HAO ZHOU

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RESEARCH OVERVIEW

My research lies in the span of **AI-powered mobile sensing**. By **various modalities** (Ultra-wideband, IMU, Vision, Acoustics, etc.), I aim to bring insights to human lives in domains such as **pose tracking, mobile health, and accessibility**.

EDUCATION

The Pennsylvania State University — State College, PA, USA
Doctor of Philosophy in Computer Science and Engineering — *2021 - May 2025 (Expected)*
Advisor: Dr. Mahanth Gowda

The University of Mississippi — Oxford, MS, USA
Master of Science in Computer Science — *2019 - 2021*
Bachelor of Science in Computer Science — *2016 - 2019*

SELECTED PUBLICATIONS

- ♠ *Rethinking Orientation Estimation with Smartphone-equipped Ultra-wideband Chips*
  Hao Zhou, Kuang Yuan, Mahanth Gowda, Lili Qiu, Jie Xiong
  ACM MobiCom 2024

- ♠ *Know Your Heart Better: Multimodal Cardiac Output Monitoring using Earbuds*
  Hao Zhou with Digital Health Lab at Samsung Research America
  IEEE ICASSP 2025

- ♠ *ASLRing: American Sign Language Recognition with Meta-Learning on Wearables*
  Hao Zhou, Taiting Lu, Kenneth DeHaan, and Mahanth Gowda
  ACM/IEEE IoTDI 2024 (Now Part of SenSys)

- ♠ *SmartDampener: An Open Source Platform for Sport Analytics in Tennis*
  Runze Liu, Taiting Lu, Shengming Yuan, **Hao Zhou**, and Mahanth Gowda
  ACM IMWUT/UbiComp 2024

- ♠ *SignQuery: A Natural User Interface and Search Engine for Sign Language with Wearable Sensors*
  Hao Zhou, Taiting Lu, Kristina McKinnie, Joseph Palagano, Kenneth DeHaan, and Mahanth Gowda
  ACM MobiCom 2023

- ♠ *An Open Source Smartring Platform for Finger Motion Analytics and Healthcare Applications*
  Hao Zhou, Taiting Lu, Yilin Liu, Shijia Zhang, Runze Liu, and Mahanth Gowda
  ACM/IEEE IoTDI 2023 (Now Part of SenSys)
  🎗 **Best Paper Award for Edge IoT AI**

- ♠ *I am an Earphone and I can Hear my Users Face: 3D Facial Reconstruction using Smart Earphones*
  Shijia Zhang, Taiting Lu, **Hao Zhou**, Yilin Liu, Runze Liu, and Mahanth Gowda
  ACM Transactions on Internet of Things 2023

- ♠ *Backdoor Threats from Compromised Foundation Models to Federated Learning*
  Xi Li, Songhe Wang, Chen Wu, **Hao Zhou**, and Jiaqi Wang
  NeurIPS 2023 Workshop

- ♠ *Learning on the Rings: Self-Supervised 3D Finger Motion Tracking using Wearable Sensors*
  Hao Zhou, Taiting Lu, Yilin Liu, Shijia Zhang, and Mahanth Gowda
  ACM IMWUT/UbiComp 2022

INDUSTRIAL EXPERIENCE

Samsung Research America, hosted by Digital Health Lab — May 2024 - Aug 2024

- Developed multimodal health monitoring systems for digital biomarkers (e.g., cardiac output, blood pressure, heart rate variability) with Samsung devices.

Microsoft Research Asia, hosted by Prof. Jie Xiong — May 2023 - Aug 2023

- Utilize ultra-wideband (UWB) on consumer-level electronics for device orientation, respiration sensing.
- Explore 3D Vision (LiDAR) for mobile health.

FUNDRAISING & PROPOSAL EXPERIENCE

Part of NSF Medium Proposal (Aim for $1,200,000) — PennState, 2024
Nominated for Google Ph.D. Fellowship (1-2 candidates per university) — PennState, 2024
Entrepreneurial Lead (Awarded $50,000) — NSF National I-Corps Program, 2023

HONORS & AWARDS

Student Travel Grant — ACM MobiCom, 2024
Best Paper Award for Edge IoT AI — ACM/IEEE IoTDI, 2023
International Student Travel Grant — The Pennsylvania State University, 2023
Outstanding Teaching Assistant Award — The Pennsylvania State University, 2022
Summa Cum Laude — University of Mississippi, 2019
International Undergraduate Student Scholarship — University of Mississippi, 2017 - 2019

SELECTED RESEARCH PROJECTS

Pose Tracking

- *Full-body Pose Tracking*: Track full-body poses with extremely sparse observations from foot pressure (in progress).
- *Device Orientation Estimation*: Utilize UWB modules on consumer-level electronics (phones, smartwatches, airtags, etc.) for fine-grained orientation estimation, enhancing spatial awareness.
- *Hand Pose Tracking*: Reconstruct arbitrary hand poses from limited and sparse IMU observations via 1) effective feature learning and 2) virtual IMU data synthesis from publicly available videos.
- *Facial Expression Tracking*: Continuously track facial expression by in-ear acoustic signals.

Mobile Health

- Estimate comprehensive biomarkers such as cardiac output, and blood pressure using commodity earbuds and rings, providing deep insights into cardiac functions.
- Explore the potential of wireless signals such as UWB for contactless mobile health.

Accessibility

- *Sign Language Search Engine*: A search engine that supports native sign language queries for the Deaf community, in which an embedding space (with videos, texts, and IMU) is built for retrieving relevant documents (e.g., videos) given queries in sign languages (captured by IMUs).
- *Sign Language Recognition*: A sign language recognition system with wearables that addresses issues such as user diversity, and signing habits via meta-learning.

TALKS & PRESENTATIONS

Rethinking Orientation Estimation with Smartphone-equipped Ultra-wideband Chips

- ACM MobiCom @ D.C., USA, 2024.

Pose Estimation with Wearables and Its Applications in Sign Languages

- Samsung Research America @ Moutain View, USA, 2024.

ASLRing: American Sign Language Recognition with Meta-Learning on Wearables

- ACM/IEEE IoTDI @ HongKong, China, 2024.

A Natural User Interface and Search Engine for Sign Language with Wearable Sensors

- ACM MobiCom @ Madrid, Spain, 2023.

Learning on the Rings: Self-Supervised 3D Finger Motion Tracking using Wearable Sensors

- Microsoft Research Asia @ Shanghai, China, 2023.
- ACM IMWUT/UbiComp @ Atlanta, USA, 2022.

PROFESSIONAL SERVICES

Program Committee

- ACM MobiCom'24 S3 Workshop
- ACM MobiCom'24 Artifact Evaluation
- ACM MobiSys'24 Artifact Evaluation

Reviewer

- ACM UbiComp/IMWUT, 2022-2024
- IEEE Transactions of Mobile Computing, 2024
- ACM Transactions on Sensor Networks, 2024
- International Conference on Learning Representations (ICLR), 2025
- Journal of Intelligent Manufacturing, 2021

Student Volunteer

- MobiCom'24
- MobiQuitous'22

TEACHING EXPERIENCE

CSE/EE 559: Wireless and Mobile Sensing in the age of IoT	PennState, FA'24
CMPEN 462: Wireless Communication Systems and Security	PennState, SP'24
CMPEN 462: Wireless Communication Systems and Security	PennState, SP'22