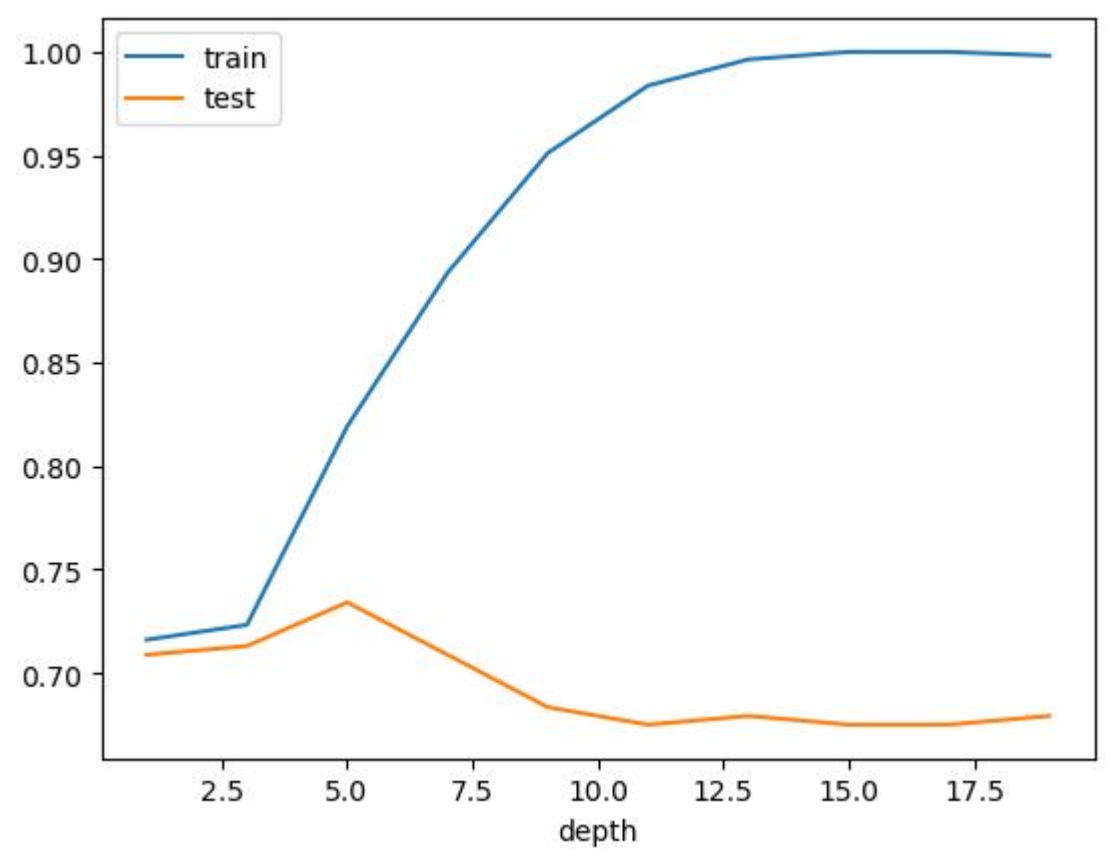
API For FRED: https://fred.stlouisfed.org/docs/api/fred/#General_Documentation

API For BEA: https://apps.bea.gov/api/signup/

Result/Conclusion 1

Can PCE lead to predictions of the Fed interest rates?

Max Depth Optimization For Initial Prediction.



