

# **DLP Final Project Proposal: Market Guided Stock Transformer**

Group 7

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# Outline

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

# 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

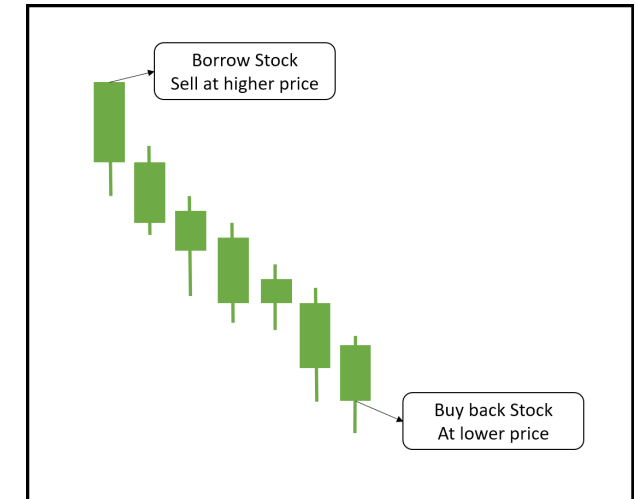
# Introduction - Market Guided

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

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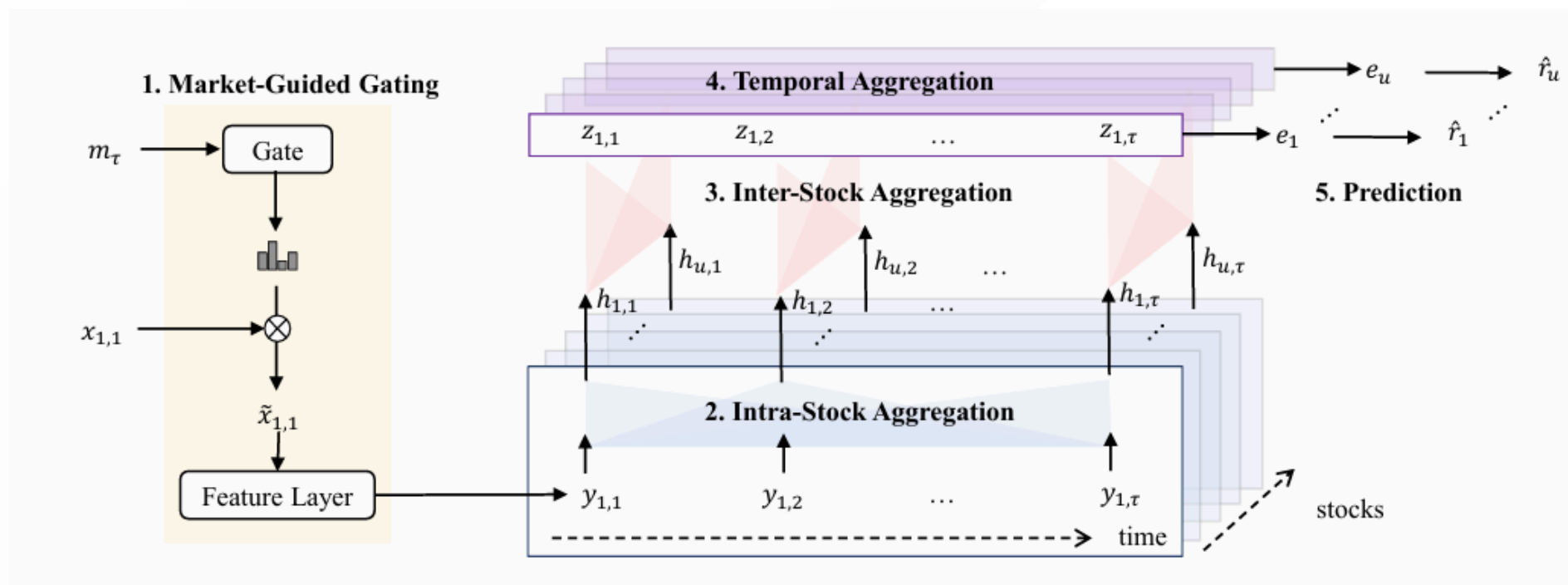
## **Example: Short Selling**

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 <sup>[1]</sup>



# Limitation

Simple Representation of Market Status:

