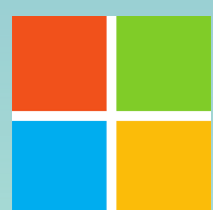# COMET: NFT Price Prediction with Wallet Profiling

Tianfu Wang, Liwei Deng, Chao Wang, Jianxun Lian, Yue Yan, Nicholas Jing Yuan, Qi Zhang, Hui Xiong
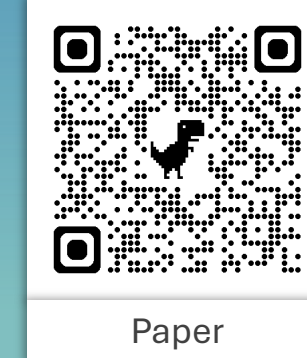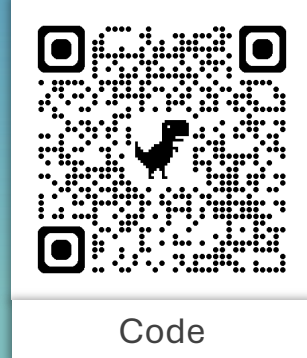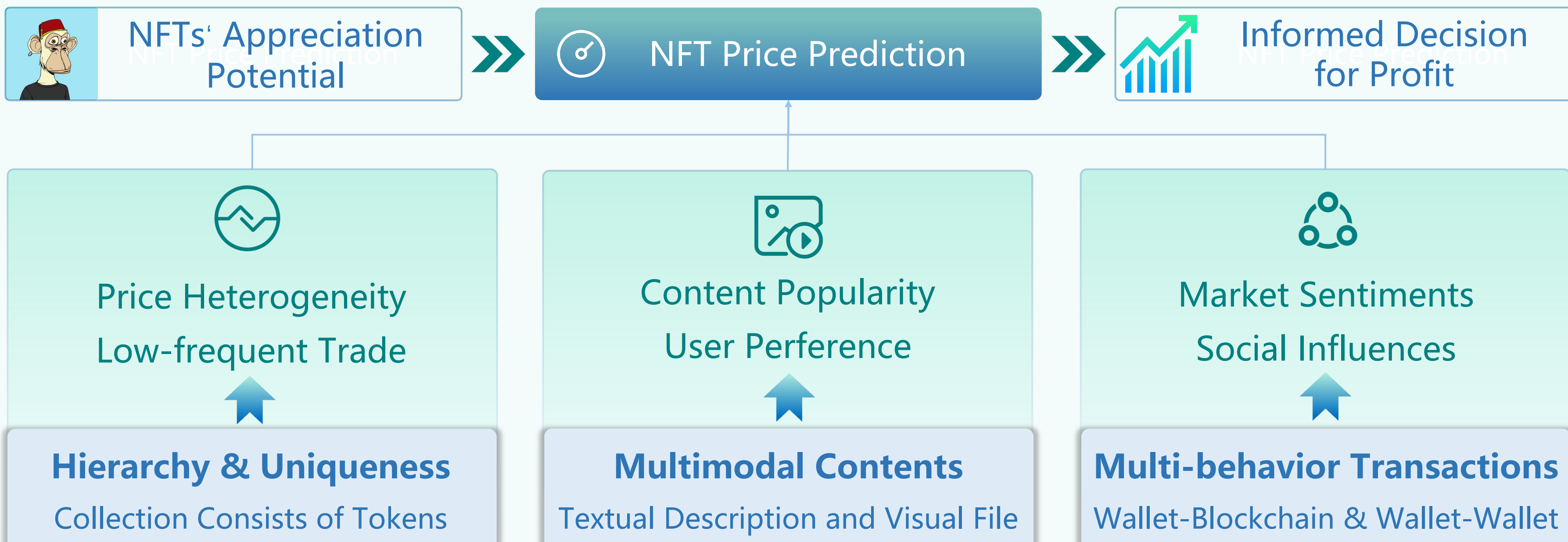
USTC · Microsoft · HKUST-GZ

KDD2024

Paper · Code

NFT Price Prediction

NFTs are unique digital assets that certify ownership and authenticity via blockchain
NFTs present significant financial opportunities, attracting many investors
Accurate price prediction is essential for informed investment decisions and max returns.