Result/Conclusion 2

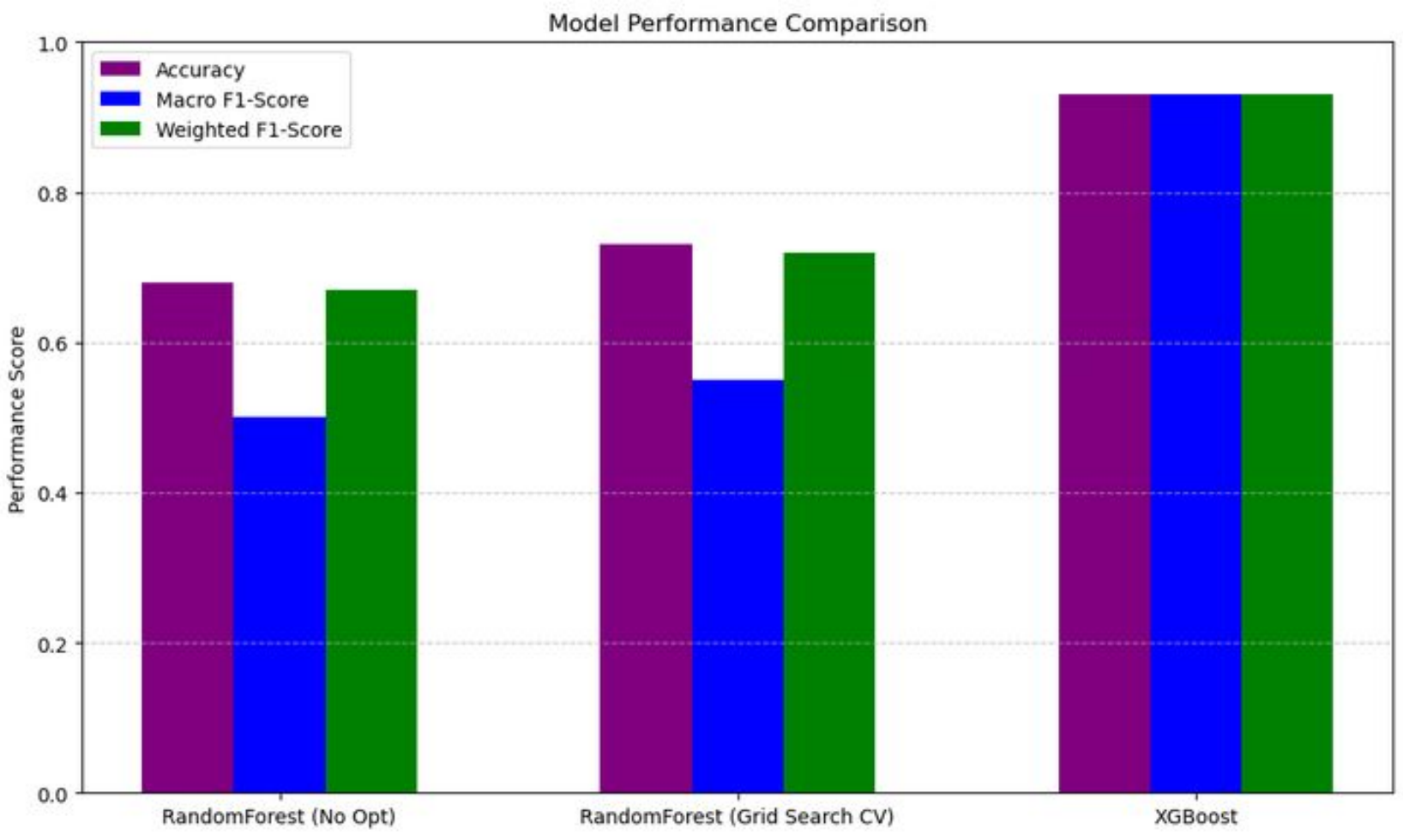
Which optimization model had the best accuracy score?

XGBoost Optimization - Extreme Gradient Boosting

	precision	recall	f1-score	support
Down	0.93	1.00	0.96	13
No Change	0.86	0.92	0.89	13
Up	1.00	0.89	0.94	19
accuracy			0.93	45
macro avg	0.93	0.94	0.93	45
weighted avg	0.94	0.93	0.93	45

Result/Conclusion 2 Cont.

Model Performance Comparison For Grid Search CV and XGBoost Optimization



Result/Conclusion 3

How could the ability to predict Fed rate movement be helpful to consumers and businesses?

Investment Strategies: Predictions can guide bond and securities investments, as Fed rate changes significantly impact bond yields and stock prices.

Loan Pricing: Banks and other financial institutions can better anticipate changes in interest rates, enabling them to adjust loan interest rates and mortgage products in advance.

Mortgage and Loan Decisions: Consumers can lock in favorable rates for mortgages, auto loans, or personal loans before potential increases.

Summary

- **Can PCE lead to predictions of the Fed interest rates?**
  Yes, using the PCE an be an effect way to predict the movement in the federal reserve interest rate.

- **Which optimization model had the best accuracy score?**
  The XGBoost Optimization model was superior to the other optimization models we tried which include Max Depth, and Grid Search CV.

- **How could the ability to predict Fed rate movement be helpful to consumers and businesses?**
  Financial Institutions, businesses, and personal consumers can better address risk of borrowing money.

Problems Encountered

- Switching to a Time Series Random Forest model initially resulted data leakage on the 2nd x feature and overfitting.
- API calls were returning more data than the dataset we downloaded.
- Smaller dataset limited our ability to use larger n-estimator values, sample splits, etc.
- Issues committing to GitHub.
- The Fed Rate outliers for the 1980’s caused variations of up to 5% on our optimization accuracy scores when running the model multiple times.

Future Considerations

- Additional investigation into feature selection for improved accuracy.
- Review potential feature pairs for correlation.
- Run prediction model on November and December PCE data(currently not published).

Any Questions?