

Project Overview

This project is a **stock and earnings analysis system** built to analyze historical financial data for Apple Inc. (AAPL). It combines stock market data with earnings reports to uncover patterns, flag anomalies, and explore potential insider trading signals. The system leverages Python for data processing, visualization, and interactive analytics.

Objectives

- Analyze Stock Data:**
 - Study price trends, volatility, and trading volumes.
 - Identify significant price movements and volume spikes.
 - Integrate Earnings Data:**
 - Combine earnings data with stock market performance to explore correlations and impacts.
 - Detect Anomalies:**
 - Flag unusual market activities, such as simultaneous significant price and volume changes, as potential indicators of insider trading.
 - Visualization and Insights:**
 - Create interactive dashboards for intuitive exploration of data trends and anomalies.
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How It's Built

- Data Collection:**
 - Stock Data:** Downloaded daily stock data (open, high, low, close, adjusted close, and volume) for Apple Inc. using the `yfinance` library.
 - Earnings Data:** Retrieved historical earnings reports through the Alpha Vantage API.
 - Combined both datasets by aligning time periods using fiscal months.
- Data Cleaning and Preparation:**
 - Checked for missing values and applied forward-filling techniques.
 - Formatted dates consistently and merged datasets using time-based keys.
- Feature Engineering:**
 - Calculated daily percentage changes in stock prices and volumes.
 - Defined thresholds for significant price movements ($>5\%$) and volume spikes ($>50\%$).
- Anomaly Detection:**
 - Flagged instances of both significant price changes and volume spikes as potential indicators of insider trading.
 - Highlighted patterns around earnings dates.
- Visualization:**
 - Created interactive plots using the `plotly` library:
 - Stock price trends with markers for significant movements.
 - Trading volumes with indicators for volume spikes.

- Combined charts for side-by-side analysis of price and volume anomalies.
6. **Output and Reporting:**
- Exported the merged dataset with anomalies flagged to Excel for further analysis.
 - Designed dashboards to make findings accessible and actionable.
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Why It's Useful

1. **Financial Analysis:**
 - Helps investors and analysts identify trends in stock price and volume behavior.
 - Provides insights into the impact of earnings announcements on stock performance.
 2. **Compliance and Risk Monitoring:**
 - Flags potential insider trading activities based on unusual market behavior.
 - Supports regulatory teams in monitoring and investigating compliance breaches.
 3. **Operational Efficiency:**
 - Automates data collection, integration, and anomaly detection, saving time and reducing manual effort.
 4. **Adaptability:**
 - The methodology is extendable to other stocks, industries, or financial datasets.
 - Could be integrated into enterprise systems for real-time monitoring.
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Key Insights and Outcomes

- **Trend Analysis:** Identified periods of high volatility and volume spikes around key events (e.g., earnings reports).
 - **Anomaly Detection:** Flagged simultaneous price and volume changes as potential insider trading events.
 - **Visualization:** Delivered interactive dashboards for a clear and intuitive understanding of stock and earnings data.
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Technical Highlights

1. **Libraries Used:**
 - `yfinance`: For stock data collection.
 - `requests` and `json`: For API integration with Alpha Vantage.
 - `pandas` and `numpy`: For data cleaning, transformation, and analysis.
 - `plotly`: For interactive visualizations.
 - `openpyxl`: For exporting data to Excel.

2. Key Techniques:

- Time-based data merging for aligning stock data with earnings reports.
- Threshold-based anomaly detection for significant price movements and volume spikes.
- Dynamic and interactive plotting to explore complex data relationships.

Relevance

This project demonstrates proficiency in:

- **Data Management:** Handling large datasets, ensuring quality, and merging diverse data sources.
- **Financial Analytics:** Understanding market dynamics and leveraging data-driven insights for decision-making.
- **Visualization and Reporting:** Communicating complex data insights through interactive dashboards.
- **Problem-Solving:** Addressing challenges such as missing data and API integration errors.