NFTs' Appreciation Potential ⟫ NFT Price Prediction ⟫ Informed Decision for Profit

Price Heterogeneity
Low-frequent Trade
→ **Hierarchy & Uniqueness** — Collection Consists of Tokens

Content Popularity
User Perference
→ **Multimodal Contents** — Textual Description and Visual File

Market Sentiments
Social Influences
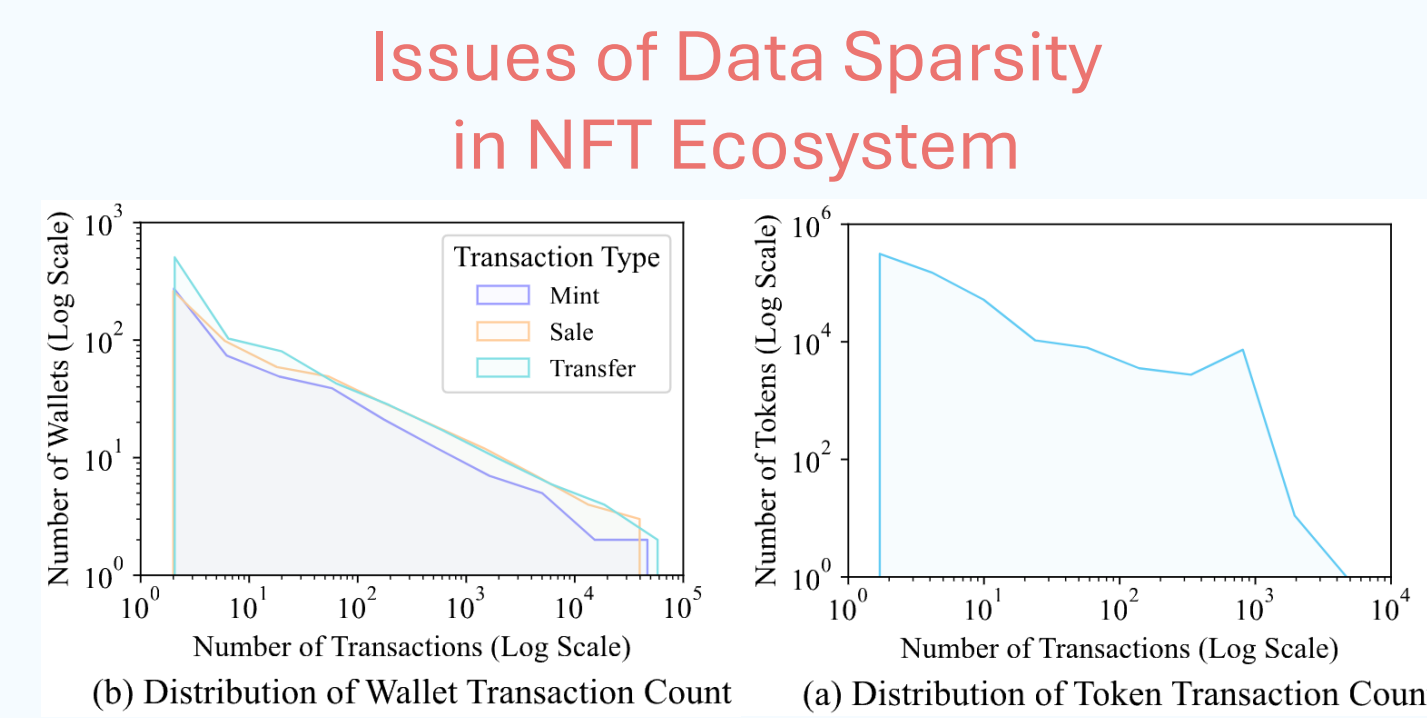→ **Multi-behavior Transactions** — Wallet-Blockchain & Wallet-Wallet

