HAOWEN (JOHN) WEI

Homepage ◇ Google Scholar ◇ GitHub ◇ LinkedIn
Research Associate & Research Technician at Massachusetts Institute of Technology
+1(774) 262-1909 ◇ hw2892@columbia.edu ◇ Boston, MA

EDUCATION

Columbia University 09/2022 - 05/2024

Master of Computer Science (Thesis Track), GPA: 3.81/4.00

- Advisors: Prof. Steven K. Feiner & Prof. Paul Sajda & Prof. Kaveri Thakoor
- Master's Thesis: From Brain–Computer Interfaces to AI-Enhanced Diagnostics: Developing Cutting-Edge Tools for Medical and Interactive Technologies. Paper

Worcester Polytechnic Institute 08/2018 - 05/2022

Bachelor of Computer Science & Electrical and Computer Engineering (Double Major), GPA: 3.91/4.00

- Advisors: Prof. Erin Solovey & Prof. Kaveh Pahlavan
- Dean's List: Fall 2018, Spring 2019, Fall 2019, Spring 2021, Fall 2021; Graduated with Distinction.
- 2022 Best Undergraduate Major Qualification Project, 3rd Place (IndexPen)

RESEARCH INTEREST

Sensor Fusion, Eye-Tracking, Computer Vision, Wireless Sensing, Virtual Reality, Augmented Reality, Signal Processing, Deep Learning, Machine Learning Neuroimaging (EEG, fNIRS), Brain-Computer Interface, Brain Stimulation (TMS-EEG), Human-Computer Interaction.

PUBLICATIONS

*** These Authors Contributed Equally.**

- Ziheng Li*, **Haowen Wei***, Kuang Sun, David Li, Leyi Cui, Steven Feiner, Kaveri Thakoor. "Interactively Assisting Glaucoma Diagnosis with an Expert Knowledge-distilled Vision Transformer." ACM The ACM CHI conference on Human Factors in Computing Systems Late-Breaking Work 2025. Paper, Video
- Wei Dai, Peilin Chen, Malinda Lu, Daniel Li, **Haowen Wei**, Hejie Cui, and Paul Pu Liang. "Data Foundations for Large Scale Multimodal Clinical Foundation Models." arXiv preprint arXiv:2503.07667 (2025). Paper
- Ziheng Li*, **Haowen Wei***, Ziwen Xie, Yunxiang Peng, June Pyo Suh, Steven Feiner, Paul Sajda. "PhysioLabXR: A software platform for real-time multi-modal, brain-computer interfaces and extended reality experiments." Journal of Open Source Software 9, no. 93 (2024): 5854. Paper, GitHub
- **Haowen Wei***, Ziheng Li*, Alexander D. Galvan, Zhuoran Su, Xiao Zhang, Kaveh Pahlavan, and Erin T. Solovey. "IndexPen: Two-Finger Text Input with Millimeter-Wave Radar." Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 6, no. 2 (2022): 1-39. Paper, Video, Dataset
- Xing Xie, **Haowen Wei**, and Yongjie Yang. "Real-Time LiDAR Point-Cloud Moving Object Segmentation for Autonomous Driving." Sensors 23, no. 1 (2023): 547. Paper
- Zhuoran Su, Kaveh Pahlavan, Emmanuel Agu, and **Haowen Wei**. "Proximity Detection During Epidemics: Direct UWB TOA Versus Machine Learning Based RSSI." International journal of wireless information networks 29, no. 4 (2022): 480-490. Paper
- Shiyu Cheng, Kaveh Pahlavan, **Haowen Wei**, Zhuoran Su, Seyed Reza Zekavat, and Ali Abedi. "A Study of Interference Analysis Between mmWave Radars and IEEE 802.11 AD at 60 GHz Bands." International Journal of Wireless Information Networks 29, no. 3 (2022): 222-231. Paper
- Ziheng Li, Xichen He, **Haowen Wei**, Mengyuan Wu, Zeyi Tong, Ben Yang, Steven Feiner. "SwEYEpe and Beyond: Exploring Intuitive, Efficient Text Entry for Mixed Reality via Eye and Hand Tracking", The ACM Symposium on User Interface Software and Technology (UIST) (Under Review)

CONFERENCE PRESENTATIONS

- 2023 Brain & Human Body Modeling (BHBM) - Harvard Medical School Martinos Bioimaging Center(Hybrid Local Conference): PhysioLabXR: A software platform in Python for multi-modal brain-computer interface and real-time experiment pipelines. **Haowen Wei**, Ziheng Li, Steven Feiner, Paul Sajda Link
- 2022 Brain & Human Body Modeling (BHBM) - Harvard Medical School Martinos Bioimaging Center(Hybrid Local Conference): Hardware, real-time signal processing techniques, and data collection for TMS induced EMG responses with RenaLabApp. **Haowen Wei**, Mohammad Daneshzand Link
- 2021 Brain & Human Body Modeling (BHBM) - Harvard Medical School Martinos Bioimaging Center (Hybrid Local Conference): Interplay between TES and EEG Interplay with boundary element fast multipole method (BEM-FMM) via Helmholtz reciprocity principle. Sergey Makarov, **Haowen Wei**, Aapo Nummenmaa Link

RESEARCH

PhysioLabXR: A software platform in Python for multi-modal brain-computer interface and real-time experiments
Advisors: Prof. Steven K. Feiner & Paul Sajda 05/2020 - Present
Role: Co-Founder & Lead Software Engineer *Boston, MA, Worcester, MA, & New York, NY*

- Led development of data visualization, user interface, digital signal processing modules, and real-time TMS/fMRI visualizer.
- Developed a sensor fusion application for data collection, visualization, and real-time neural network inference.
- Implemented serial connections for non-Lab Streaming Layer sensors and created adaptable data collection interfaces.
- Created Brain-Computer Interface experiment paradigms (e.g., P300 Speller) to educate researchers.
- Maintained the application and provided support to research labs at WPI and Columbia University.

