S&P 500 Impact on Currency

Brigilda Lleshi, Yousef Sersy, Mario Penagos, and Megan Eunpu

Overview

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Results Summary

Implications

Conclusion

15 July 2024

Overview

This project utilizes predictive modeling by analyzing historical data to predict whether an investor in the foreign exchange market should invest in the S&P 500 using their desired currency for a specified period. The ultimate objective is to enhance algorithmic trading strategies by forecasting market trends.

Hypothesis

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Currency rates are significantly influenced by the movements of the S&P 500, and this relationship can be accurately predicted using machine learning models.

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Selected Models

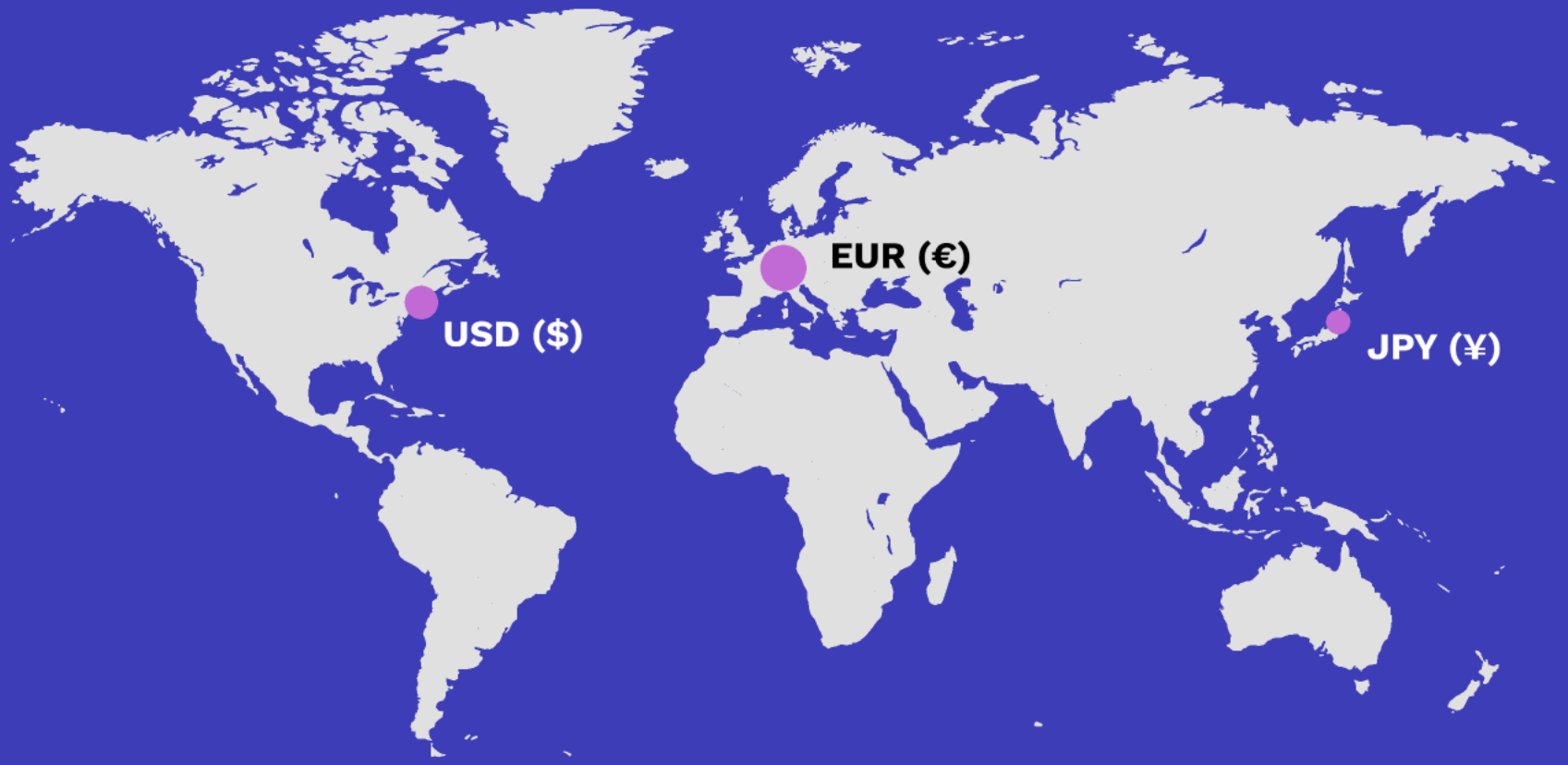
Simple, interpretable, good for binary classification.

Logistic Regression

Robust to overfitting, handles non-linear data.

