

DLP Final Project Proposal: Market Guided Stock Transformer

Group 7

110705009 陳重光、313551047 陳以瑄、313554043 戴明貴

Outline

- Introduction - Market Guided
- MASTER - AAAI'24
- Method
- Dataset

Introduction - Market Guided

Stock prediction features can be divided into two types:

1. Individual Stock Features:

- Open price, close price, etc.
- Trading volume

2. Shared Market Features:

- Market index
- Macroeconomic indicators, e.g. interest rate

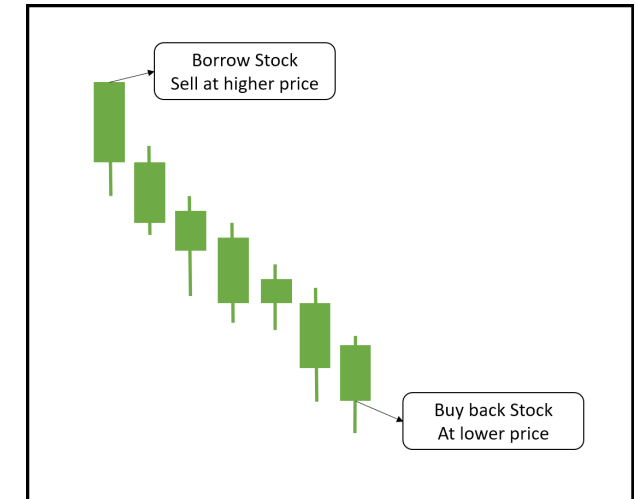
Introduction - Market Guided

The market feature impacts the effectiveness of other features.

Example: Short Selling

When investors believe a stock is overvalued.

1. Borrow stock, sell at high price.
2. Buy back at lower price when it falls.
3. Return to owner.



Short selling interest: the amount of stocks being short.

Introduction - Market Guided

The market feature impacts the effectiveness of other features.