Interactively Assisting Glaucoma Diagnosis with an Expert Knowledge-distilled Vision Transformer
Advisors: Prof. Steven K. Feiner & Prof. Kaveri Thakoor 04/2023 - 07/2025
Role: Project Lead & Lead Software Engineer & Experimenter *New York, NY*

- Developed the Interactive Area of Interest (AOI) Augmentation method, which enhances clinical image diagnosis by using a vision transformer's attention layer to highlight key areas in ocular images, guiding clinicians' focus.
- Spearheaded the full system development in Unity and PhysioLabXR, including architecture, design, and implementation for real-time interactions during diagnosis.
- Led two user studies with 15 ophthalmologists, demonstrating system flexibility and proving the impact of AOI augmentation in glaucoma diagnosis.

IndexPen: Two-Finger Text Input with Millimeter Wave Radar
Advisors: Prof. Erin Solovey & Prof. Kaveh Pahlavan 08/2019 - 09/2022
Role: Project Lead & Lead Software Engineer & Experimenter *Worcester, MA*

- Introduced IndexPen, a novel touch-free, in-air text input system using two-finger micro-gestures, leveraging mmWave radar to detect gestures resembling real-world writing.
- Led the end-to-end development, including data collection, machine learning pipeline (CNN+LSTM), and real-time radar processing.
- Designed and implemented the radio frequency processing pipeline and neural network architecture for gesture detection, significantly improving text entry accuracy.

LiDAR Moving Object Segmentation (MOS) of Point Cloud Sequences
Advisor: Xinming Huang 03/2021 - 09/2022
Role: Lead Software Engineer *Worcester, MA*

- Built the deep neural network to segmenting point cloud into two moving and non-moving categories by using deep learning andlabeling points bellows to a moving object different from static object; used SemanticKitti for dataset

A Comparative Study of Accuracy of BLE and UWB Signal
Advisors: Prof. Kaveh Pahlavan & Prof. Emmanuel Agu 06/2021 - 05/2022
Role: Lead Sotware Engineer *Worcester, MA*

- Introduced machine learning for time series "Signal to Noise Ratio" (SNR) from Blue Tooth; compareddistance estimation using BLE and UWB technology in epidemic
- Provided technical support to research team; set up data collection interface between hardware andcomputer
- Publication: Proximity Detection During Epidemics: Direct UWB TOA Versus Machine Learning Based RSSI

A Study of Interference Analysis Between mmWave Radars and IEEE 802. 11AD at 60GHz
Advisors: Prof. Kaveh Pahlavan & Prof. Seyed Reza Zekav 10/2020 - 09/2021
Role: Lead Sotware Engineer *Worcester, MA*

- Guided research team to use the Texas Instrument mmWave radar; took charge of the basic setup and data analysis.

WORK EXPERIENCE

Reserach Assistant Harvard Medical School 12/2021 - 09/2022, 09/2024 - Present
Athinoula A. Martinos Center for Biomedical Imaging (TMS Lab) *Boston, MA*

- Building real-time TMS-EEG signal processing pipeline and brain signals reconstruction.
- Led the development of an EEG, TMS, and EMG devices API for the research team, significantly enhancing the setup speed of the experiment pipeline.

Reserach Assistant Columbia University 09/2022 - 05/2024
LIINC Lab & CGUI Lab & AI4VS Lab *New York, NY*

- Built multi-modal physiological data classifier, Unity experiment paradigm, and led the development of PhysioLabXR from scratch.
- Continuously working on multiple projects and published 3 articles in top level journals & conferences.

Teaching Assistant Worcester Polytechnic Institute 10/2020 - 12/2021
ECE 2029: Introduction to Digital Circuit Design. & ECE 3308 Introduction to Wireless Networks *Worcester, MA*

- Assisted students with daily homework tasks, solved homework and code problems, explained how to complete MATLAB and Verilog code, corrected exam assignments.
- Led students to design project flow to meet lab experiments

Reserach Assistant Worcester Polytechnic Insitute 10/2019 - 05/2022
CWINS Lab & HCI Lab & Embedded Lab *Worcester, MA*

- Led multiple projects and carries out four publications in top conferences and journals
- Provided software development assistant to other research teams from lab; worked on direct research relates to finger gesture motion detection using mmWave Radar. Work has been published in top conferences and Journals

SKILLS

Programming Language	Python, C#, Java, MATLAB, Verilog/FPGA, C/C++, SQL, JavaScript, HTLM
Research	Deep Learning, Machine Learning, Computer Graphics, Computer Vision, Real-time Signal Processing, Physiological Data Processing (EEG, fNIRS), Eye Tracking, Image Processing, mmWave Radar,UWB Radar, Brain Stimulation, Natural Language Processing, LiDAR Point Cloud Segmentation
Platform	Pytorch, TensorFlow, Unity3D, SOLIDWORKS, FPGA, Qt/PyQt (Software), Operating System , Real-time Operating System (RTOS), FreeSurfer