Yinxu Tang

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Professional Summary

- **PhD Candidate in Computer Science**
  at Yeoh's Optimization and Decision Analytics (YODA) Lab, Washington University in St. Louis, USA
- **Research Interests**: *Human-AI Interaction/ LLM Reasoning / Bandits & Reinforcement Learning*

Education

Washington University in St. Louis   **Saint Louis, Missouri, USA**
PhD in Computer Science | GPA: 3.84   *Sep. 2023 – May 2027 (Expected)*

ShanghaiTech University (Co-Founded by the Chinese Academy of Sciences)   **Shanghai, China**
Master's in Information & Communication Engineering | Major GPA: 3.7 | Overall GPA: 3.66   *Sep. 2020 – Jun. 2023*

ShanghaiTech University   **Shanghai, China**
Bachelor's in Computer Science & Technology | Major GPA: 3.5 | Overall GPA: 3.43   *Sep. 2016 – Jun. 2020*

Research Experience

Human-AI Interaction | *Research Leader*   **Sep. 2023 – Present**

- ***Dynamic and Personalized Probabilistic Human Modeling***
  - Proposed **Persona**, a dynamic user modeling framework that shifts from static profiles to real-time adaptation via *Argumentation-based Dialogues*.
  - Integrated *Prospect Theory* (specifically probability weighting) with *Bayesian Inference* to mathematically capture evolving user beliefs and cognitive biases during interactions.
  - Demonstrated through human-subject evaluations that the framework significantly outperforms state-of-the-art methods in personalization and intent alignment.
  - **Publication: Yinxu Tang**, Stylianos Loukas Vasileiou & William Yeoh. *"Does Your AI Agent Get You? A Personalizable Framework for Approximating Human Models from Argumentation-based Dialogue Traces."* AAAI Conference on Artificial Intelligence, 2025 (Oral).

- ***Probabilistic Model Reconciliation Framework***
  - Pioneered the first model reconciliation framework grounded in *Probabilistic Logic Programming (PLP)* to address uncertainty in human knowledge, moving beyond traditional deterministic approaches[cite: 30, 36].
  - Formulated explanations as *Cost-Optimal Model Updates* that reconcile inconsistencies in *Maximum Posteriori Estimation (MPE)* outcomes between AI and human models.
  - Engineered optimized search algorithms (including *Greedy* and *Weighted* variants) guided by theoretical structural insights, achieving significant scalability and efficiency over generic baselines.
  - Validated the framework's effectiveness through human-subject studies on explanation preferences and computational experiments demonstrating superior performance.
  - **Publication: Yinxu Tang**, Stylianos Loukas Vasileiou & William Yeoh. *" Model Reconciliation via Cost-Optimal Explanations in Probabilistic Logic Programming"* Neural Information Processing Systems (NeurIPS), 2025 (poster).

LLM Reasoning | *Research Leader*   **Aug. 2025 – Present**

- ***LLM Reasoning for Knowledge Graph Question Answering (UniRel-R1)***
  - Formalized the novel task of *Relation-Centric KGQA*, shifting the paradigm from single-entity prediction to generating explanatory subgraphs that capture semantic associations.
  - Developed **UniRel-R1**, a unified framework integrating multi-stage graph pruning with an *RL-tuned LLM* to navigate vast search spaces and identify unique reasoning paths.
  - Engineered a custom reward function that incentivizes *compactness, specificity, and informativeness*.
  - Achieved significant gains in connectivity and answer quality over baselines, demonstrating strong generalization capabilities to unseen entities and relations.
  - **Relevant Paper: Yinxu Tang**, Chengsong Huang, Jiaxin Huang & William Yeoh *"UniRel-R1: RL-tuned LLM Reasoning for Knowledge Graph Relational Question Answering."* (Under Review)

Bandits & Reinforcement Learning   **Feb. 2019 – Jun. 2023**

- ***Constrained Bandits*** | *Research Leader and Active Contributor*
  - Formulated a *Stochastic Optimization* framework for Multi-Armed Bandits (MAB) with non-linear objective functions and long-term constraints.

