Pioneering Intent-Driven Intelligence

Research Achievements of Professor Jingyu Wang's Team

IE-Team（万物有灵IE战队）

State Key Laboratory of Networking and Switching Technology,
Beijing University of Posts and Telecommunications (BUPT)

Our Vision: From the Internet of Things to Intent-Driven Intelligence

Professor Jingyu Wang

National High-Level Talent

CIC Fellow (China Institute of Communications)

Head of NIRC, State Key Laboratory of Networking and Switching Technology, BUPT

Our mission is to advance the frontier from the Internet of Things to **Intent-Driven Intelligence** (从万物互联到意图智联), building autonomous systems that understand, act, and adapt.

Our Research Pillars

1. Intent-Driven Intelligent Networks
2. MLSys & Foundation Models
3. Multimodal Learning & System Understanding
4. HCI & Intelligent Augmentation
5. LLM Security & Alignment

1. Intent-Driven Intelligent Networks

Academic Excellence: Automating Network Intent

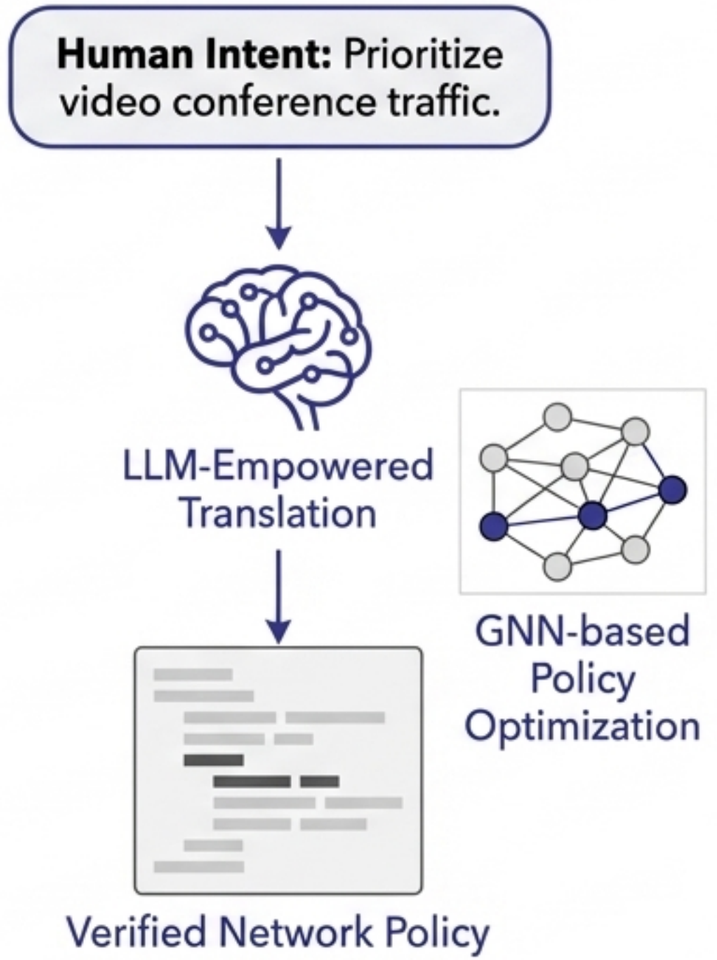
Core Challenge

Translating high-level human intent into low-level, error-free network configurations is a major bottleneck in network operations.

Our Innovations

We are pioneering methods to automate this translation process, ensuring accuracy and scalability.