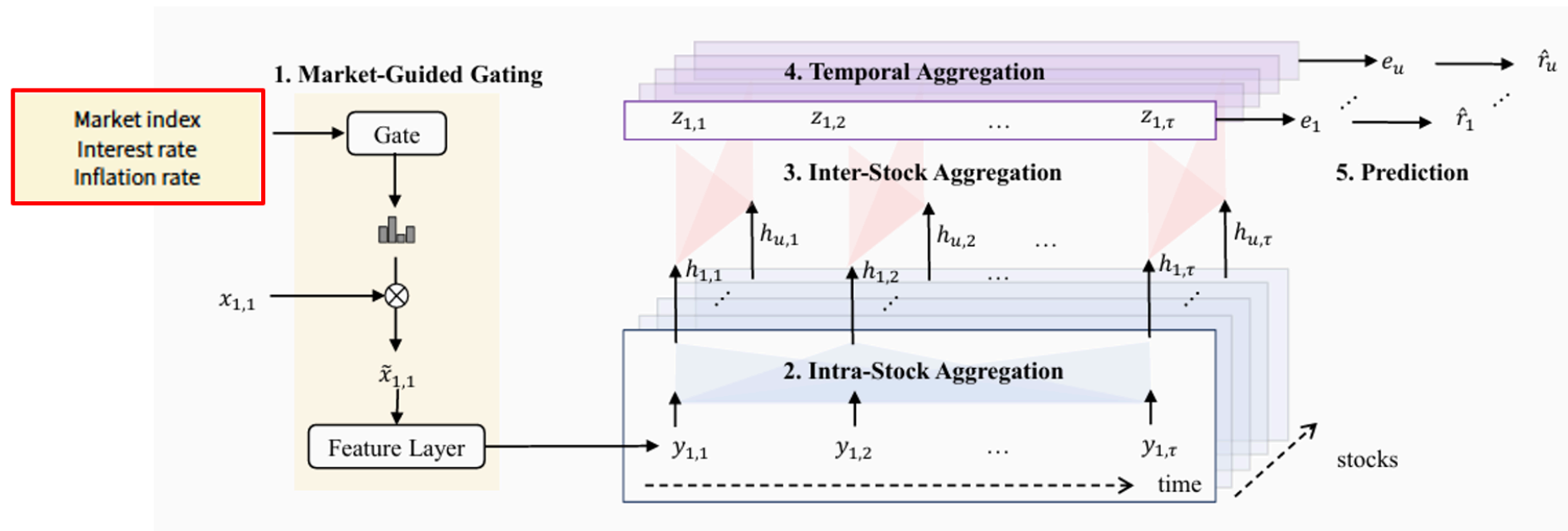
Only market index prices and trading volumes are used as inputs.

Improvements: Expanding Shared Market Features

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

# Idea 1 - Expand Market Features

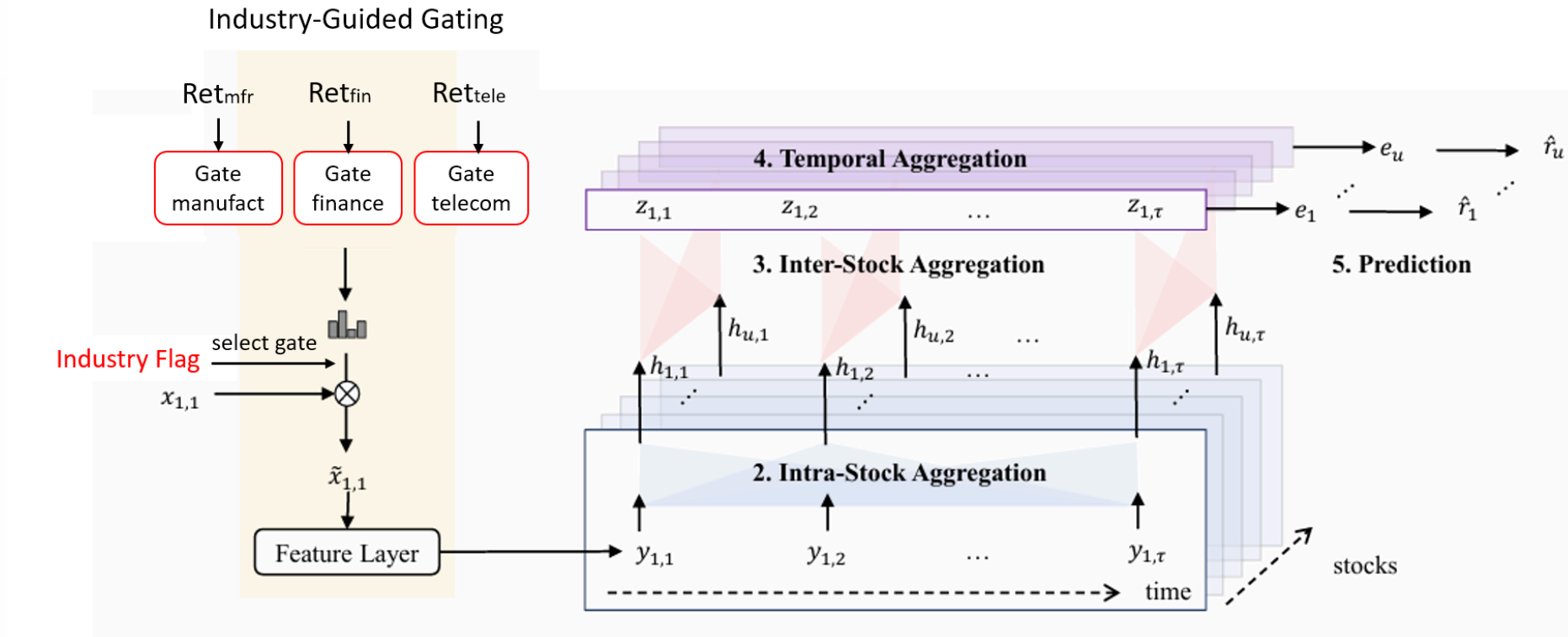
Market-guided indicators expansion for richer market dynamics