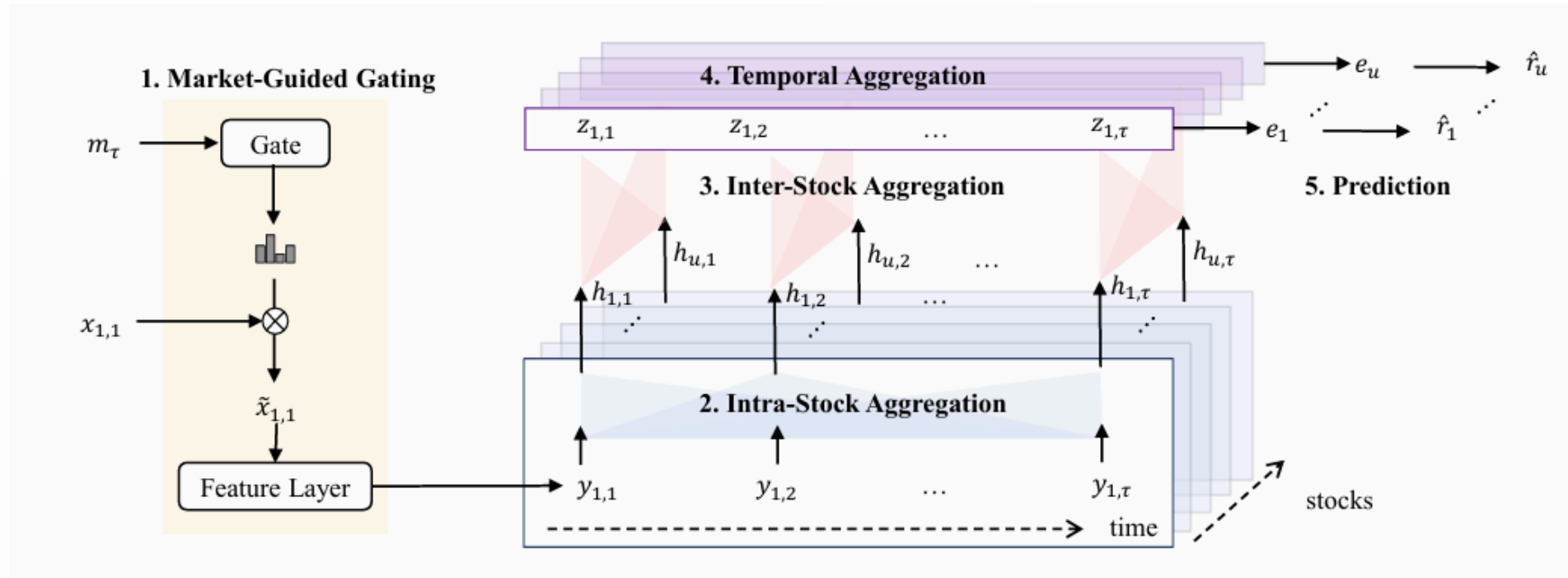
Example: Short Selling

Effectiveness in different market status:

- Bull Market: short selling loses money, less concern.
- Bear Market: short selling signals pessimism, more significant.

→ **Using market status to select relevant features.**

MASTER:Market-Guided Stock Transformer for Stock Price Forecasting ^[1]



Limitation

Simple Representation of Market Status:

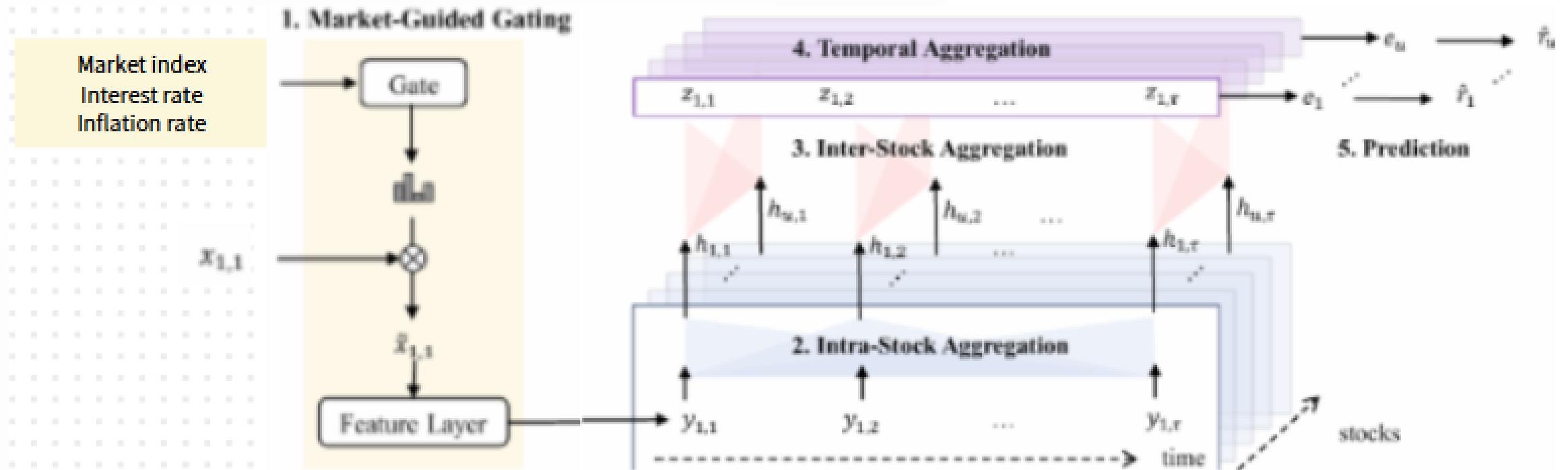
Only market index prices and trading volumes are used as inputs.

