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Lingzhi Zhao

Ph.D. Candidate

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My research broadly focuses on networked multimedia systems (video on demand, live streaming, XR) and intelligent mobile systems. I am currently interested in optimizing emerging interactive systems, such as XR, VLM-based applications, and generative streaming systems, from both human-centered and system-level perspectives.

Education

Ph.D. in Computer Science, *University of Illinois Urbana-Champaign* 2022 — 2026 (expected)
Advisor: Prof. Klara Nahrstedt

M.S. in Electrical and Computer Engineering, *Shanghai Jiao Tong University* 2019 — 2022
Advisor: Prof. Ying Cui

B.S. in Electrical and Computer Engineering, *Shanghai University* 2015 — 2019

Skills

Tools and Languages	Python, C++, MATLAB, Swift, Java, C#, Rust
(Video) Systems & Dev.	FFmpeg, DASH, NVCodec, Wireshark, iperf3, tc, Git, NS-3
Machine Learning	PyTorch, Tokenizers, Transformers, Instruction Tuning

Research and Industrial Experience

Multimedia Operating Systems and Networking (MONET) Research Group, UIUC **Aug. 2022 — Current**
Graduate Research Assistant (Advisor: Klara Nahrstedt)

Project: Generative Codec-based Real-time Video Streaming
- Optimized a generative video compression model (Cosmos) on a single RTX 4090 GPU for real-time video streaming, achieving 50%-78% bandwidth savings versus H.264/H.265 and prior neural codecs at comparable quality.
- Proposed a practical token adaptation approach by exploiting video context diversity to handle network dynamics.
- Improved perceptual quality (LPIPS) by 38%–59% under matched target bitrates and loss patterns compared with state-of-the-art systems.

Project: Generative Codec-based Image Transmission on Mobile Systems [1]
- Developed the first acoustic-based mobile system enabling reliable image transmission between Android devices via generative compression in resource-constrained environments.
- Optimized generative image compression (TiTok and VQGAN) to enhance its bandwidth efficiency (40%) and transmission error resilience via token clustering and fine-tuning.
- Achieved superior compression efficiency compared to PNG, JPEG, and traditional neural network-based compression; reduced BER from 19% to below 2% on average compared with state-of-the-art systems.

Project: VLM-powered Intelligent Mobile Systems [2]
- Developed the first vision-language model (VLM)-based mobile system for cooperative communication and improving situation awareness in extreme underwater environments.
- Instruction-tuned MobileVLMV2 to generate context-aware conversations based on multimodal data (underwater images and diving sensor readings).
- Designed a hierarchical message generation approach to better align users' intents while reducing inference latency and cost.
- Built an iOS prototype integrating on-device inference (LLMFarm) with a chirp-based physical-layer transmission protocol.
- Contributed to building an end-to-end immersive simulation testbed for system evaluation.

Multimedia Lab, Bytedance Inc., San Diego, CA **Mar 2024 — Dec. 2024, Mar 2025 — Aug. 2025**
Research Internship (Manager: Shu Shi)

Project: Cost-effective VR Streaming [2]
- Developed and validated a motion-aware rate adaptation algorithm in an end-to-end cloud VR streaming system, achieving a 15% bandwidth reduction without degrading QoE, supported by a comprehensive user study with real-world VR applications.
- Extended the system to support multiple rate control modes (CBR, VBR, CQP) and integrated motion vector extraction for rate adaptation optimization.

Project: Latency-aware Cloud VR Gaming [1]
- Proposed and validated that users exhibit different latency tolerance across action types (head, hand, and body motion) using an open-source first-person shooting (FPS) VR game.
- Developed a partial panoramic streaming method to adapt viewport coverage based on motion-to-photon (MTP) latency.
- Designed a delayed-rendering strategy for hand motion to bridge the latency gap in a cloud-edge rendering architecture.
- Prototyped an end-to-end cloud VR gaming system that achieves comparable QoE performance to prior VR streaming systems while reducing bandwidth cost and GPU utilization by 60% and 40%.

Institute of Wireless Communications Technology, Shanghai Jiao Tong University (SJTU) **Aug. 2020 — Mar. 2022**
Graduate Research Assistant (Advisor: Ying Cui)

Project: RL-based adaptive video streaming [3]

- Theoretically analyzed and optimized a reinforcement learning (RL)-based adaptive bitrate (ABR) algorithm for video streaming, accelerating training convergence and improving quality of experience (QoE) by 14.4%.
- Incorporated and mathematically modeled lower-layer network information (e.g., physical resource block (PRB) number and Modulation and Coding Scheme (MCS)) into the RL framework to further enhance QoE performance.
- Designed an online tuning approach to balance generalizability and specificity across diverse network environments using a progressive neural network framework.
- Supported deployment of the optimized algorithm in Tencent's production streaming system.

Publications and Preprints

Publications

1. Beitong Tian*, **Lingzhi Zhao***, Bo Chen, Mingyuan Wu, Haozhen Zheng, Deepak Vasisht, Francis Y. Yan, and Klara Nahrstedt. AquaScope: Reliable Underwater Image Transmission on Mobile Devices. *ACM MobiSys*, 2026. (*: equal contributions)
2. **Lingzhi Zhao**, Yongqiang Gui, Yanyan Suo, Sandesh Dhawaskar Sathyanarayana, Ruixiao Zhang, Shu Shi, and Klara Nahrstedt. Trinity: Exploiting Latency Sensitivity to Improve Quality of Experience on Cloud VR Gaming. *ACM MMSys*, 2026.
3. **Lingzhi Zhao**, Qian Zhou, Bo Chen, and Klara Nahrstedt. 360LiveCast: A Low-Latency and Bandwidth-efficient Multicast Framework for Live 360 Video. *IEEE MIPR*, 2025.
4. **Lingzhi Zhao**, Ying Cui, Yuhang Jia, Yunfei Zhang, and Klara Nahrstedt. Enhancing Neural Adaptive Wireless Video Streaming via Lower-Layer Information Exposure and Online Tuning. *IEEE Trans. Multimedia*, 2025. (Short version published in *IEEE ICC 2024*)
5. **Lingzhi Zhao**, Ying Cui, Sheng Yang, and Shlomo Shamai (Shitz). An Optimization Framework for General Rate Splitting for General Multicast. *IEEE Trans. Wireless Commun.*, 2022. (Short version published in *IEEE ICC 2022*)
6. **Lingzhi Zhao**, Ying Cui, Zhi Liu, Yunfei Zhang, and Sheng Yang. Adaptive Streaming of 360 Videos with Perfect, Imperfect, and Unknown FoV Viewing Probabilities in Wireless Networks. *IEEE Trans. Image Process.*, 2021. (Short version published in *IEEE GLOBECOM 2020*)

Preprints

1. **Lingzhi Zhao**, Yongqiang Gui, Yanyan Suo, Shu Shi, and Klara Nahrstedt. MARS: Motion-aware Rate Adaptation for Bandwidth-efficient VR Streaming. *ACM Multimedia*, 2026, under review.
2. Beitong Tian*, **Lingzhi Zhao***, Bo Chen, Haozhen Zheng, Jingcheng Yang, Mingyuan Wu, Deepak Vasisht, and Klara Nahrstedt. AquaVLM: Improving Underwater Situation Awareness with Mobile Vision Language Models. *ACM MMSys*, 2026, under review. (*: equal contributions)