Research Statement

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Background

The digital economy is increasingly shaped by large-scale collaboration among data owners, model developers, compute providers, and application builders. However, existing centralized platforms struggle with trust, fair value distribution, and sustainability. My research addresses these challenges by advancing the theory and systems of collaborative intelligence in open, decentralized, yet highly coordinated environments. I aim to establish data, models, and compute resources as first-class digital assets that can be governed, priced, audited, and incentivized through tokenization, thereby enabling a sustainable and trustworthy digital economy.

My work sits at the intersection of decentralized AI, privacy-preserving computation, blockchain systems, and data economics. It combines rigorous algorithmic foundations with system-level design and real-world deployment considerations, addressing both technical and economic dimensions of collaborative intelligence.

Research Areas

1. Core Research Challenges

Trust and incentivization are the two fundamental barriers preventing large-scale collaboration in decentralized intelligence ecosystems.

Trust requires verifiable guarantees on data quality, model behavior, computation correctness, and participant accountability—without exposing sensitive information. Incentivization requires mechanisms that reward contribution fairly and sustainably, aligning individual rationality with system-level welfare.

2. Research Pillar
2.1 Pillar I: Collaborative Intelligence

This research pillar focuses on enabling large-scale collaborative intelligence through privacy-aware, decentralized, and economically grounded mechanisms.

- o Privacy-Enhancing Computation

Privacy-preserving computation is a foundational enabler for collaboration across organizational andjurisdictional boundaries. My work leverages federated learning, secure aggregation, and resource decoupling to enable collaborative model training without centralized data pooling.

o Consensus Protocols for the Data Intelligence Economy

I introduced Proof-of-Data, a consensus protocol that integrates data contribution and provenance directly into decentralized intelligence systems. This protocol aligns trust guarantees with economic incentives, enabling decentralized validation of data-driven value creation.

o Decentralized AI with Resource Decoupling

Traditional federated learning assumes tightly coupled data and compute resources. My research proposes resource-decoupled federated learning architectures, allowing compute providers to act as independent economic agents while preserving learning performance.

o Data Assetization, Pricing, and Auditing

I study how data can be treated as an economic asset through pricing models, contribution measurement, and auditing. My work on data pricing in machine learning pipelines establishes principled methods for valuing data contributions, while ongoing research explores model and data auditing for accountability.

2.2 Pillar II: Tokenized Economy

This pillar explores tokenized economic mechanisms as incentive layers for collaborative intelligence systems. I investigate how tokenomics design, DeFi primitives, and emerging Web3 paradigms can align incentives across decentralized ecosystems. Key directions include token-based reward allocation, real-world asset tokenization, X-to-Earn mechanisms for data and compute contribution, decentralized infrastructure networks (DePIN), decentralized science (DeSci), and prediction markets for collective intelligence.

2.3 Pillar III: Secure Asset Management

As digital assets become increasingly tokenized, secure asset management is essential. My research addresses on-chain analytics, AI-enabled regulatory technology, wallet and cross-chain security, and future-proof cryptographic protocols. My work on detecting malicious cryptocurrency behavior demonstrates how graph analytics and AI can support trust and compliance in decentralized systems.

6. Future Directions and Impact

Looking forward, my research aims to unify collaborative intelligence, tokenized economies, and secure asset management into a coherent framework for sustainable digital economies. This work has direct implications for AI governance, data markets, decentralized finance, and public-sector digital infrastructure.

Selected Publications and Outputs

Huiwen Liu, Feida Zhu, Ling Cheng. Proof-of-Data: A Consensus Protocol for Collaborative Intelligence. CoRR abs/2501.02971, 2025.

Jianzhe Zhao et al., Feida Zhu. Data Assetization via Resources-decoupled Federated Learning. CoRR abs/2501.14588, 2025.

Zicun Cong, Xuan Luo, Jian Pei, Feida Zhu, Yong Zhang. Data Pricing in Machine Learning Pipelines. Knowledge and Information Systems, 2022.

Ling Cheng, Feida Zhu, Yong Wang et al. Evolve Path Tracer: Early Detection of Malicious Addresses in Cryptocurrency. KDD 2023.

Zezhi Shao et al., Feida Zhu. Heterogeneous Graph Neural Network with Multi-View Representation Learning. IEEE TKDE, 2023.

Bin Yang, Feida Zhu, Wei Wei. Editorial: DSAA 2023 Journal Track. International Journal of Data Science and Analytics, 2024.