Motivations

▶ Ambiguous problem definitions and evaluation method in existing works

▶ Mining social impact from publicly accessible user behaviors (Transactions)

▶ Identify potential price trend correlations among NFTs and between NFTs and wallets

Contributions

Addressing the Gaps — Definitions and Evaluation

Mining Social Impact — Wallet Profiling with Graph

COMET Model — Temporal & Community-driven

Practical Deployment — Infra. & Product Application

NFT Price Prediction System

- **Hierarchical Problem Definition**: Considers collection and token levels analyses to address the universal requirements of investors.
- **NFT Data Engineering**: Collects NFT-related data and perform pre-processing to obtain insightful data.
- **Wallet Profiling Framework**: Creates a comprehensive profile of a digital wallet with the NFT ecosystem.
- **COMET Model**: Proposes a **CO**mmunity enhanced **M**ulti-b**E**havior **T**ransaction graph model and hierarchical prediction.
  - **Temporal Transaction Graph Network** to capture social impact and market dynamic
  - **Community-aware Information Fusion Module** to alleviating data sparsity issues

Issues of Data Sparsity in NFT Ecosystem

(b) Distribution of Wallet Transaction Count
(a) Distribution of Token Transaction Count

Investment Experience — asset & profitability of wallet

Content Preference — popularity of NFT

Social Connections — latent similarity among wallets

Behavior Patterns — dynamic trading strategies

Wallet Profiling — Mining social influence behind transactions

Dataset & Evaluation & Deployment

Dataset Collection

January 2021 - June 2023
Top-100 Collections

Count (Million)

Transaction Types
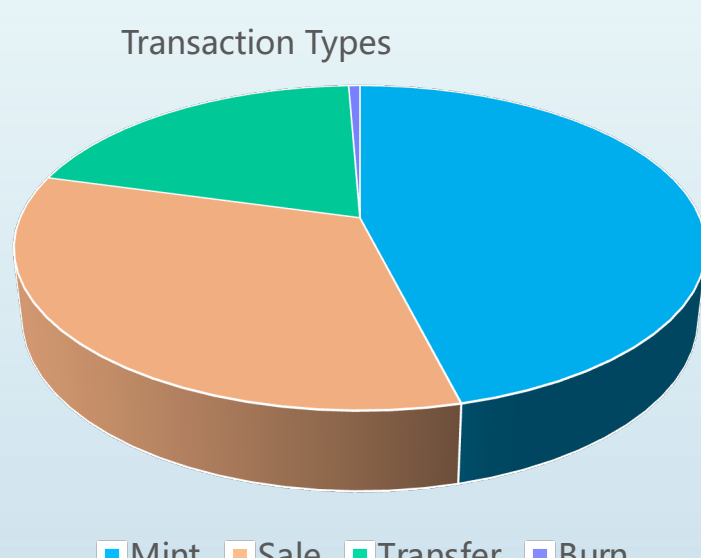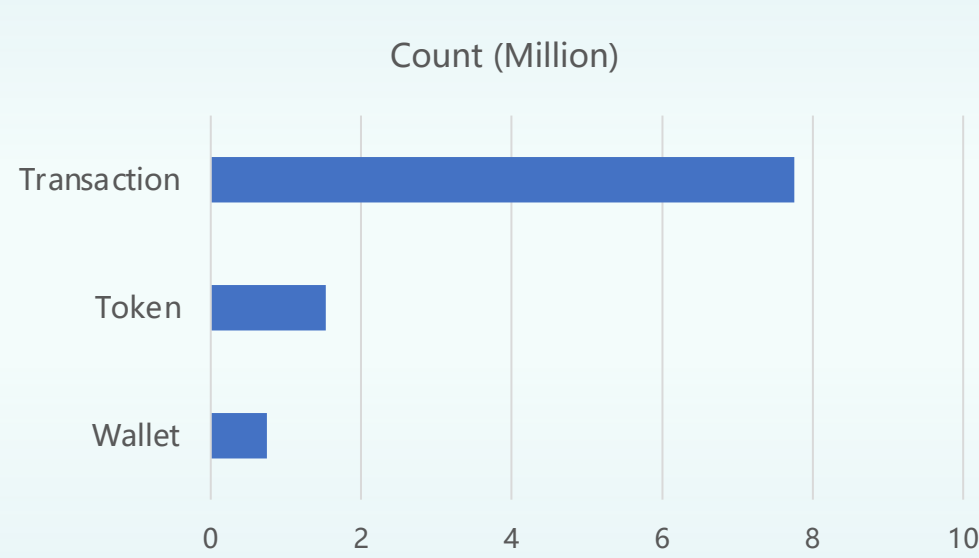
A.1 Collection-level Task Results