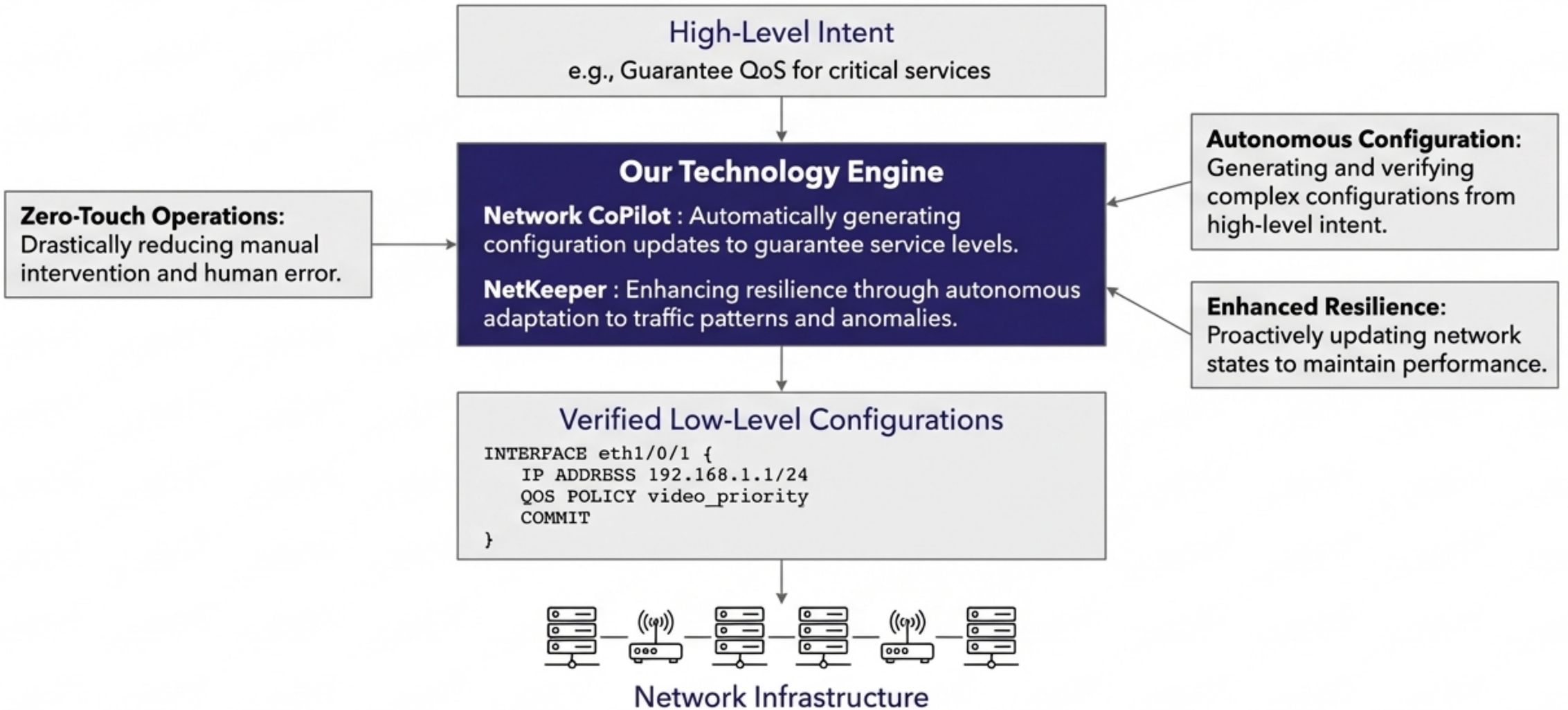
- **LLM-Empowered Translation:** Utilizing Large Language Models with manual guidance and hierarchical index retrieval to interpret complex network intents (“Following the Compass”).
- **GNN-based Policy Solving**: Employing Graph Neural Networks to rapidly solve complex Access Control List (ACL) policies under intricate constraints, ensuring both speed and scalability.



Key Publications: *IEEE/ACM Transactions on Networking (ToN)* [CCF A] • *IEEE International Conference on Network Protocols (ICNP)* [TH-CPL A] • *IEEE Conference on Computer Communications (INFOCOM)* [CCF A] • *ACM MobiCom* [CCF A]

1. Intent-Driven Intelligent Networks

Industrial Contribution: Building Self-Driving Networks



Industry Collaborations: China Unicom, China Mobile.

2. MLSys & Foundation Models

Academic Excellence: Optimizing the AI Engine

Core Challenge

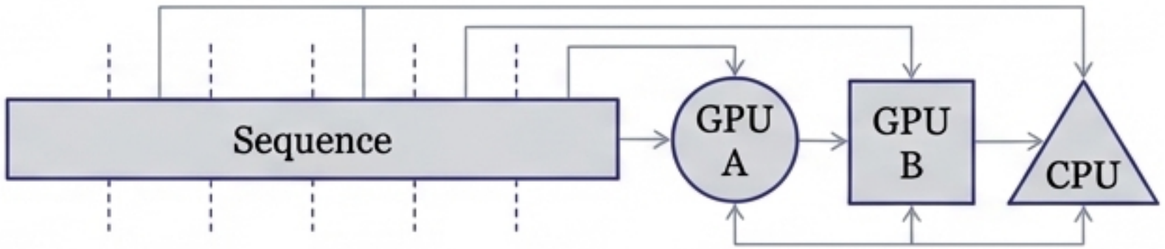
The training and inference of large foundation models are prohibitively expensive in terms of computation, energy, and storage.

