AI-Powered Trade Exception Detection and Explanation System

# 1. Introduction

This project aims to build a simple, end-to-end machine learning system that can identify and explain anomalous (potentially failing) financial trades before settlement. It is inspired by real-world use cases at companies like Broadridge, which specialize in post-trade processing and financial technology solutions. The system is designed to be lightweight and student-friendly, while demonstrating core AI/ML capabilities such as anomaly detection and rule-based natural language explanation.

# 2. Project Flow

## Step 1: Data Generation & Feature Engineering

- Generate synthetic trade data with columns like trade\_date, settlement\_date, trade\_amount, stock\_symbol, counterparty\_id, etc.  
- Engineer features such as:  
 • settlement\_lag = settlement\_date - trade\_date  
 • price\_deviation = % deviation from previous day  
 • volume\_vs\_avg = trade size / average daily volume  
- These features help identify risk of failure.

## Step 2: Anomaly Detection Model

- Use an Isolation Forest model to flag unusual trades based on engineered features.  
- Train the model on normal data, validate on data with injected anomalies.  
- Output: For each trade, a prediction: Normal or Anomaly.

## Step 3: Root-Cause Explanation

- When a trade is flagged, generate a human-readable explanation.  
- Use simple rule templates like:  
 • "This trade is 5 days late because settlement\_date > trade\_date + 3."  
 • "High price deviation of 12% from previous day's average."  
- These explanations help compliance officers understand and act quickly.

## Step 4: Streamlit Web App (UI)

- Build a clean interface using Streamlit.  
- Upload a CSV → show flagged trades → show reasons next to each row.  
- Optional features: download results, visualize top causes with charts.

## Step 5: Evaluation & Demo Preparation

- Evaluate model using accuracy, precision, recall on test anomalies.  
- Record a short screencast of the working tool.  
- Prepare interview-ready talking points (why this model, future plans, etc).

# 3. Conclusion

This project demonstrates a clear understanding of anomaly detection, explainability, and user-friendly deployment. It is aligned with real use cases from financial technology firms like Broadridge and is structured to be both technically meaningful and easy to present in interviews.