Algorithm	1-step		3-step		5-step	
	ACC ↑	MCC ↑	ACC ↑	MCC ↑	ACC ↑	MCC ↑
RF	0.5627	-0.0017	0.5476	-0.003	0.5675	0.0371
SVM	0.5678	0.0537	0.5668	0.0197	0.5884	0.0419
XGBoost	0.5640	0.0665	0.5616	0.099	0.5755	0.1119
MLP	0.5513	0.0620	0.5792	0.1365	0.5808	0.1123
LSTM	0.5776	0.1372	0.5840	0.1348	0.5843	0.1237
TCN	0.5781	0.1387	0.5890	0.1386	0.5978	0.1698
ALSTM	0.5893	0.1537	0.5977	0.1681	0.5946	0.1329
D-Linear	0.5663	0.0451	0.5695	0.0427	0.5910	0.0680
N-BEATS	0.5835	0.1112	0.5902	0.1425	0.6029	0.0262
Informer	0.5505	-0.0173	0.5894	0.1266	0.5841	0.0262
Autoformer	0.5668	0.1063	0.5645	0.1422	0.6079	0.1479
COMET	0.6075	0.1861	0.6158	0.2092	0.6214	0.2128

A.2 Token-level Task Results

Algorithm	1-step		3-step		5-step	
	MAE ↓	MSE ↓	MAE ↓	MSE ↓	MAE ↓	MSE ↓
RF	0.4723	2.1812	0.4757	2.2164	0.4743	2.1892
SVR	0.4901	2.2098	0.4849	2.1602	0.4921	2.2178
XGBoost	0.4815	2.1524	0.4950	2.2175	0.4835	2.1604
MLP	0.4181	1.9728	0.4305	2.0321	0.4201	1.9808
LSTM	0.3689	1.775	0.3638	1.7831	0.3679	1.7836
TCN	0.3859	1.9224	0.4003	1.9808	0.3796	1.8904
ALSTM	0.3631	1.7523	0.3714	1.8054	0.3601	1.7209
COMET	0.3442	1.5825	0.3379	1.619	0.3395	1.5643
w/o CE	0.3529	1.6163	0.3424	1.6370	0.3479	1.6005
w/o TF	0.3576	1.6394	0.3561	1.6793	0.3606	1.6674