Our Innovations

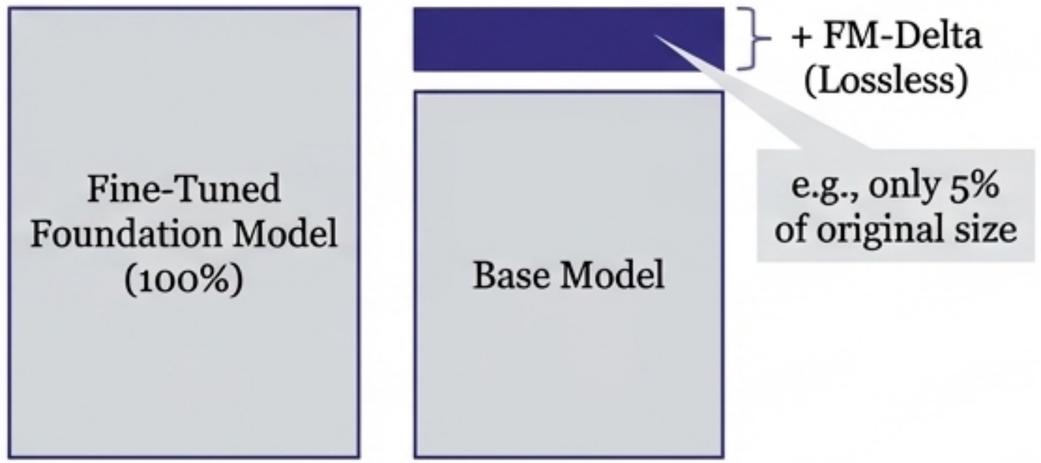
We design novel systems and algorithms to make large-scale AI more efficient and accessible.

- **PipeLLM**: A pipeline inference framework for large language models that uses sequence slicing to efficiently run on heterogeneous devices.
- **FM-Delta**: A lossless compression technique for storing massive fine-tuned foundation models, drastically reducing storage overhead without compromising performance.

PipeLLM: Sequence Slicing for Heterogeneous Pipelines



FM-Delta: Lossless Compression



Key Publications: *NeurIPS* [CCF A] • *SIGCOMM* [CCF A] • *ICDE* [CCF A] • *CVPR* [CCF A]

