Take-home challenge

Stock Price Prediction

Candidate: Minh-Quan Le

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1 Introduction

With the development in graph neural network, recent studies integrate the relationships between stocks to form graph. Based on the idea that it is challenging to model the relationships between stocks, I use fully connected graph to model latent relationships between sectors and intra-sector relation as well.

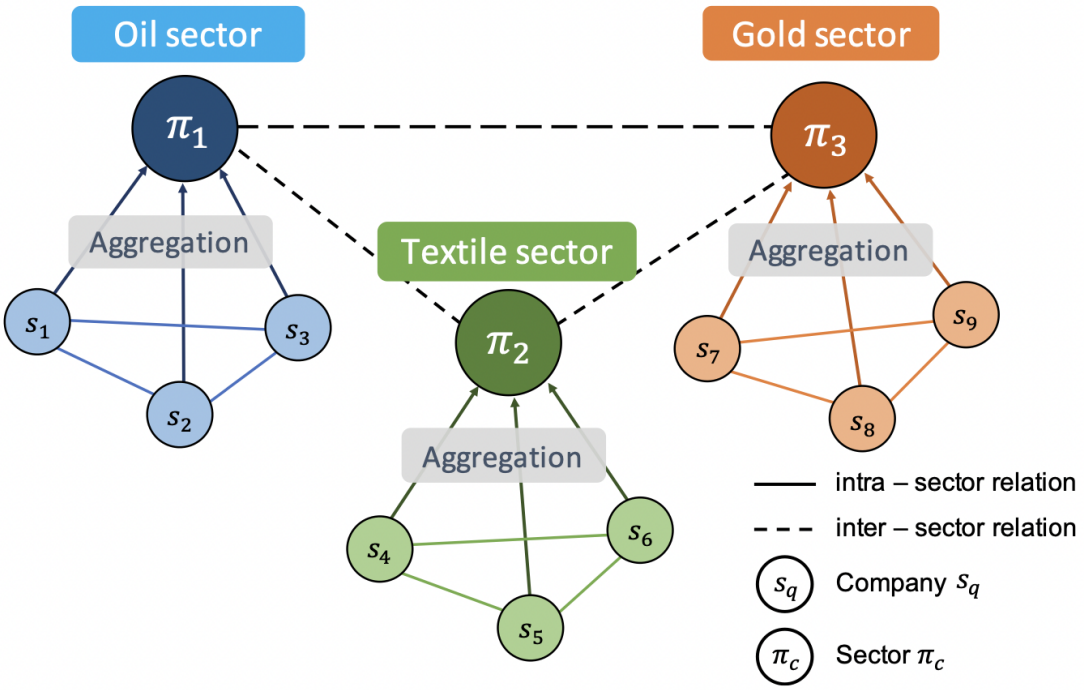

Figure 1: A toy example of intra-sector relations and inter- sector relations.

I use graph neural network-based model [1] for modeling hierarchical relationships among stocks and sectors. The framework three main modules including stock-level feature learning, sector-level feature learning, and multi-task learning. First, I extract features representation of each stocks at a certain period via gated recurrent units (GRU) to learn short-term sequential features. Next, I utilize Graph Attention Network (GAT) to model latent intra-sector relations. Then, I use an aggregation layer to combine stock's short term embeddings and learn long-term sequential features.

A graph pooling mechanism is leveraged to generate the long- term embeddings of same-sector stocks. Finally, I train a multi-task learning method including regression and classification (stock price prediction and stock movement).

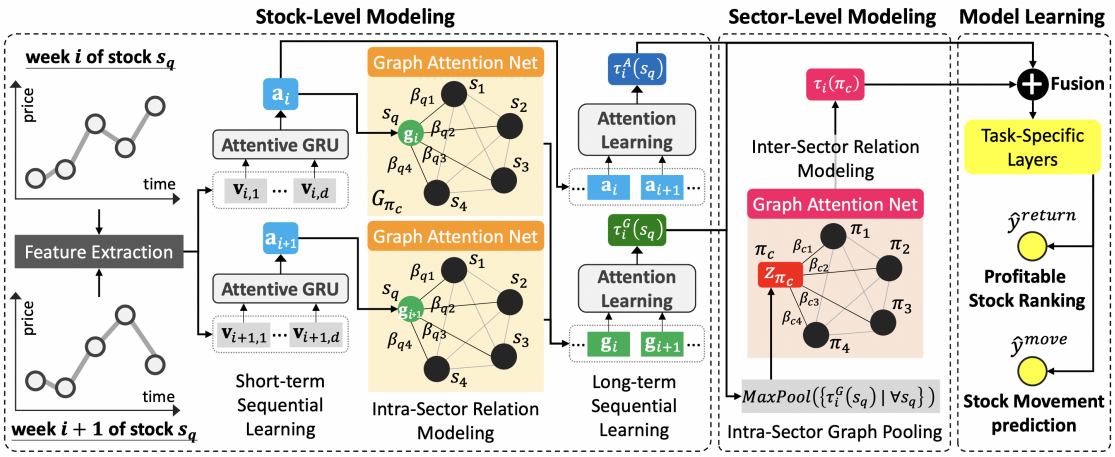

Figure 2: The architecture of the framework

2 The model architecture

2.1 Feature extraction

I use hand-craft features, including price-ration features:

$$\mathcal{F}_\mu = \frac{\mu_i}{\text{close}_j} - 1 \tag{1}$$

where $\mu \in$ open, high, low and moving-average features:

$$\mathcal{F}_\mu = \frac{\sum_{j=0}^{\phi-1} \text{adj\_close}_j}{\phi} / (\text{adj\_close}_j - 1) \tag{2}$$

2.2 Short-term sequential learning

I use RNN to learn short-term sequential features via Gated Recurrent Unit (GRU) and attention mechanism to generate the attention representation

2.3 Intra-sector Relation Modeling

Due to the fact the it is difficult to explicitly presume relations between stocks, I use a fully connected graph to model relationships between two stocks belonging to the same sector. Then, I use graph attention network to learn attention weights between nodes.

2.4 Sector-level modeling

This module is designed to learn influence and interaction between different sectors. In this module, I also create fully connected graph where each node represents a sector. After that, Graph Attention Network to learn the various attention weights of each edge.

References

[1] Yi-Ling Hsu, Yu-Che Tsai, and Cheng te Li. Fingat: Financial graph attention networks for recommending top-k profitable stocks. *ArXiv*, abs/2106.10159, 2021.