Improvements: Expanding Shared Market Features

1. Macroeconomic features
2. Industry-level features
3. News-based features

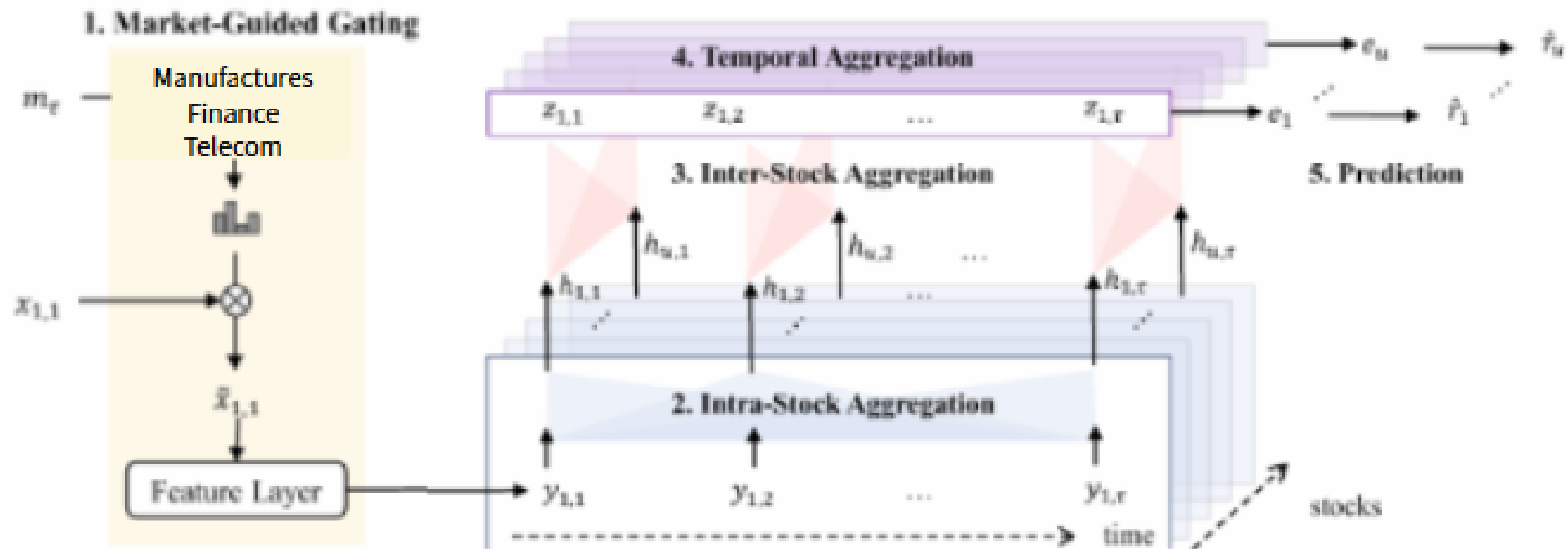
Idea 1

Market-guided indicators expansion for richer market dynamics



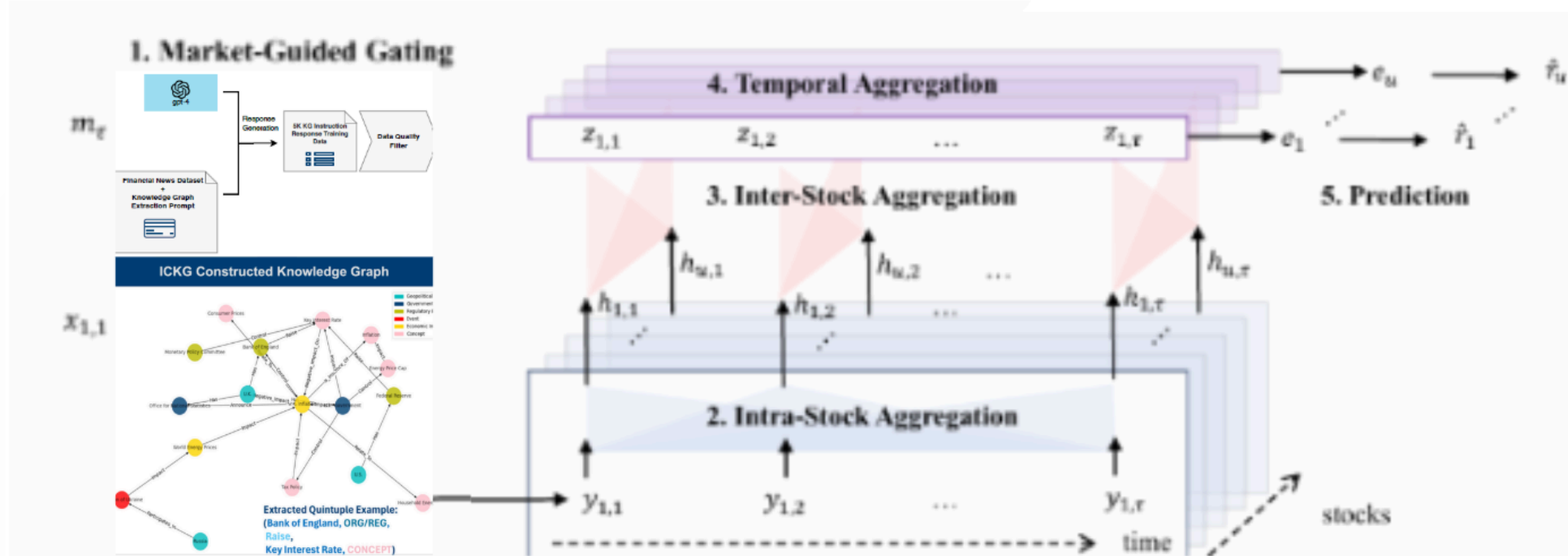
Idea 2

Industry-level features for sector-specific behavior capture



Idea 3

Supply chain and news features for enhanced forecasting



- **MASTER:** dynamic stock correlations with market-guided feature
- **FinDKG:** company relationships to identify business partners

Problem Definition

Given a set of stocks S with features $x_{u,t} \in \mathbb{R}^F$ collected at time steps $t \in [1, \tau]$:

For each stock, we consider:

- Individual stock features (price, volume)
- Shared market features (market index, macroeconomic indicators)
- Industry-Level feature (return)
- News-derived features (company and related party)

Output: The return ratio $r_u = \text{Norm}_S((c_{u,\tau+d} - c_{u,\tau+1})/c_{u,\tau+1})$

Data Description

The dataset for input of this study consists of the following data:

- **Stock prices**
- **Industry**
- **Market index**
- **Economic indicator**
- **Sentimental scores**

Data Description (cont.)

- **Stock Price:**

- Base: S&P 500 constituents
- Industry classification: base on the Fama-French 12 industry [3].
- Number of stocks: 8 firms * 12 industries = 96 firms
- Stock feature (daily):
 1. price: open, high, low, close prices
 2. volume: trading volume
 3. others: short selling interest, etc.

Data Description (cont.)

- **Industry:**

The Fama-French 12 industry returns.

- **Market Index:**

S&P 500 market index

- **Economic Indicators:**

VIX, interest rates, and other economic indicators

- **Sentimental Scores:**

News sentiment score from RavenPack [4]

Data Description (cont.)

NAME	NUMBER	TRAINING	TEST	SOURCE
Stock Price	96 * 5	2010 - 2022	2023	WRDS - CRSP
Industry	12	2010 - 2022	2023	Fama-French
Market Index	1	2010 - 2022	2023	CRSP
Economic Indicators	1	2010 - 2022	2023	VIX, FRED
Sentimental Scores	6	2010 - 2022	2023	Ravenpack