Industrial Contribution: Accelerating Large-Scale AI

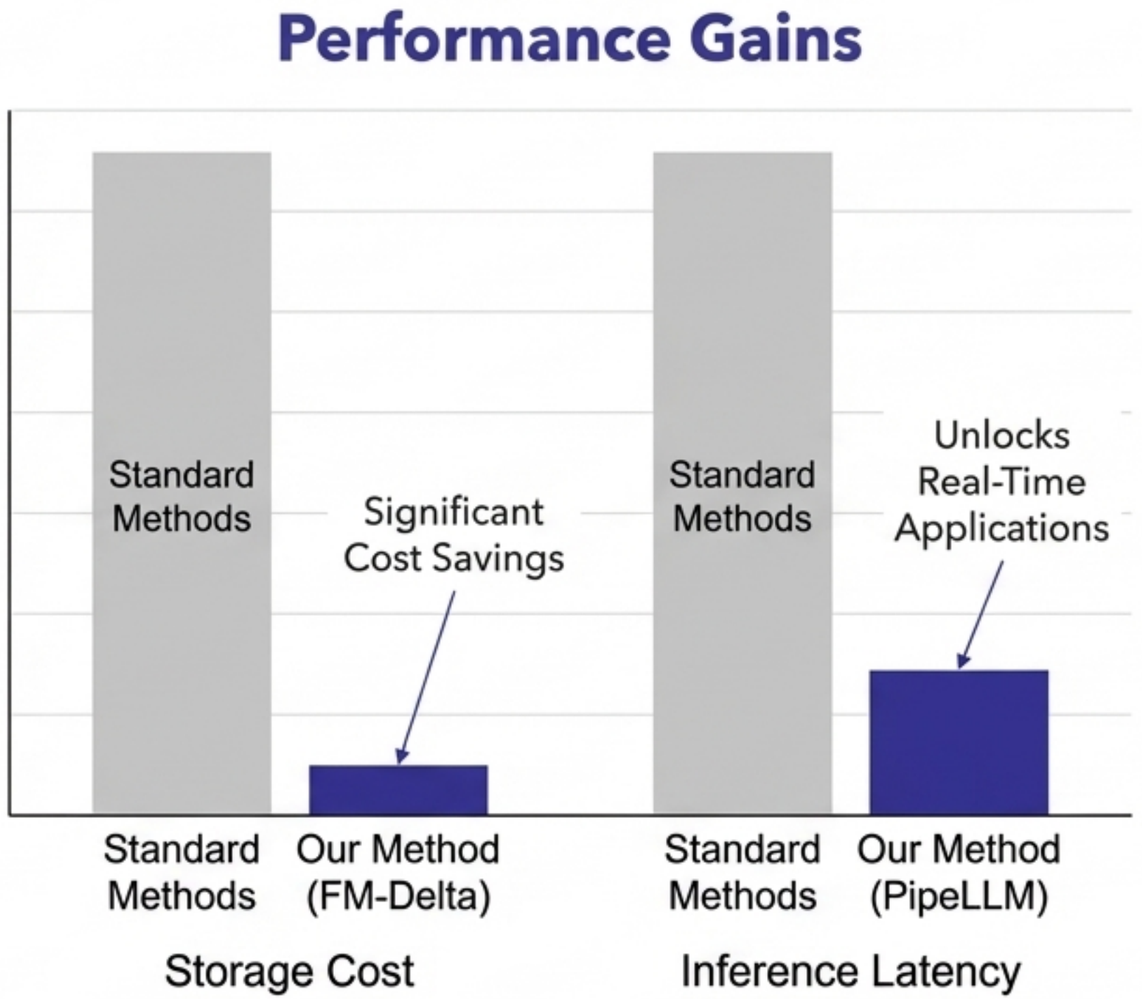
Business Impact

Enabling faster, cheaper, and broader deployment of cutting-edge AI models.

- **Accelerated Inference:** Efficient inter-operator scheduling for concurrent recommendation model inference on GPUs, boosting throughput for critical business applications.
- **Democratized Access:** PICO and DeepZoning frameworks accelerate CNN inference on diverse mobile and heterogeneous edge clusters, bringing powerful AI to more devices.

Quantifiable Gains

Our methods deliver significant performance improvements.



3. Multimodal Learning & System Understanding

Academic Excellence: Fusing Data for Deeper Insights

Core Challenge

Decision-making often requires integrating diverse data types (e.g., numerical time series and textual reports), which traditional models handle poorly.

Our Innovation: ChatTime

We developed **ChatTime**, a unified multimodal time series foundation model that bridges numerical and textual data.

