Zhijian Yang

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Research Interest

- Multi-modal machine learning and signal processing with applications to localization, mapping, AR/VR, smart home assistant, robotics etc.

Education

University of Illinois, Urbana-Champaign, Urbana, IL, USA 2018 – 2023

- *Ph.D.* in Computer Science
- Advisor: Professor Romit Roy Choudhury
- Thesis: Indoor mapping using audio reflections from mobile devices
- **Research focus area: multi-modal sensing / machine learning**
- **Publication focus: top tier systems and ML conferences, with constant 20% acceptance rate, including SIGCOMM, MobiCom, MobiSys, CVPR, Ubicomp etc.**

Tsinghua University, Beijing, China 2014 – 2018

- *B. Eng* in Electronic Information Science and Technology
- *Graduated with honor (top 10%)*

Carnegie Mellon University, Pittsburgh, PA, USA 2017

- *Visiting Student* in Electrical and Computer Engineering Department
- Advisor: Professor Swarun Kumar

Nanyang Technological University, Singapore 2016

- *Exchange Student* in School of Electrical and Electronics Engineering

Industry Experience

Samsung Research America [1]

- *Senior Engineer, Research*, Digital Health Team Apr. 2024 – present
- *Senior Researcher, Research Science*, Samsung AI Center New York May. 2023 – Feb. 2024
- *Research Intern*, Samsung AI Center New York May. 2021 - May. 2022

- Projects:
  - Multimodal (vision + audio) 3D metric scale human pose estimation for smart home. **First author paper published in CVPR 2022**, patent published in 2023, and project highlighted on Samsung Research website.
  - Multimodal (IMU+PPG) health and sleep sensing using smart watch.
  - Capacitance sensing based human hand gesture sensing and location tracking for intuitive robot arm control. **Co-authored paper in submission.**
  - Low-cost frost detection for smart refrigerators using ultrasonic piezoelectric sensor. **First author paper in accepted to ICC 2024. Technology transferred to business unit.**

Meta (Facebook)

- *Research scientist intern - computer vision/deep learning*, XR insight/ spatial AI team May. 2022 – Aug. 2022
- Topic: Multi-modal localization and tracking (vision + IMU) for Meta AR/VR devices

Samsung Research UK

- *Research Collaborator*, Samsung AI Center Cambridge Sept. 2019 – Dec. 2019
- Inaudible attack for smart voice assistants leveraging non-linearity in microphone amplifier.

Selected Research Projects

Multimodal sensing / perception

- Single view camera + ultrasound for human localization and 3D pose estimation

[1] Samsung AI Center in NYC closed in Feb 2024, transferred to Digital Health Team.

  - Bearing from key point detection on single view image; distance (ToF) from acoustic reflection
- Controller tracking for AR/VR
  - Inertial and vision fusion for Meta Quest VR controller tracking; code shipped into product
- Privacy preserving indoor mapping without camera
  - Acoustic sensing from RIR; inertial tracking for localization; conditional GAN for floor mapping
- Indoor localization for acoustic augmented reality
  - Multi-IMU fusion for human localization; acoustic and IMU fusion for location calibration
- Personalizing spatial audio for earphones
  - Acoustic sensing; IMU + acoustic fusion for sound source localization
- Health and sleep sensing using wearable devices
  - Signal processing and machine learning using smart watch PPG and IMU sensors for health monitoring

Acoustic / wireless sensing

- User location estimation for smart voice assistants based on voice signal
  - Bearing from microphone array; acoustic multi-path triangulation for user localization
- Human hand gesture recognition and location tracking using capacitance sensing
  - Custom capacitive sensing hardware design; ML for gesture and location inference
- Body pose estimation and shape sensing from wearable RFID tags
  - RFID tag localization from signal phase; array signal processing for body part orientation estimation
- Teeth interaction sensing and localization
  - Reusing headphone speaker as microphone; time-difference of arrival (TDoA) based interaction localization
- Low-cost refrigerator frost detection using piezoelectric sensors
  - Frost changes resonance property of piezoelectric sensors; custom hardware design for frost detection

