# **Shiny Application for Visualizing Liquidity and Rare Events**

## **Overview**

To support our goal of detecting rare liquidity‐related events in daily stock data, we developed an interactive Shiny application that integrates price, volume, sentiment, and anomaly detection in a unified dashboard. By allowing users to select a ticker and date range, the app brings our methodology (Isolation Forest, LOF, hyperplane classification) into an exploratory environment where patterns and outliers can be examined visually.

## **User Interface**

### **Controls (Sidebar)**

**Ticker Selection:** Dropdown for TSLA, JPM, NVDA.

**Date Range:** Calendar-style input to constrain all plots to the chosen window.

A screenshot of a login

AI-generated content may be incorrect.

A close-up of a sign

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**Figure 1:** Screenshot of the Shiny sidebar (ticker + date selectors) and the two tabs (“Dashboard” and “Liquidity Events”), illustrating how users pick their inputs and navigate.

### **Main Panel (Tabset)**

#### **Dashboard Tab**

**Price Plot:** Interactive line+marker plot of closing price with hover displaying date, price, and aggregated headlines.

**Volume Plot:** Bar chart of daily trading volume, with hover showing volume and sentiment snippet.

**Sentiment Plot:** Line+marker view of daily average news sentiment.

**A screenshot of a graph

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**Figure 2.** Composite view of the Dashboard tab showing (a) stock price over time, (b) daily trading volume, and (c) news sentiment—each with interactive hover tooltips.

### **Liquidity Events Tab**

* Overlays price time series with open‐circle markers highlighting high‐ and low-liquidity outliers (dark green outline for “high liquidity” events, blue outline for “low liquidity”).
* Marker sizes are mapped to the Isolation Forest anomaly score, clamped via a continuous scale for visual clarity.

A graph of a line graph

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**Figure 4.** Liquidity Events plot—with open circles outlined in green for high-liquidity anomalies and blue for low-liquidity—overlayed on the price line, sized by anomaly score.

## **Data Processing Pipeline**

### **I. Data Ingestion**

OHLCV data and news headlines are read per-ticker, standardized, and merged by date.

### **II. Sentiment Scoring**

Headlines are concatenated daily and processed through sentimentr to produce raw sentiment and rolling averages.

### **III. Feature Engineering**

* + Liquidity proxies (Amihud Illiquidity, high–low spread, turnover, volume z-scores) are calculated alongside behavioral signals (sentiment).

### **IV. Anomaly Detection**

* + Scaled features feed both an Isolation Forest (via isotree) and Local Outlier Factor (DMwR2) to compute anomaly scores.
  + The top 1% of scores from each model are flagged and merged into a high-confidence rare-event set.

### **V. Directional Classification**

By reversing low-liquidity indicators and summing standardized features into a single hyperplane metric, each anomaly is classified as high or low liquidity.

All transformations are wrapped in Shiny reactives, so changes in inputs immediately propagate to every plot.

## **Technical Implementation**

* **Reactive Architecture:** Efficient memoization ensures that data loading, feature computations, and model predictions rerun only when ticker or date range change.
* **Plotly Integration:** ggplot2 visuals are converted to interactive Plotly outputs, preserving hover details and zooming capabilities.
* **Modular Code Structure:** Separation of data‐loading, processing, and rendering functions enhances maintainability and facilitates future extensions.

## **Discussion and Extensions**

By providing synchronized visualizations of price, volume, sentiment, and anomalies, the Shiny app directly addresses our first three research questions:

1. **Model Validation:** Users can confirm whether Isolation Forest and LOF identify sensible outliers against price movements.
2. **Behavioral Context:** Sentiment/time plots offer immediate context around detected events, illustrating market mood shifts.
3. **Comparative Analysis:** Switching tickers and date ranges enables cross-asset comparisons of rare event frequency and magnitude.

Future enhancements could include tabs for post-event return analysis, parameter sliders for threshold tuning, and integration of forward-return visualizations to test trading-strategy performance.