B.1 Edge Ablation

w/o HE · w/o TE · w/o RE · COMET

(a) ACC · (b) MCC
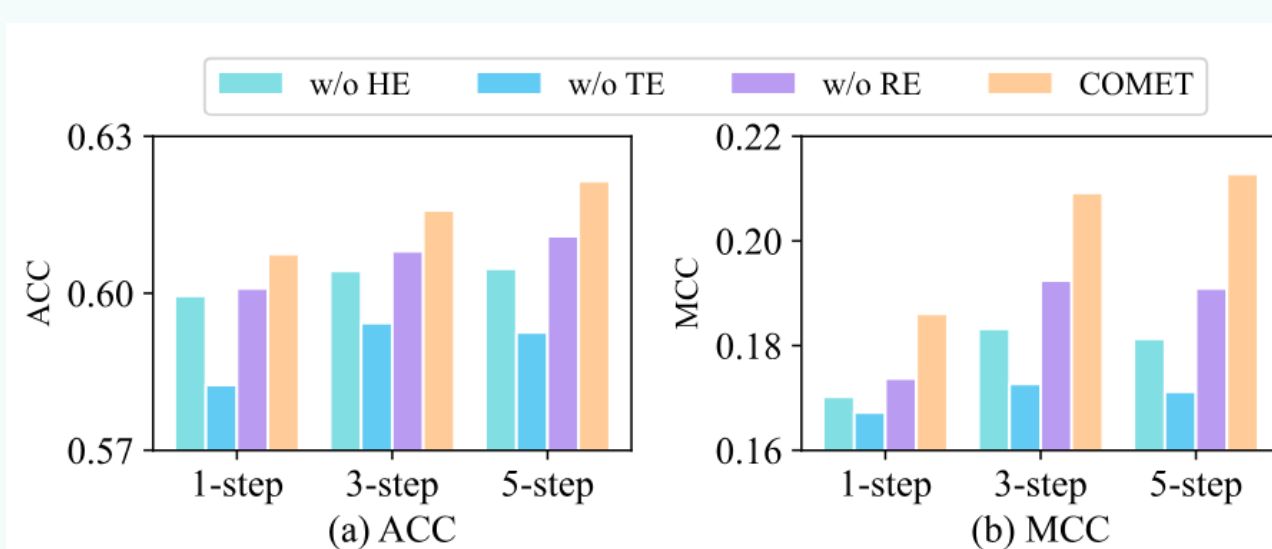
Figure 4: Results of edge ablation.

