

# HAO ZHOU

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## RESEARCH OVERVIEW

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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

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**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

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- ♠ *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
- ♠ *Optimizing Biomarkers from Earbud Ballistocardiogram: Calibration and Calibration-Free Algorithms for Accelerometer Axis Selection and Fusion*  
Yunzhi Li, ..., Hao Zhou and Digital Health Lab at Samsung Research America  
IEEE ICASSP 2025
- ♠ *BallistoBud: Heart Rate Variability Monitoring using Earbud Accelerometry for Stress Assessment*  
Md Saiful Islam, ..., Hao Zhou and Digital Health Lab at Samsung Research America  
ACM CHI 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

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**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

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*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

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*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

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### 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, smart-watches, 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 ear-buds and rings, providing deep insights into heart rate variability, cardiac functions, and stress assessment.
- 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

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### 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 @ Mountain 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

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### 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

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