## Idea 2 - Industry-Level Features

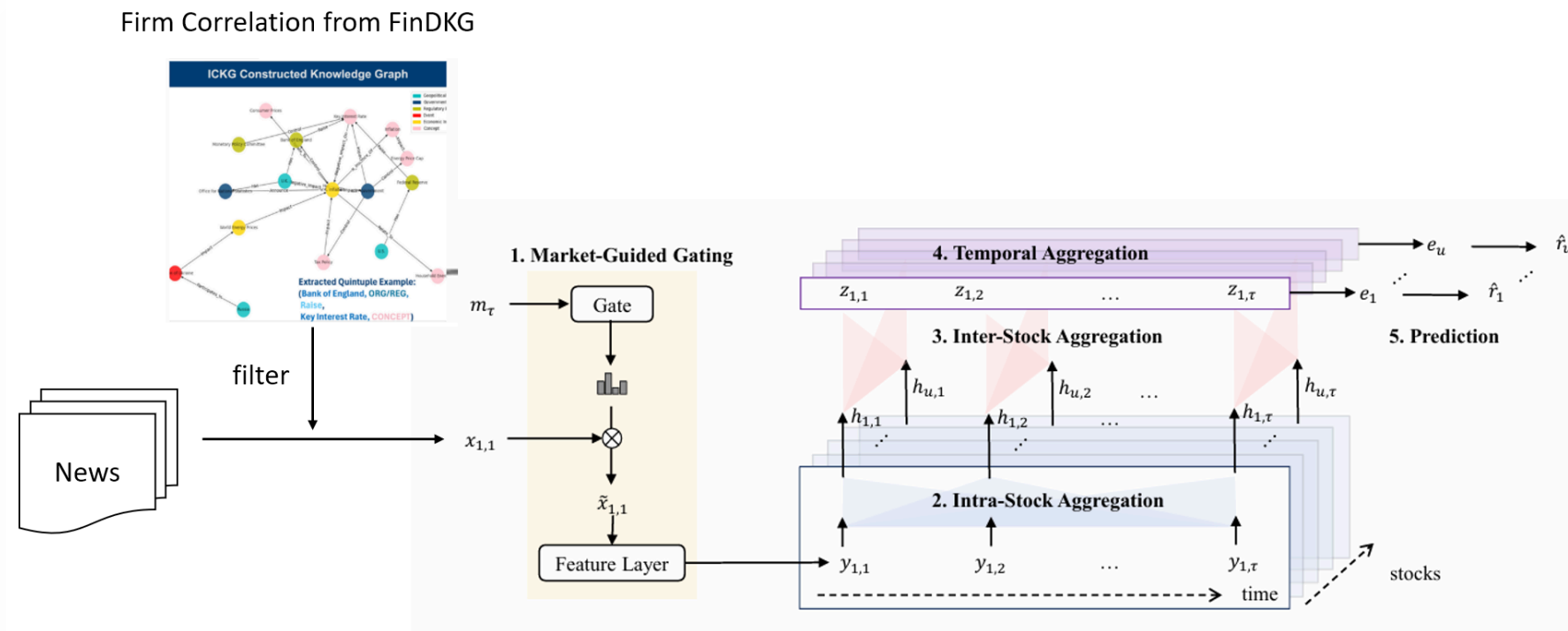
Each industry learns a different gate to capture its specific behavior. The industry flag is then used to select the relevant gate.



# Idea 3 - News-Based Features

Use FinDKG<sup>[2]</sup> to identify business partners

Then use the firm correlation to select the relevant news.



# 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 (industry return)
- News-derived features (the firm 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 - Stock Price

- **Base:** S&P 500 constituents
- **Industry classification:** base on the Fama-French 12 industry <sup>[3]</sup>.
- **Number of stocks:** 8 firms \* 12 industries = 96 firms
- **Daily stock features:**
  1. price: open, high, low, close prices
  2. volume: trading volume
  3. others: short selling interest, etc.

# Data Description - Others

- **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

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

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] Li, X. V., & Sanna Passino, F. (2024). FinDKG: Dynamic Knowledge Graphs with Large Language Models for Detecting Global Trends in Financial Markets. In Proceedings of the 5th ACM International Conference on AI in Finance (ICAIF '24) (pp. 573–581).

## 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.**