PUBLICATIONS

- **[In submission]** *Zhijian Yang, Romit Roy Choudhury*, "Helping Generative Models with Signal Processing Hints"
- **[In submission]** *Siddharth Rupavatharam, Alexis Burns, Zhijian Yang, Caleb Escobedo, Daewon Lee, Lawrence Jackel, Richard Howard, Volkan Isler*, "Marionette: Hand Gesture and Position Tracking for Intuitive Contact-free Robot Arm Control"
- **[IEEE ICC 2024]** *Zhijian Yang, Siddharth Rupavatharam, Alexis Burns, Daewon Lee, Richard Howard, Volkan Isler*, "Low-cost Frost Detection using Piezoelectric Sensors"
- **[UIUC PhD Thesis 2023]** *Zhijian Yang*. "Indoor mapping using audio reflections from mobile devices"
- **[IEEE/CVF CVPR 2022]** *Zhijian Yang, Xiaoran Fan, Volkan Isler, and Hyun Soo Park*, "PoseKernelLifter: Metric Lifting of 3D Human Pose using Sound", Acceptance rate: 2067/8161 = **25.3%**
- **[ACM SIGCOMM 2021]** *Zhijian Yang, Romit Roy Choudhury*, "Personalizing Head Related Transfer Functions for Earables", Acceptance rate: 55/241 = **22.8%**
- **[ACM MobiCom 2020]** *Zhijian Yang, Yu-Lin Wei, Sheng Shen, and Romit Roy Choudhury*, "Ear-AR: Indoor Acoustic Augmented Reality on Earphones", Acceptance rate: 62/384 = **16.1%**
- **[ACM MobiCom 2020]** *Jay Prakash, Zhijian Yang, Yu-Lin Wei, Haitham Hassanieh, and Romit Roy Choudhury*, "EarSense: Earphones as a Teeth Activity Sensor", Acceptance rate: 62/384 = **16.1%**
- **[ACM MobiCom 2020]** *Sheng Shen, Daguan Chen, Yu-Lin Wei, Zhijian Yang, and Romit Roy Choudhury*, "Voice Localization Using Nearby Wall Reflections", Acceptance rate: 62/384 = **16.1%**
- **[ACM EarComp 2019]** *Jay Prakash, Zhijian Yang, Yu-Lin Wei and Romit Roy Choudhury*, "STEAR: Robost Step Count on Earables", (Workshop with ACM UbiComp 2019)
- **[ACM UbiComp 2018]** *Haojian Jin, Zhijian Yang, Swarun Kumar, and Jason Hong*, "Towards Wearable Everyday Body-Frame Tracking using Passive RFIDs"
- **[ACM MobiSys 2018]** *Haojian Jin, Jingxian Wang, Zhijian Yang, Swarun Kumar, and Jason Hong*, "Wish: Towards a Wireless Shape-aware World using Passive RFIDs", Acceptance rate: 34/188 = **18.1%**
- **[ACM UbiComp 2018 Demo]** *Haojian Jin, Jingxian Wang, Zhijian Yang, Swarun Kumar, and Jason Hong*, "RFWear: Towards Wearable Everyday Body-Frame Tracking using Passive RFIDs", **Best Demo Honorable Mention (2/51)**

Patents

- *Haojian Jin,* ***Zhijian Yang****, Swarun Kumar, and Jason Hong*, "System and Method for Tracking a Body". US Patent App. 16/769,741
- ***Zhijian Yang****, Xiaoran Fan, Volkan Isler, and Hyun Soo Park*, "PoseKernelLifter: Metric 3D Human Pose Lifting by Listening Sounds". US Patent App. 17/987,460

Honors and Awards

- Future Generation Computer Systems Outstanding Reviewer Award (39/3300) Feb. 2023
- Ubicomp/ISWC 2018 Best Demo Honorable Mention (2/51) Oct. 2018

Talks

- Multimodal Indoor Mapping using Mobile Devices, Samsung Research America Feb 2024
- Multimodal Indoor Mapping using Mobile Devices, Samsung AI Center Toronto Feb 2024
- Privacy Preserving Localization and Mapping Using Mobile and IoT Devices, JP Morgan Chase Feb 2023
- 3D Metric Scale Human Pose Estimation using Ultrasound and Vision Fusion, Tesla Dec 2022
- PoseKernelLifter: Metric Lifting of 3D Human Pose using Sound, CSL Student Conf. Feb 2022
- Personalizing Head Related Transfer Functions for Earables, ACM SIGCOMM Aug 2021
- Building Blocks of an Acoustic Augmented Reality System, Samsung AI Center Feb 2021
- Ear-AR: Indoor Acoustic Augmented Reality on Earphones, Carnegie Mellon Univ. Nov 2020
- Ear-AR: Indoor Acoustic Augmented Reality on Earphones, ACM MobiCom Sep 2020

Teaching Experience

- UIUC CS/ECE 434: Real-World Algorithms for IoT and Data Science Spring 2023
- UIUC CS/ECE 438: Communication Networks Fall 2020
- UIUC&ZJU summer school: Wireless and Mobile IoT Summer 2020
- UIUC CS/ECE 434: Mobile Computing and Applications Spring 2020

Services

- Invited reviewer:
  - IEEE Transaction on Mobile Computing
  - IEEE Transaction on Wireless Communication
  - Computer Human Interaction (CHI)
  - Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT)
  - ACM Transaction on Sensor Networks
  - IEEE Internet of Things Journal
  - IEEE Transaction on Cognitive Communications and Networking
  - IEEE Systems Journal
  - Elsevier Future Generation Computer System, Elsevier Mobile and Pervasive Computing
  - Elsevier Computer Networks
  - Elsevier Physical Communication
- Technical Program Committee: IEEE ICPADS 2022 Conference, IEEE ICPADS 2023 Conference
- Program Board: MOBILE 2022 Conference