A Multi-Modal Framework for Credit Risk Assessment: Capturing Corporate Financial Patterns with Sequential and Graph Data

Abstract

This research explores the integration of Recurrent Neural Networks (RNNs) and Graph Neural Networks (GNNs) to enhance corporate credit rating prediction. In this talk, we expand the definition of corporate credit risk, characterizing the dynamic financial interactions and dependencies among firms using a multi-modal approach that merges graph-based and sequential data processing. This research employs Graph Convolutional Networks (GCNs) and various forms of RNNs, including Long Short-Term Memory (LSTM) units, Gated Recurrent Units (GRUs), and Transformers, to analyze corporate financial health both statically and dynamically. The models are trained using data from 318 US companies over a period of 11 years, synthesizing numerical data from quarterly financial statements and graph data constructed from stock market interactions to capture intricate patterns of corporate financial activities. The market interaction graph is built by measuring the dynamic correlation of volatility of the stock prices, filtered by a Triangulated Maximally Filtered Graph technique to achieve a network capturing the nuances in how companies' risk relates while simultaneously eliminating noisy irrelevant connections. The effectiveness of these multi-modal models is measured on both the companies it was trained on, in a transductive way, and inductively using companies that were excluded during model training. The superior performance in both seen and unseen data scenarios versus unimodal models, and models over structured data, demonstrates robust generalization capabilities, essential for practical deployment in financial risk assessment.

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