Random Forest

Currencies Used in Model



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Data

Data Collection

- Yahoo Finance for currencies and SPY (S&P 500 ETF) for time period of 05/01/2019 - 05/01/2024 (MM/DD/YYYY)

Data Processing

- Download and clean data
- Calculate percentage changes
- Create target signals (SPY direction)

Balancing Dataset

- SMOTE (Synthetic Minority Over-Sampling Technique)

Model Training

Process

- Split data into training and testing sets (60% and 40%, respectively)
- Train Logistic Regression and Random Forest models

Performance Evaluation (Metrics)

- Accuracy
- Classification Report (Precision, Recall, F1-Score)

Results

- Logistic Regression
- Random Forest


CODE DEMO

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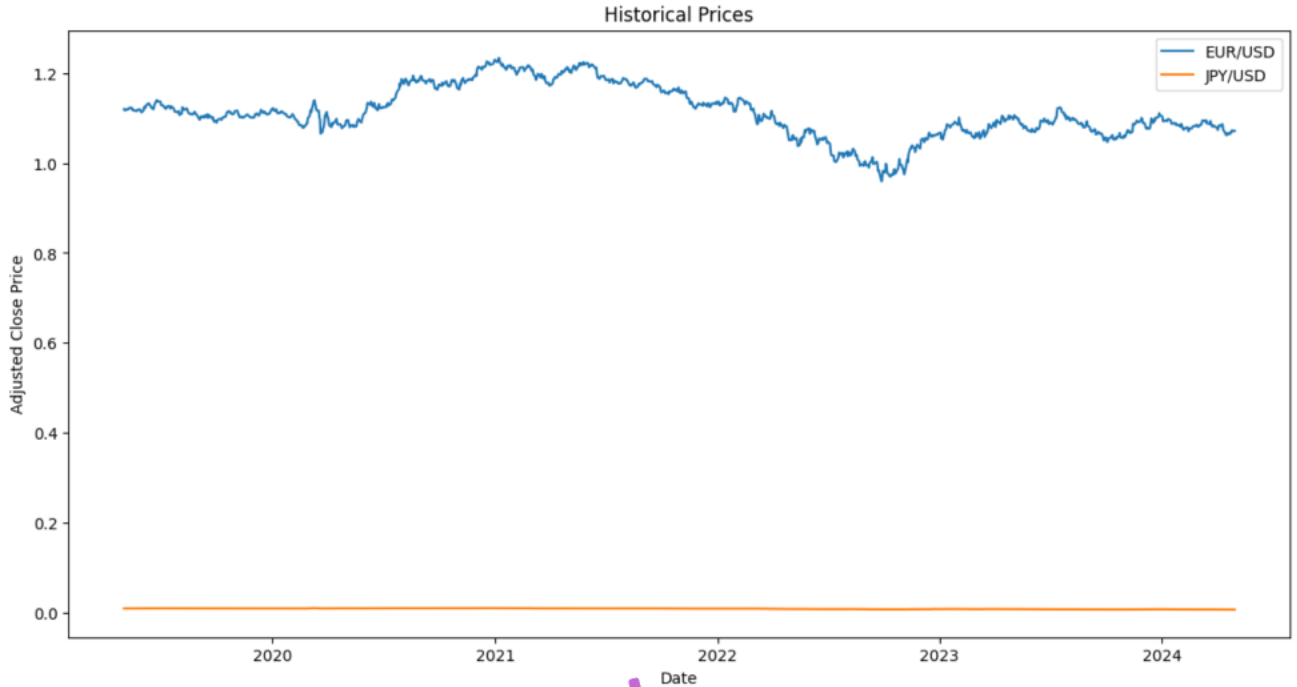
Results Summary

Both models have similar accuracy (52%), indicating they are performing only slightly better than random guessing.

- **Logistic Regression**
  - Better at identifying when the S&P 500 does not go up (higher recall for class 0 at 72%).
  - Less effective at identifying when the S&P 500 goes up (lower recall for class 1 at 32%).
- **Random Forest**
  - More balanced in identifying both classes compared to Logistic Regression.
  - Slightly better recall for class 1 at 48%, indicating it is better at identifying days when the S&P 500 goes up compared to Logistic Regression.