Expected result

Dataset	Model	IC	ICIR	RankIC	RankICIR	AR	IR
CSI300	XGBoost	0.051 ± 0.001	0.37 ± 0.01	0.050 ± 0.001	0.36 ± 0.01	0.23 ± 0.03	1.9 ± 0.3
	LSTM	0.049 ± 0.001	<u>0.41 ± 0.01</u>	0.051 ± 0.002	0.41 ± 0.03	<u>0.20 ± 0.04</u>	<u>2.0 ± 0.4</u>
	GRU	0.052 ± 0.004	<u>0.35 ± 0.04</u>	0.052 ± 0.005	0.34 ± 0.04	0.19 ± 0.04	<u>1.5 ± 0.3</u>
	TCN	0.050 ± 0.002	0.33 ± 0.04	0.049 ± 0.002	0.31 ± 0.04	0.18 ± 0.05	1.4 ± 0.5
	Transformer	0.047 ± 0.007	0.39 ± 0.04	0.051 ± 0.002	<u>0.42 ± 0.04</u>	0.22 ± 0.06	2.0 ± 0.4
	GAT	<u>0.054 ± 0.002</u>	0.36 ± 0.02	0.041 ± 0.002	<u>0.25 ± 0.02</u>	0.19 ± 0.03	1.3 ± 0.3
	DTML	<u>0.049 ± 0.006</u>	0.33 ± 0.04	<u>0.052 ± 0.005</u>	0.33 ± 0.04	0.21 ± 0.03	1.7 ± 0.3
	MASTER	$0.064^* \pm 0.006$	0.42 ± 0.04	$0.076^* \pm 0.005$	0.49 ± 0.04	0.27 ± 0.05	2.4 ± 0.4
CSI800	XGBoost	0.040 ± 0.000	0.37 ± 0.01	0.047 ± 0.000	0.42 ± 0.01	0.08 ± 0.02	0.6 ± 0.2
	LSTM	0.028 ± 0.002	0.32 ± 0.02	0.039 ± 0.002	0.41 ± 0.03	0.09 ± 0.02	0.9 ± 0.2
	GRU	0.039 ± 0.002	0.36 ± 0.05	0.044 ± 0.003	0.39 ± 0.07	0.07 ± 0.04	0.6 ± 0.3
	TCN	0.038 ± 0.002	0.33 ± 0.04	0.045 ± 0.002	0.38 ± 0.05	0.05 ± 0.04	0.4 ± 0.3
	Transformer	0.040 ± 0.003	0.43 ± 0.03	0.048 ± 0.003	0.51 ± 0.05	0.13 ± 0.04	1.1 ± 0.3
	GAT	<u>0.043 ± 0.002</u>	0.39 ± 0.02	0.042 ± 0.002	0.35 ± 0.02	0.10 ± 0.04	0.7 ± 0.3
	DTML	<u>0.039 ± 0.004</u>	0.29 ± 0.03	<u>0.053 ± 0.008</u>	0.37 ± 0.06	<u>0.16 ± 0.03</u>	<u>1.3 ± 0.2</u>
	MASTER	$0.052^* \pm 0.006$	<u>0.40 ± 0.06</u>	0.066 ± 0.007	<u>0.48 ± 0.06</u>	$0.28^* \pm 0.02$	$2.3^* \pm 0.3$

Table 1: Overall performance comparison. The best results are in bold and the second-best results are underlined. And * denotes statistically significant improvement (measured by t-test with p-value < 0.01) over all baselines.

Expected result (cont.)

The set of stocks has changed from Chinese stocks to U.S. stocks
→ Prior related works are no longer directly applicable.

We aim to compare performance between:

1. The original version of MASTER
2. MASTER with three improvements

References

- [1] Li, T., Liu, Z., Shen, Y., Wang, X., Chen, H., & Huang, S. (2024). MASTER: Market-Guided Stock Transformer for Stock Price Forecasting. In Proceedings of the AAAI Conference on Artificial Intelligence, 38(1), 162-170.
- [2] Xie, J., Zhang, Y., Gong, X., Huang, J., Li, Z., Qin, B., & Liu, T. (2023). CausalStock: Deep End-to-end Causal Discovery for News-driven Stock Movement Prediction. In Proceedings of the 46th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR '23) (pp. 2320-2329). ACM.

References (cont.)

[3] Fama, E. F., & French, K. R. (1997). Industry costs of equity. Journal of financial economics, 43(2), 153-193.

Thank you for listening.