B.2 Edge Ablation

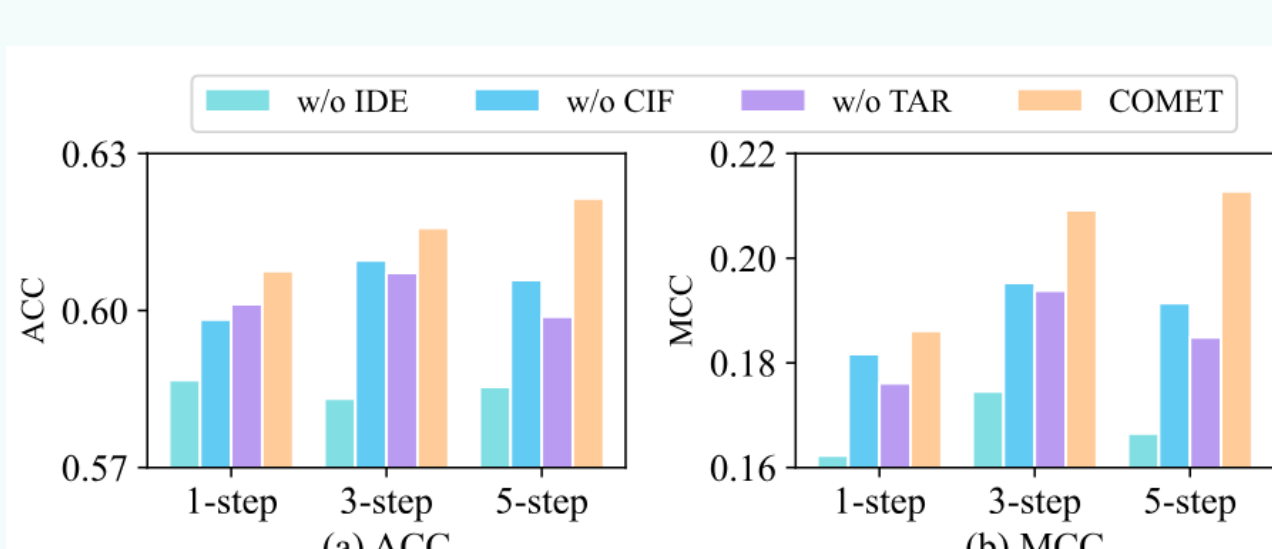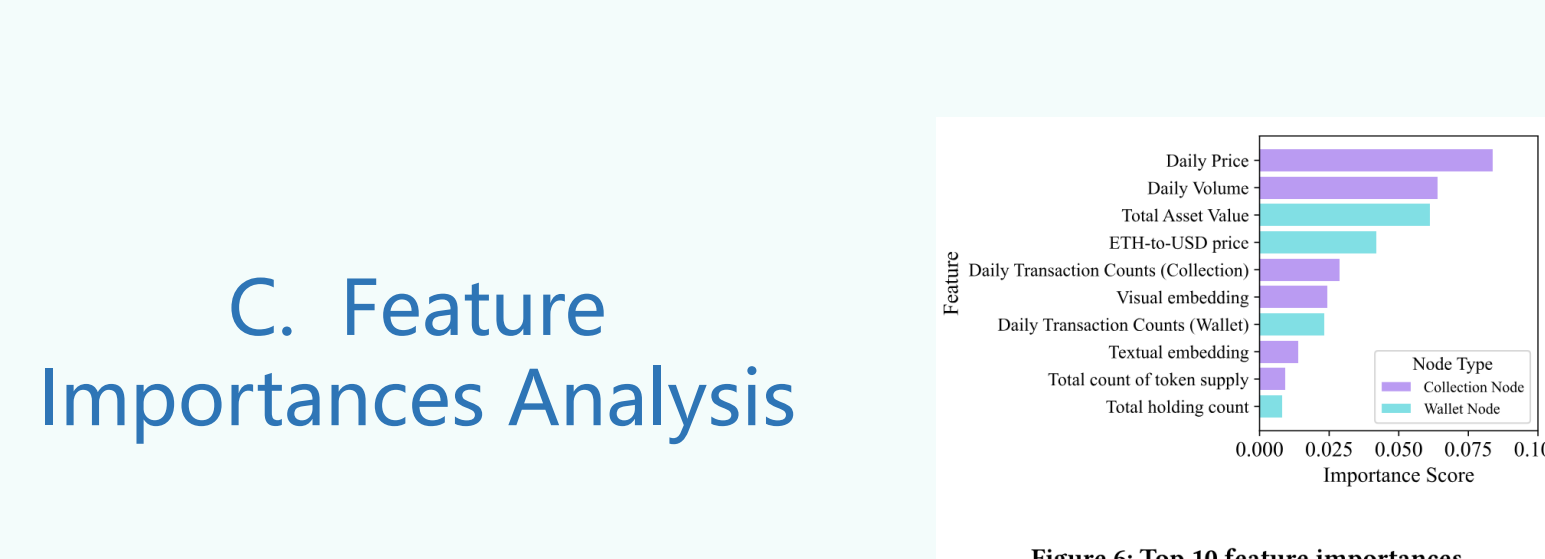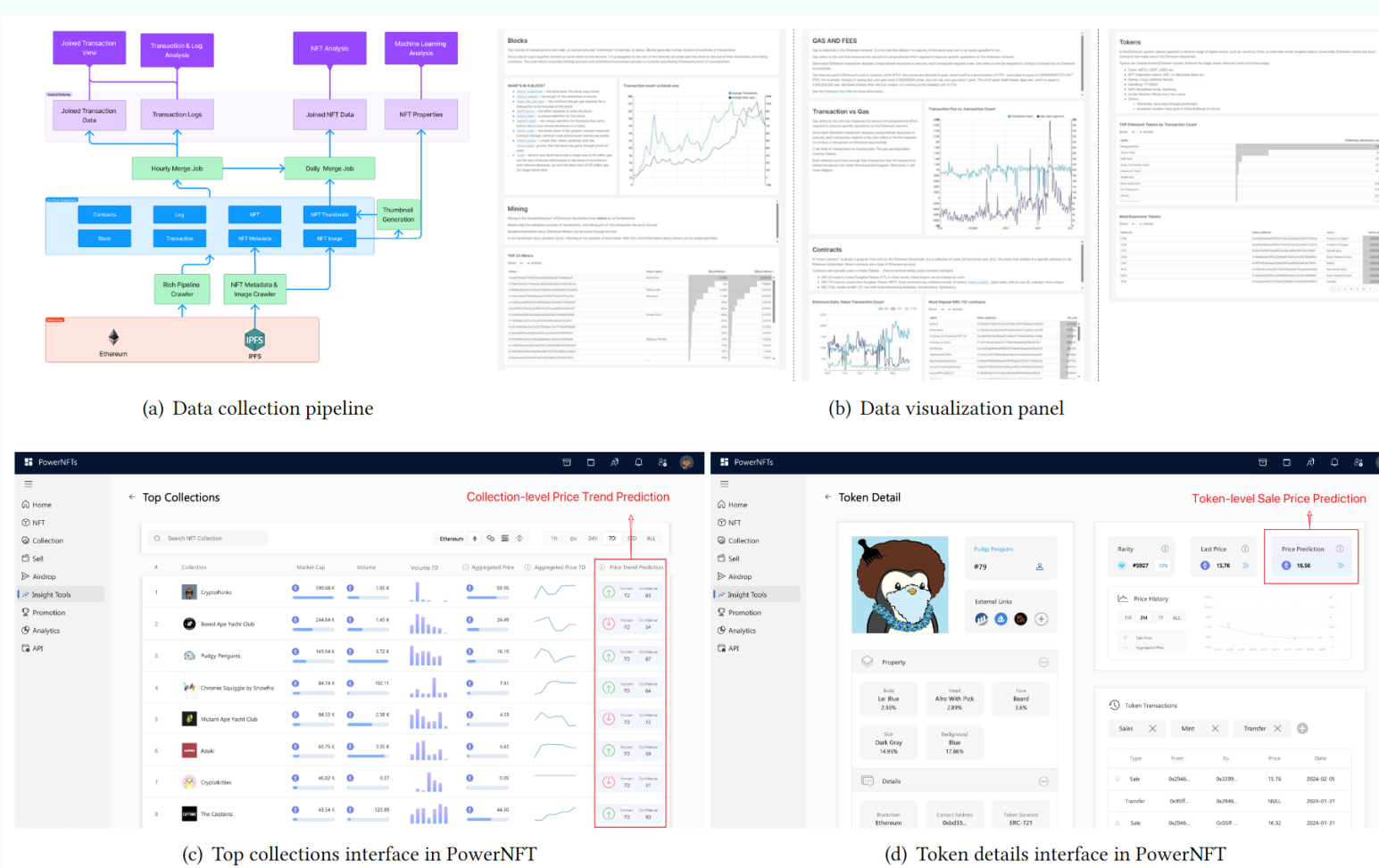
w/o IDE · w/o CIF · w/o TAR · COMET