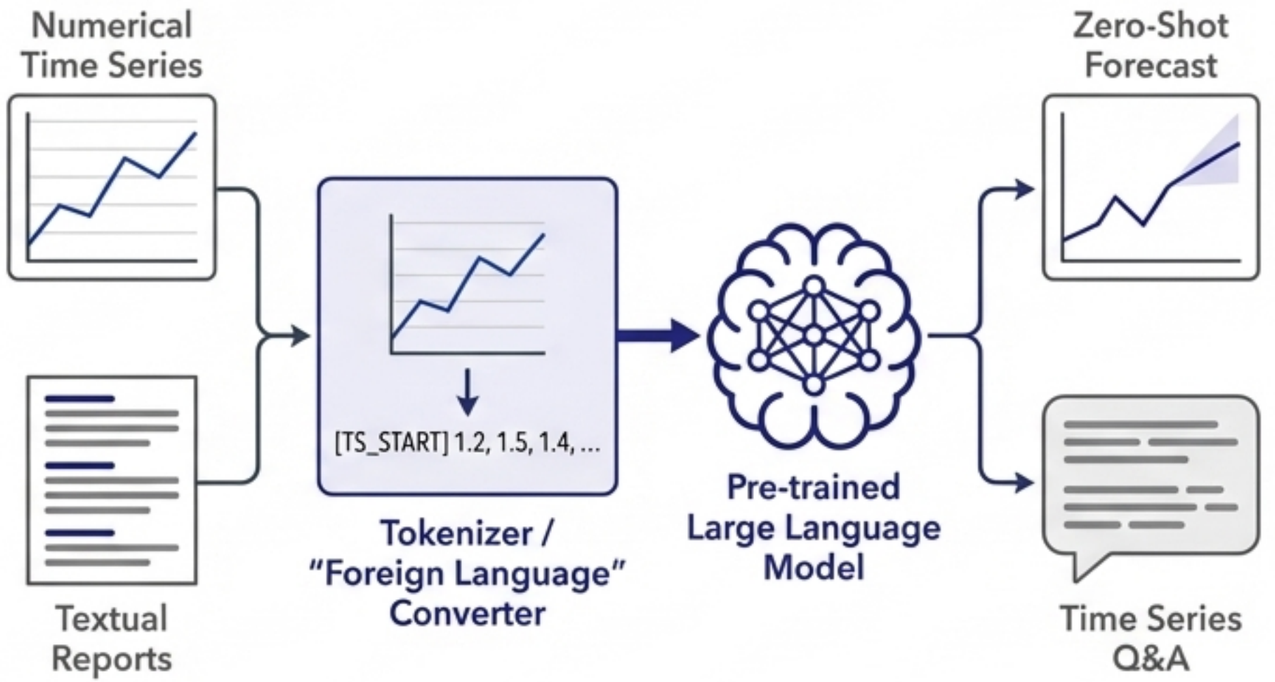
Core Concept

We innovatively conceptualize time series as a "foreign language," allowing a pre-trained LLM to process both numerical series and text within a single framework.

Capabilities

Achieves zero-shot forecasting and supports bimodal input/output , enabling tasks like context-guided forecasting and time series question answering.

ChatTime: Unified Multimodal Processing



Key Publications: *AAAI* [CCF A] • *CVPR* [CCF A] • *IJCAI* [CCF A] • *ACL* [CCF A]

3. Multimodal Learning & System Understanding

Industrial Contribution: From Smarter Forecasts to Safer Cities

Applied Solutions

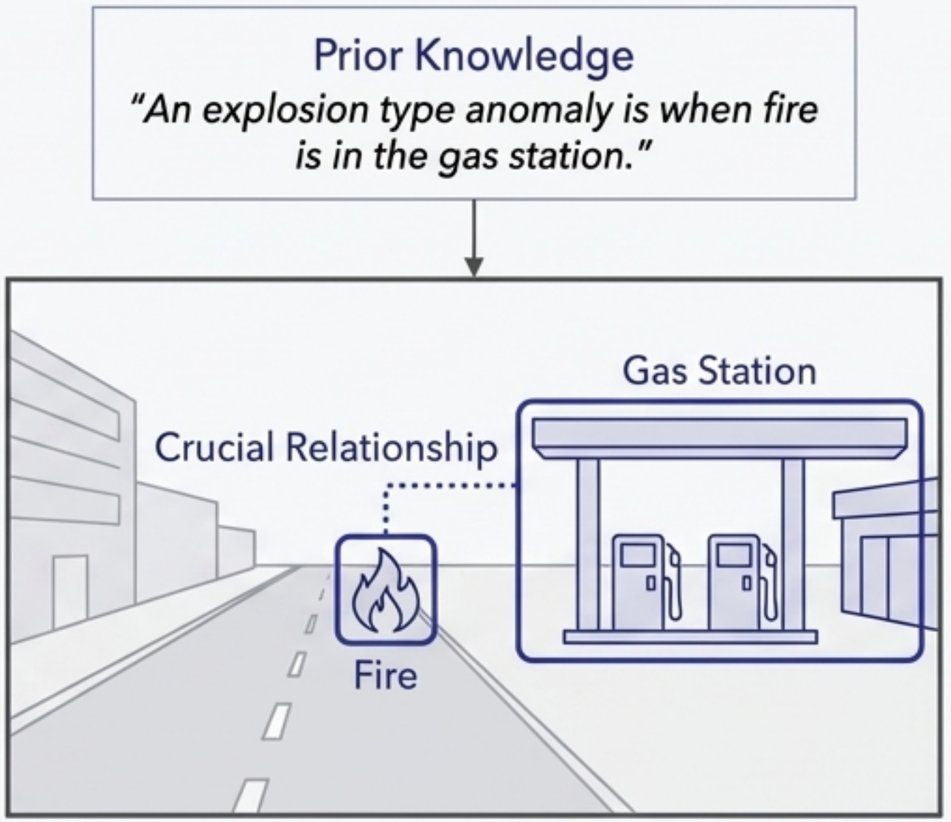
Our multimodal models provide critical intelligence for real-world systems.

- **Enhanced Forecasting**: ChatTime integrates textual information (e.g., policy reports, weather data) with numerical series for more accurate financial and climate predictions.
- **Smarter Surveillance**: Our **Cognition Guided Video Anomaly Detection (CG-VAD)** framework uses prior knowledge to focus on crucial relationships (e.g., fire near a gas station) for proactive threat detection in urban environments.