- Derived theoretical _Sub-linear Regret Bounds_ and constraint violation guarantees using _Lyapunov Optimization_ and _Upper Confidence Bound (UCB)_ techniques.
- Implemented and validated predictive models using _BERT, LSTM, and RNNs_ for high-dimensional sequence prediction, analyzing convergence rates in edge intelligence systems.
- **Publications:**
  (a) **Yinxu Tang**, Jianfeng Hou, Xi Huang, Ziyu Shao & Yang Yang. _"Green Edge Intelligence Scheme for Mobile Keyboard Emoji Prediction."_ IEEE Transactions on Mobile Computing (TMC), 2024.
  (b) Xi Huang, **Yinxu Tang**, Ziyu Shao & Yang Yang. _"Joint Switch-Controller Association & Control Devolution for SDN Systems: An Integrated Online Perspective of Control & Learning."_ IEEE Transactions on Network & Management (TNSM), 2021.
  (c) Jianfeng Hou, **Yinxu Tang**, Xi Huang, Ziyu Shao & Yang Yang. _"Green Edge Intelligence Scheme for Mobile Keyboard Emoji Prediction."_ IEEE International Conference on Communications (ICC), 2021.
  (d) Xin Gao, Xi Huang, **Yinxu Tang**, Ziyu Shao & Yang Yang. _"History-Aware Online Cache Placement in Fog-Assisted IoT Systems: An Integration of Learning & Control."_ IEEE Internet of Things Journal (IoT-J), 2021.
  (e) Xi Huang, **Yinxu Tang**, Ziyu Shao & Yang Yang. _"Joint Switch-Controller Association & Control Devolution for SDN Systems: An Integration of Online Control & Online Learning."_ IEEE/ACM International Symposium on Quality of Service (IWQoS), 2020.
  (f) Xin Gao, Xi Huang, **Yinxu Tang**, Ziyu Shao & Yang Yang. _"Proactive Cache Placement with Bandit Learning in Fog-Assisted IoT Systems."_ IEEE International Conference on Communications (ICC), 2020.
  (g) Junge Zhu, Xi Huang, **Yinxu Tang** & Ziyu Shao. _"Learning-Aided Online Task Offloading for UAVs-Aided IoT Systems."_ IEEE Vehicular Technology Conference (VTC), 2019.

- **_Constrained Graphical Bandits_** | _Active Contributor_
  - Applied online learning algorithms that exploit _Graph Feedback Mechanisms_ (side-observations) to accelerate convergence and reduce exploration variance.
  - Conducted rigorous theoretical analysis to characterize the dependency of _Regret Bounds_ on graph topology metrics, specifically the _Independence Number_ and _Degree Centrality_.
  - Performed extensive simulations on diverse graph structures to benchmark algorithm robustness and quantify the trade-off between information flow and learning efficiency.
  - **Publications:**
    (a) Shangshang Wang, Simeng Bian, **Yinxu Tang** & Ziyu Shao. _"Social-Aware Distributed Meta-Learning: A Perspective of Constrained Graphical Bandits."_ IEEE International Conference on Communications (ICC), 2023.
    (b) Simeng Bian, Shangshang Wang, **Yinxu Tang** & Ziyu Shao. _"Social-Aware Edge Intelligence: A Constrained Graphical Bandit Approach."_ IEEE Global Communications Conference (GLOBECOM), 2022.

- **_Privacy-Preserving Constrained Bandits_** | _Research Leader_
  - Incorporated _Local Differential Privacy (ϵ-LDP)_ mechanisms to secure distributed learning, establishing rigorous privacy guarantees via noise injection.
  - Derived theoretical bounds to quantify the _Privacy-Utility Trade-off_, mathematically characterizing how the privacy budget (ϵ) impacts the algorithm's _Regret Convergence_.
  - Validated the theoretical analysis through extensive simulations, demonstrating algorithm robustness under varying noise regimes and privacy constraints.
  - **Publication:** Tianyi Zhang, Shangshang Wang, **Yinxu Tang**, Ziyu Shao & Yang Yang. _"Privacy-Preserving Edge Intelligence: A Perspective of Constrained Bandits."_ IEEE Wireless Communications and Networking Conference (WCNC), 2024.

- **_Bandits with Nash Equilibrium_** | _Research Leader_
  - Formulated a decentralized resource allocation framework integrating _Multi-Armed Bandits_ with the _Gale-Shapley Deferred Acceptance_ mechanism to solve two-sided matching problems.
  - Proved theoretical convergence to _Nash Stability_ (Stable Matching) and analyzed the trade-off between exploration regret and matching stability in dynamic environments.
  - **Publication: Yinxu Tang**, Tao Huang, Xi Huang, Ziyu Shao & Yang Yang. _"Learning-Aided Stable Matching for Switch Controller Association in SDN Systems."_ IEEE International Conference on Communications (ICC), 2022.

Networks | _Active Contributor_   **Nov. 2023 − Mar. 2024**
- Proposed a 6G-based deployment framework for _RAG-enhanced_ generative services, emphasizing real-time knowledge base updates, service customization, and edge intelligence integration.
- Addressed key challenges using techniques such as data fusion, dynamic KB distribution, service customization, and user-interaction optimization in 6G environments.
- _Relevant Paper_:
  (a) Xi Huang, **Yinxu Tang**, Junling Li, Ning Zhang & Xuemin Shen. _"Toward Effective Retrieval Augmented Generative Services in 6G Networks."_ IEEE Network, 2024.

Technical Skills

Languages: Python (PyTorch, TensorFlow, Scikit-learn, NumPy, Pandas), C++, C, Matlab.

Awards & Honors

- **National Scholarship for Graduate Students — Ministry of Education of China**   **Oct. 2022**
- **Merit Student — ShanghaiTech University**   **Dec. 2021**
- **Meritorious Winner — Mathematical Contest in Modelling**   **Jun. 2018**

Teaching

Probability & Mathematical Statistics   **Fall 2022 & Fall 2021**

Teaching Assistant   *ShanghaiTech University*

- Led weekly tutorial sessions for 70-80 students, focusing on exercises, discussions, and interactive learning.
- Designed and graded assignments, including weekly exercises, project proposals, and exam papers.
- Provided mentorship to students through one-on-one consultations and tailored guidance during office hours.