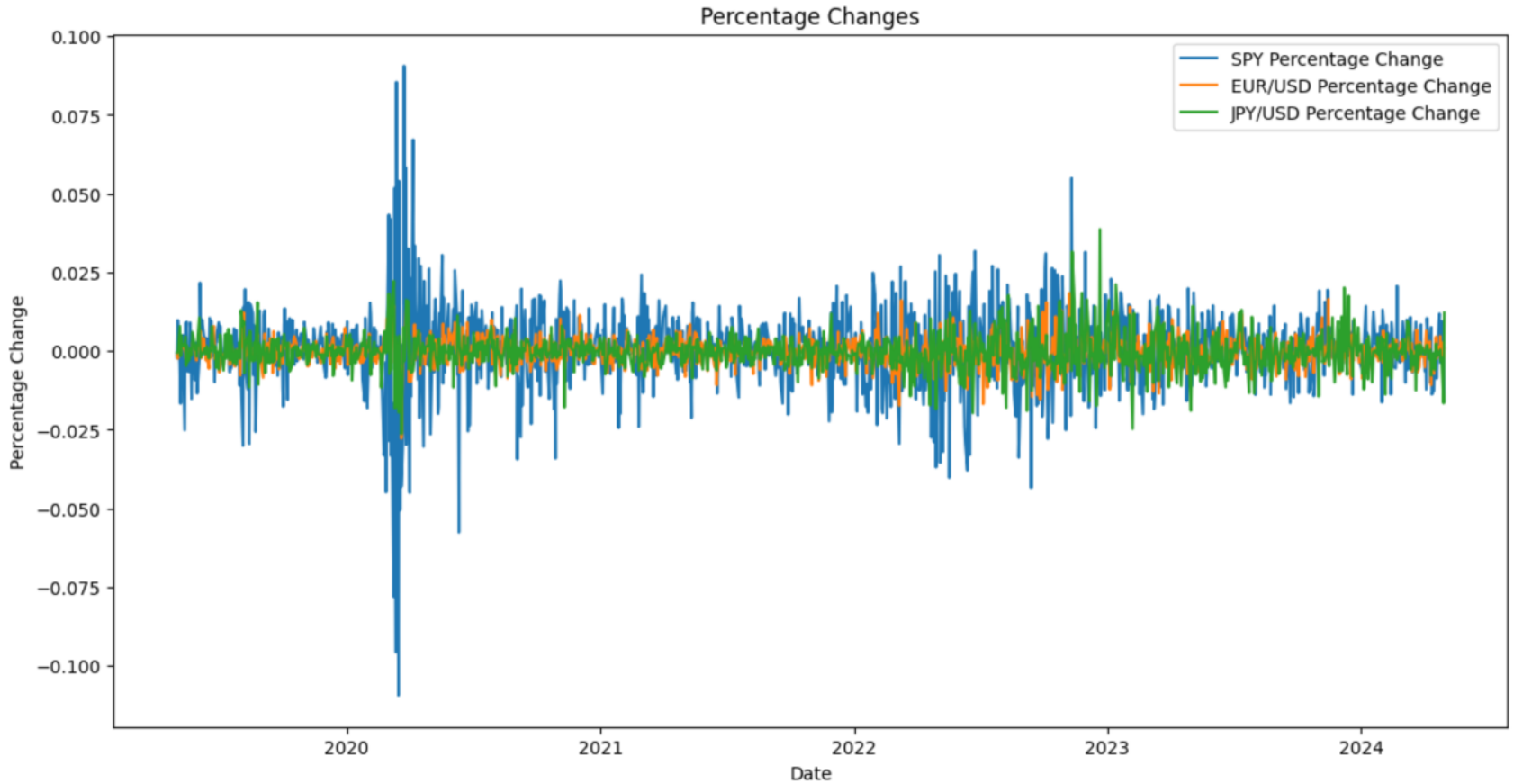
```
Logistic Regression accuracy: 0.52
Random Forest accuracy: 0.50
Logistic Regression Classification Report:
              precision    recall  f1-score   support

           0       0.51      0.72      0.60       268
           1       0.55      0.32      0.41       276

    accuracy                           0.52       544
   macro avg       0.53      0.52      0.50       544
weighted avg       0.53      0.52      0.50       544

Random Forest Classification Report:
              precision    recall  f1-score   support

           0       0.50      0.55      0.52       268
           1       0.51      0.46      0.48       276

    accuracy                           0.50       544
   macro avg       0.50      0.50      0.50       544
weighted avg       0.50      0.50      0.50       544
```

Visualizations (Part I)



Separate chart to show fluctuation of the Japanese Yen.

Visualizations (Part II)



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Implications

It is understood that the current version of this project requires additional features in order to capture the complex relationships between the SPY and exchange rates. Features, like engineered or financial indicators/ market sentiment data, might show a stronger relationship with SPY movements.

Implications include:

Model Improvement

(more sophisticated models, etc.)

Strategies for Market Stress

Model Improvements

Hyperparameter Tuning

- Techniques, like Grid Search or Random Search, to find the optimal hyperparameters for each model

Addressing Overfitting/Underfitting

- Regularization
- Pruning

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Conclusion

The current models show limited predictive power with an accuracy of 52%.

Future work should focus on improving feature engineering, exploring more sophisticated models, and handling periods of market stress to enhance prediction accuracy.

Questions?

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