HAO ZHOU

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RESEARCH INTERESTS

Internet of Things, Wireless Sensing, Wearable Computing, and Multimodal Learning

EDUCATION

The Pennsylvania State University — State College, PA, USA
Doctor of Philosophy in Computer Science and Engineering — *2021 - Present*

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

HONORS & AWARDS

International Student Travel Grant — The Pennsylvania State University, 2023
Student Travel Grant — ACM MobiCom, 2023
Best Paper Award for Edge IoT AI — ACM/IEEE IoTDI, 2023
Outstanding Teaching Assistant Award — The Pennsylvania State University, 2022
Best Paper Award — IEEE SBAC-PAD 2021, 2021
Summa Cum Laude — University of Mississippi, 2019
International Undergraduate Student Scholarship — University of Mississippi, 2017 - 2019

PUBLICATIONS

[C.4] SignQuery: A Natural User Interface and Search Engine for Sign Language with Wearable Sensors
Hao Zhou, Taiting Lu, Kristina McKinnie, Joseph Palagano, Kenneth DeHaan, Mahanth Gowda
ACM MobiCom, 2023

[C.3] One Ring to Rule Them All: An Open Source Smartring Platform for Finger Motion Analytics and Healthcare Applications
Hao Zhou, Taiting Lu, Yilin Liu, Shijia Zhang, Runze Liu, Mahanth Gowda
ACM/IEEE IoTDI, 2023, (**Best Paper Award for Edge IoT AI**)

[J.2] 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, Mahanth Gowda
ACM Transactions on Internet of Things, 2023

[J.1] Learning on the Rings: Self-Supervised 3D Finger Motion Tracking using Wearable Sensors
Hao Zhou, Taiting Lu, Yilin Liu, Shijia Zhang, Mahanth Gowda
ACM IMWUT/UbiComp 2022

[C.2] DACHash: A Dynamic, Cache-Aware and Concurrent Hash Table on GPUs
Hao Zhou, David Troendle, Byunghyun Jang
IEEE SBAC-PAD 2021, **(Best Paper Award)**

[C.1] Exploring Faster RCNN for Fabric Defect Detection
Hao Zhou, Byunghyun Jang, Yixin Chen, David Troendle
IEEE AI4I 2020

INTERNSHIPS

Microsoft Research Asia May 2023 - Aug 2023, Shanghai, China
Mentor: Dr. Jie Xiong

- Ultra-wideband (UWB) Sensing on Consumer-level Devices
- Exploring Intersection of 3D Vision and Wireless Sensing

RESEARCH EXPERIENCE

Graduate Research Assistant, *September 2021 - Present*
The Pennsylvania State University State College, PA, USA
Advisor: Dr. Mahanth Gowda

- Sign Language Search Engines with Wearables
  - Propose a system, *SignQuery*, to capture queries (signs in form of IMU signals) by Deaf users, and retrieve relevant documents from an online sign video database with diverse topics.
  - Accessibility is greatly improved for Deaf users by having them search as hearing people on search engines such as Google, Bing, and Baidu.
- 3D Facial Expression Tracking with Smart Earphones
  - Propose a system, *EarFace*, to continuously track facial expressions with acoustic signals.
  - Leverage *FLAME* to render a realistic 3D face from 2D landmarks.
- Finger Motion Analytics and Healthcare Application using Smartrings
  - Propose a system, *OmniRing*, to analyze finger motion and monitor health conditions.
  - Harvest virtual IMU data from online videos to reduce the training overhead from the effort of collecting real IMU data; Inter-finger relation is learned based on the use of Transformer architectures to reduce the number of rings required.
  - PPG sensor is incorporated for estimating health conditions such as heart rates.
- Finger Motion Tracking Aided by Self-supervised Learning
  - Propose a system, *ssLOTR* that leverages the anatomical constraints of finger motions and deep learning modules to track 3D finger motion.
  - Design a contrastive learning framework along with data augmentation techniques to learn better representations for IMU signals, by which only 15% labeled IMU data is necessary to achieve similar accuracy with its supervised counterpart.
  - Conduct a systematic user study to demonstrate *ssLOTR* is robust to environments, sensor positions, etc., enabling a number of applications in augmented and virtual reality, sign language recognition, rehabilitation healthcare, sports analytic, etc., with the promise of ubiquitous finger motion tracking.

Graduate Research Assistant, *September 2019 - May 2021*
The University of Mississippi Oxford, MS, USA
Advisor: Dr. Byunghyun Jang

- Develop a Concurrent Data Structure (Hash Table) on GPU
  - Optimize hash table performance by considering memory access pattern and thread divergence.
  - Utilize warp synchronization to minimize thread divergence.
  - Leverage fast cache for data re-usage.
- Optimized Faster RCNN for Fabric Defect Detection
  - Studied how Faster RCNN works as a two-stage object detector.
  - Analyzed performance of Faster RCNN on fabric images.

TEACHING EXPERIENCE

Graduate Teaching Assistant
The Pennsylvania State University State College, PA, USA
CMPEN 462: Wireless Communication Systems and Security, Spring 2022

- Helped students understand the concepts in linear algebra, wireless communications, and state-of-the-art systems in wireless sensing, mobile computing, etc.
- Assisted students in a distance estimation project where acoustics signals are leveraged.

PROFESSIONAL SERVICE

Invited Reviewer for IMWUT	2023
Invited Reviewer for Journal of Intelligent Manufacturing	2022
Student Volunteer @ MobiQuitous '22	2022