

Sample Project

Farhan Sadeek, Jalen Francis, Jayson Clark
Aditya Bhati, Andrew McKenzie

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Abstract

This project aims to evaluate investment strategies beyond the traditional buy-and-hold approach. By analyzing historical data of the S&P 500 and bond yields, we classify market states and develop a neural network-based investment strategy that adapts to changing market conditions. Our approach includes anomaly detection to account for extraordinary events like the COVID-19 pandemic.

Problem Statement

Although buying and holding is considered the best strategy in investing, we aim to prove or disprove this hypothesis based on the dataset provided, which includes the price of the S&P 500 and bond yield rates. Our goal is to identify more optimal entry and exit points by employing a mixed-methods approach that combines statistical analysis with machine learning techniques.

Market Classification

- **Objective:** Classify market states (Bear, Bull, Static) using S&P 500 data.
- **Methodology:**
 - Calculate rolling peak and trough.
 - Bear: Drawdown from peak $> 20\%$.
 - Bull: Increase from trough $> 20\%$.
 - Static: Neither Bear nor Bull.
- **Implementation:**
 - Python with Pandas, NumPy, Matplotlib.

- Logging and visualization.
- **Results:**
 - Market state distribution.
 - Plot of S&P 500 with market states.

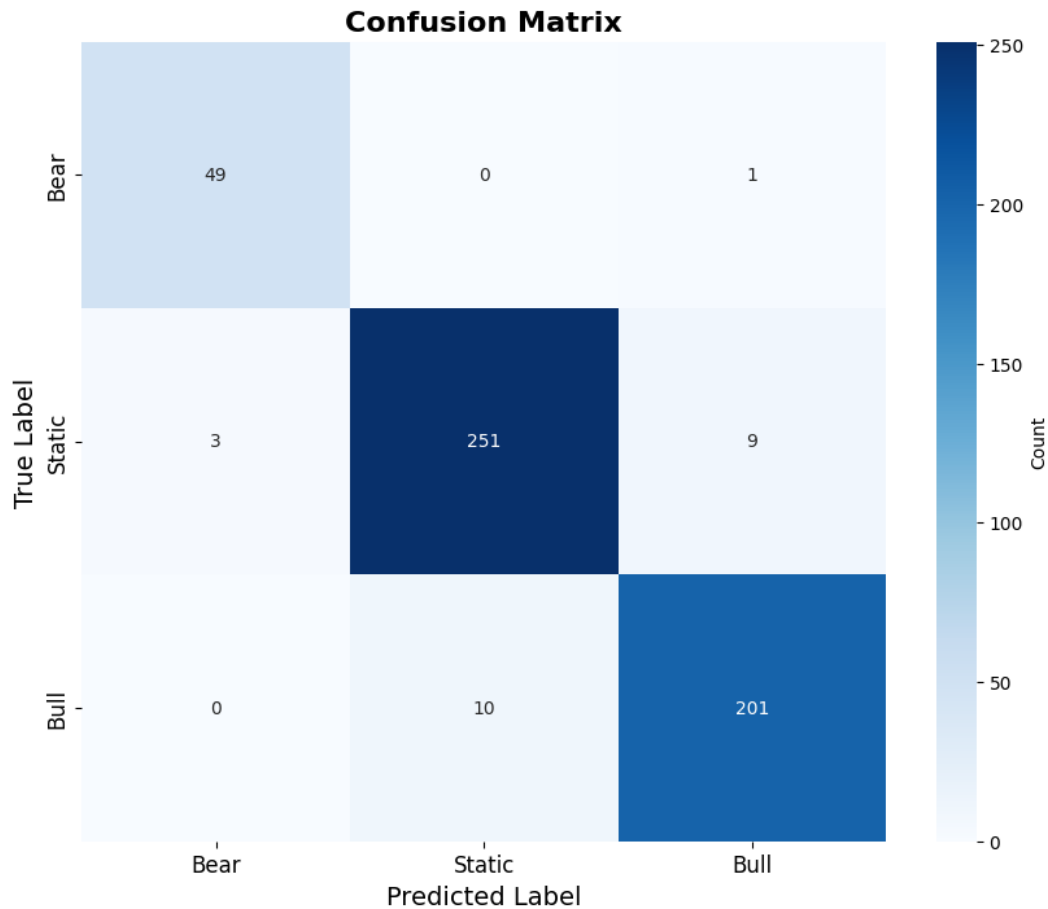


Figure 1: S&P 500 with Market State Classification

Why Neural Networks for Investment Strategy?