(a) ACC · (b) MCC

Figure 5: Results of module ablation.

Practical Deployment

The establishment of data infrastructure
The integration of practical products

(a) Data collection pipeline
(b) Data visualization panel
(c) Top collections interface in PowerNFT
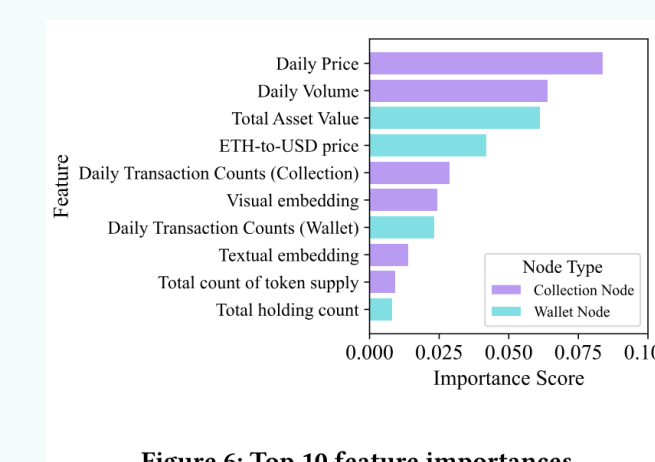(d) Token details interface in PowerNFT

C. Feature Importances Analysis

Figure 6: Top 10 feature importances.