

Synopsis for FDEWS

Project Title

AI-Powered Financial Distress Early Warning System (FDEWS) for Companies and Markets

Abstract / Overview

The proposed project aims to develop an intelligent system capable of predicting financial distress in companies and markets before traditional indicators signal risk. Financial distress, including bankruptcy, liquidity crises, and stock collapses, often occurs despite apparently healthy financial statements, resulting in significant losses for investors, banks, and regulators. FDEWS integrates multiple data sources—financial ratios, market indicators, sentiment analysis from news and social media, and macroeconomic variables—into a unified predictive framework. Leveraging machine learning algorithms and explainable AI techniques, the system generates a **Financial Distress Index (FDI)**, providing early warnings and actionable insights to stakeholders for proactive risk mitigation.

Problem Statement

Predicting financial distress is a complex and high-stakes challenge. Traditional methods, such as Altman Z-scores and static ratio analysis, are limited in scope and often reactive rather than proactive. They fail to incorporate dynamic market behavior, sentiment fluctuations, or operational signals, resulting in delayed detection of financial crises. There is a critical need for a predictive system that continuously monitors multi-modal financial and market data to detect early warning signs of distress, enabling timely interventions and informed decision-making.

Objectives

1. To design a hybrid machine learning system that predicts financial distress in companies using multi-source data.
2. To integrate traditional financial ratios, market indicators, sentiment analysis, and macroeconomic metrics for comprehensive risk assessment.
3. To develop a **Financial Distress Index (FDI)** quantifying the likelihood of distress.
4. To implement explainable AI techniques (SHAP/LIME) for transparency and interpretability of predictions.

5. To provide a functional prototype with a dashboard for visualization of risk trends, top at-risk companies, and early warning signals.
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Proposed System / Solution

FDEWS is a predictive platform designed to continuously assess the financial health of companies:

- **Data Collection:** Integrates company-level financial statements, stock market data, macroeconomic indicators, and sentiment data from news sources.
- **Feature Engineering:** Computes rolling averages, volatility metrics, sentiment indices, and financial ratios over time.
- **Model Training:** Implements machine learning models (Random Forest, XGBoost, LightGBM) for binary classification of "Distress" versus "Healthy" companies.
- **Early Warning Design:** Generates a **Financial Distress Index (FDI)** ranging from 0 to 1, with threshold-based alerts for high-risk companies.
- **Explainability:** Uses SHAP/LIME to provide feature-level explanations for predictions, highlighting key risk drivers such as liquidity drops, negative sentiment trends, or rising debt ratios.
- **Visualization Dashboard:** Displays risk levels, temporal trends, and ranking of at-risk companies for investor and regulatory insights.

The system reduces reliance on traditional reactive metrics and enables proactive monitoring and decision-making.

Technology Stack

- **Data Collection & Preprocessing:** Python (Pandas, NumPy), APIs (Yahoo Finance, Alpha Vantage, NewsAPI)
 - **Machine Learning & Modeling:** Scikit-learn, XGBoost, LightGBM, optional LSTM for time-series
 - **Explainability:** SHAP, LIME
 - **Visualization:** Plotly, Seaborn, Matplotlib
 - **Deployment / Prototype:** Streamlit or Flask dashboard for interactive demonstration
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Scope of the Project

Phase 1 (Core Implementation):

- Collect and preprocess financial, market, and sentiment data.
- Train and evaluate machine learning models for distress prediction.

- Compute the Financial Distress Index (FDI) and generate basic risk alerts.

Phase 2 (Extended Implementation):

- Integrate explainable AI for feature-level insights.
 - Develop interactive dashboard for visualization of risk trends and alerts.
 - Optionally, extend with time-series models (LSTM) and cloud deployment for real-time monitoring.
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Expected Outcome

- A functional prototype capable of predicting financial distress in companies with measurable accuracy.
 - Transparent and interpretable risk scores (FDI) for informed decision-making.
 - Visualization dashboard enabling stakeholders to monitor trends, identify at-risk companies, and act proactively.
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Future Enhancements

- Integration of live market feeds for real-time distress monitoring.
- Automated alerts to investors or regulatory dashboards.
- Advanced sentiment modeling using FinBERT or transformer-based NLP.
- Expansion to multi-market or sector-wide distress analysis.
- Incorporation of portfolio risk assessment and predictive simulations.