- Neural networks can identify complex patterns in financial data that traditional models are very likely to miss.
- Our approach avoids hard-coded investment rules, allowing the model to learn optimal strategies directly from historical market data.
- This data-driven methodology adapts to changing market conditions more effectively than static strategies.

- The model incorporates multiple factors simultaneously, capturing nuanced relationships between S&P 500 movements and bond yields.

Anomaly Detection

While creating our model, we realized that certain market conditions might affect the performance of our investment strategies. For example, the COVID-19 pandemic caused the market to perform abruptly. To account for that, we developed a neural network that detects anomalies and avoids those pitfalls. You can find our analysis on that in `market_anomaly.py`.

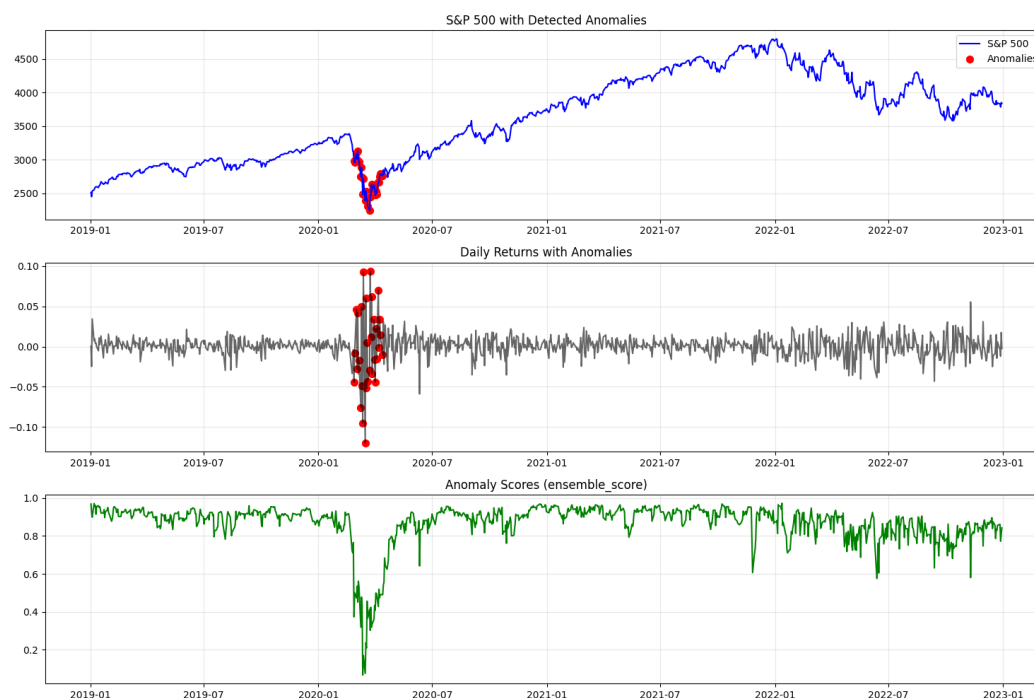


Figure 2: S&P 500 with Anomaly Detection

Our Solution

We will disprove the buy-and-hold hypothesis by coming up with our own investment strategy that minimizes risk while maximizing returns. By employing a mixed-methods approach that combines statistical analysis with machine learning techniques, we aim to identify potential patterns and trends within the financial data that can inform our investment strategy. Specifically, we will analyze historical price movements of the S&P 500 alongside various economic indicators, including bond yield rates, to uncover correlations that may suggest more optimal entry and exit points.