Key Contributions

- Created four new public multimodal datasets for time series analysis to spur further research.
- CG-VAD achieves state-of-the-art performance on 6 benchmark datasets, proving its robustness for real-world surveillance.

CG-VAD: Cognition-Guided Anomaly Detection



Anomaly Detected: Explosion Risk

4. HCI & Intelligent Augmentation

Academic Excellence: Redefining Human-Machine Interaction

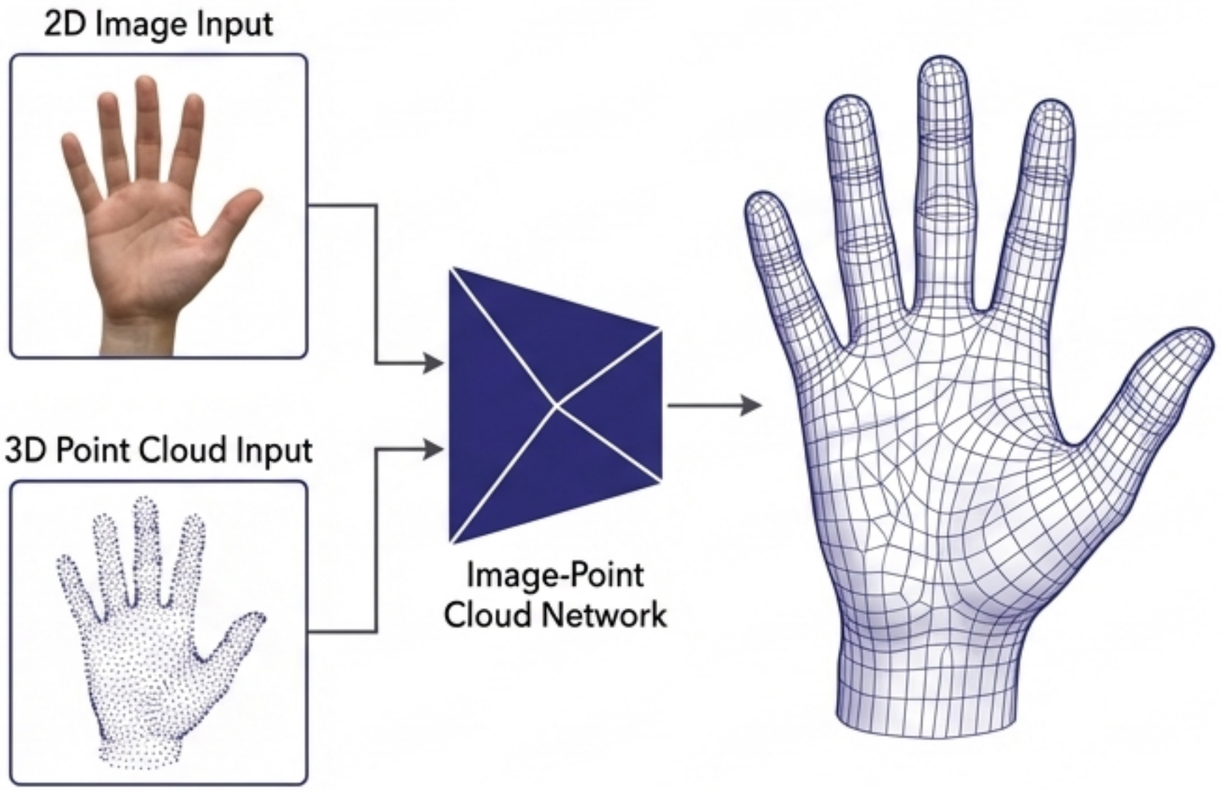
Core Challenge

Creating natural, robust, and intuitive interfaces requires accurately interpreting complex human inputs like hand gestures in 3D space.

Our Innovations

We have developed state-of-the-art models for 3D hand pose and mesh estimation.

- **Novel Architectures:** An "Image-Point Cloud Network" that effectively fuses 2D and 3D information.
- **Advanced Learning:** Pioneering self-supervised frameworks that learn from multi-view information without requiring labeled data.



AAAI 2023 Distinguished Paper Award

For our paper: "Two Heads are Better than One: Image-Point Cloud Network"

Key Publications:
AAAI [CCF A] • *CVPR* [CCF A] • *WWW* [CCF A] • *NeurIPS* [CCF A]

4. HCI & Intelligent Augmentation

Industrial Contribution: Enabling Next-Generation Interfaces

3D Pose Estimation Technology

Augmented & Virtual Reality

Enabling intuitive, bare-hand interaction in immersive environments.

