

# HAOWEN (JOHN) WEI

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Research Assistant at Harvard Medical School, Athinoula A. Martinos Center for Biomedical Imaging

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## EDUCATION

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### 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

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

## PUBLICATIONS

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\* **These Authors Contributed Equally.**

- Ziheng Li\*, **Haowen Wei\***, Ziwen Xie, Yunxiang Peng, June Pyo Suh, Steven Feiner, Paul Sajda. "Physio-LabXR: 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](#)

### Under Review:

- 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 Transactions on Computer-Human Interaction 2025, Under Review).
- **Haowen Wei**, Ziheng Li, Xichen He, Ben Yang, Steven Feiner. "Efficient Text-Entry in Mixed Reality: Tap, Gaze & Pinch, SwEYEpe." (CHI 2025, Late-Breaking Work, Preparing)

## CONFERENCE PRESENTATIONS

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- 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

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### **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 - Present

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 and labeling points belongs 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 Software Engineer

Worcester, MA

- Introduced machine learning for time series “Signal to Noise Ratio” (SNR) from Blue Tooth; compared distance estimation using BLE and UWB technology in epidemic
- Provided technical support to research team; set up data collection interface between hardware and computer
- 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 Software Engineer

Worcester, MA

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

## WORK EXPERIENCE

**Research 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.

**Research 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

**Research Assistant** Worcester Polytechnic Institute

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, HTML

**Research**

Deep Learning, Machine Learning, Computer Graphics, Computer Vision, Real-time Signal Processing, Physiological Data Processing (EEG, fNIRS, fMIR), 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