Robotics

Allowing for more natural control and programming of robotic manipulators.

Touchless Control Systems

Creating hygienic and accessible interfaces for public and private spaces.

Industrial Advantage

Category-Agnostic

Our models can estimate poses for objects beyond hands, demonstrating high versatility.

Noise-Robust

We develop models that maintain high accuracy even with imperfect or noisy input data, a critical requirement for real-world deployment.

5. LLM Security & Alignment

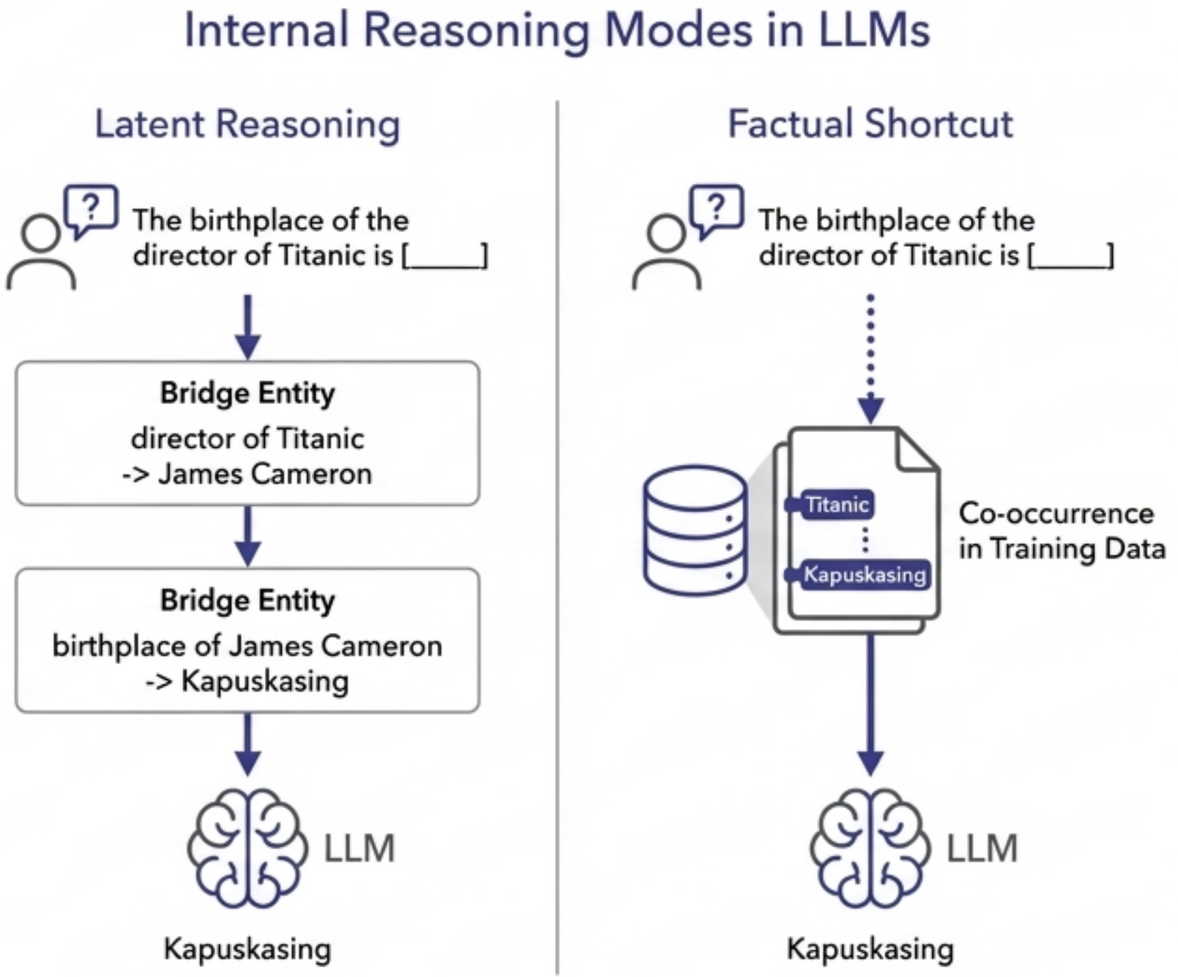
Academic Excellence: Building Trustworthy AI

Core Challenge

The widespread adoption of Large Language Models (LLMs) is hampered by significant security, safety, and transparency risks.

A Two-Pronged Approach

- **Analyzing External Threats**: Systematically studying the threat of 'PROMPTS', including jailbreaking and prompt leakage attacks, to understand attacker methodologies and build robust defenses.
- **Understanding Internal Flaws**: We investigate the internal reasoning modes of LLMs, distinguishing between genuine **Latent Reasoning** and unreliable **Factual Shortcuts** to diagnose model failures.



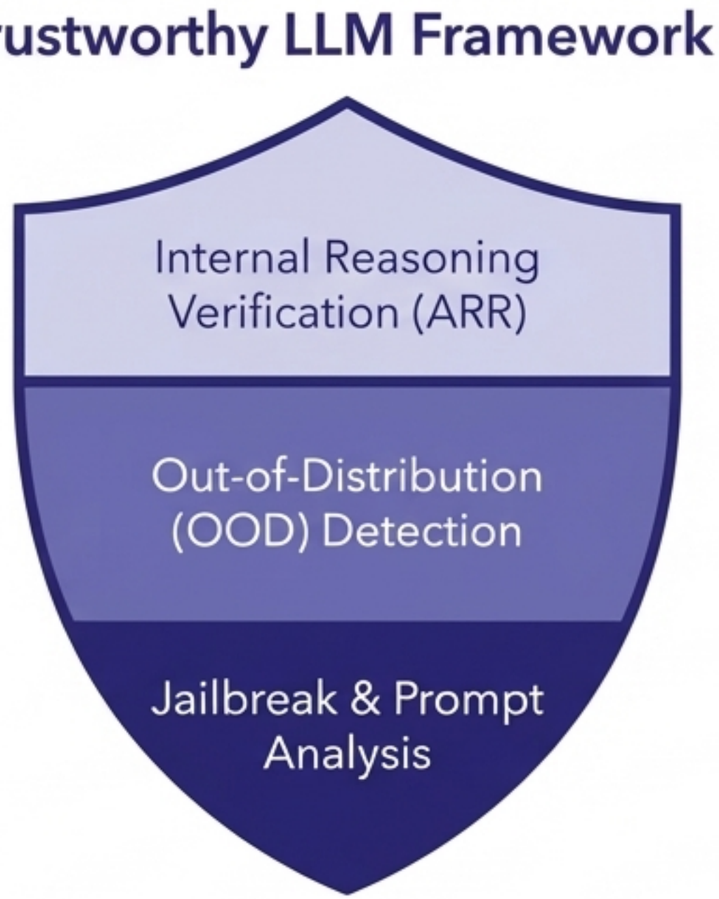
5. LLM Security & Alignment

Industrial Contribution: A Framework for Secure & Reliable LLMs

Impact on the AI Ecosystem

Our work provides essential tools and insights for developers and users of LLMs.

- **Robust Defenses**: Our analysis of prompt injection and jailbreaking informs the development of stronger security guardrails.
- **Novel Evaluation Metrics**: We introduced the **Attribute Rate Ratio (ARR)**, a simple and efficient metric to classify a model's internal reasoning mode, achieving ~90% accuracy and helping to identify untrustworthy 'shortcut' behaviors.
- **Improved OOD Detection**: We demonstrated that while diffusion models can reduce robustness, this sensitivity can be leveraged to create state-of-the-art Out-of-Distribution (OOD) detectors, improving detection accuracy by up to 18%.



A Legacy of Excellence: Key Honors & Awards

A selection of prestigious recognitions validating our research impact.

National Level Honors

National Science and Technology Progress Award, Second Prize (2023)

National High-Level Talent Plan (2024)

Ministry of Education Science and Technology Progress Award

Top Academic Awards

AAAI Distinguished Paper Award (2023)

IEEE System Journal Best Paper Award (2021)

Multiple awards from the China Institute of Communications (CIC)

Society & Industry Recognition

CIC Fellow (China Institute of Communications)

Global Top 2% Scientist

Honorary Expert, China Mobile

The Future: Integrated Intent-Driven Systems

Our work across networks, MLSys, multimodality, HCI, and security converges towards a single goal: creating truly autonomous, intelligent systems that can understand, anticipate, and act on human intent.

HCI & Augmentation creates a natural interface for interaction.

Intelligent Networks form the nervous system.

Multimodal Learning gives the system its senses.

MLSys & Foundation Models provide the powerful brain.

Security & Alignment ensures the system is trustworthy and safe.

Looking Ahead: We are continuing to push the boundaries, building the next generation of systems that are not just automated, but truly intelligent and intent-aware.

Thank You

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