Mingzhuo Ma

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EDUCATION

University of Michigan, Ann Arbor , US — Aug 2026 - Present
Ph.D. in Computer Science and Engineering

- Advised by Prof. Ke Sun and Prof. Junyi Zhu

University of Washington (UW), Seattle, US — Sep 2023 - Jun 2026
MS in Electrical Engineering - Data Science

- **GPA:** 3.95/4.0, **Advisor:** Prof. Yiyue Luo
- **Thesis:** Designing Closed-loop Sensing and Feedback Systems for Embodied Human Interaction

University of Electronic Science and Technology of China (UESTC), Chengdu, China — Sep 2019 - Jun 2023
BEng in Electrical and Electronics Engineering (Dual Degrees)

- **GPA:** 3.89/4.0, Ranking 9/242, **Minor**: Interactive New Media Art (iArt), 4.0/4.0
- **Thesis:** Real-time Breath Monitoring through Smart Fashion

University of Glasgow, Glasgow, UK — Sep 2019 - Jun 2023
BEng in Electrical and Electronics Engineering **(First Class Honours Degree)**

- **GPA:** 3.89/4.0, University of Glasgow and UESTC Joint Educational Programme

RESEARCH INTERESTS

- **Goals:** Unobtrusive Human Sensing in Everyday Environments; Bridging Sensing and Intervention for Health and Accessibility
- **Approaches:** Wearable Computing, Multimodal Sensing, Embedded Systems, Physiological Sensing, Signal Processing, Applied Machine Learning, Human-Computer Interaction

PUBLICATIONS

[1] J. Moon*, **M. Ma***, Q. Yang, S. Hwang, Y. Choi, K. Kim, S. Burden, and Y. Luo. **A Closed-Loop CPR Training Glove with Integrated Tactile Sensing and Haptic Feedback**. ICRA 2026.[DOI]

[2] **M. Ma**, H. Lai, and Y. Luo. **BrailleRhythm: Enhancing Braille Character Recognition and Learning via Real-time Tactile Sensing and Audio Feedback**. UIST 2025 (Poster). [DOI]

[3] P. Garg, **M. Ma**, H. J. MacKinnon, M. Richley, V. Iyer, S. Patel, and A. Adams. **DopFone: Doppler-based Fetal Heart Rate Estimation Using Commodity Smartphones**. IMWUT 2025. [DOI]

RESEARCH EXPERIENCE

Multimodally Sensing Knitted Fabrics for Rehabilitation Assessment — Sep 2024 - Jun 2026
Research Assistant; Supervisor: Prof. Yiyue Luo, UW Wearable Intelligence Lab

- Created a user-friendly and portable knitted sleeve to help patients conduct in-home rehabilitation exercises with a mobile app reflecting the rehabilitation effectiveness
- Developed the control circuits PCB of EIS, EMG, and Capacitive sensing using Teensy 4.0, ADC, multiplexers, operational/instrumentation amplifiers, wave generator, BLE modules, MOSFET, and relays
- Performed quantitative sleeve experiments to optimize electrode geometry and dielectric thickness, and to map muscle contraction, hand posture, and joint angle to EMG, EIS, and capacitive-sensing signals, respectively

Microphone-IMU-based Stethoscope for Extubation Failure Detection — Feb 2025 - Jun 2026
Research Assistant, Supervisor: Prof. Shwetak Patel, UW Ubiquitous Computing Lab

- Designed a printed circuit board (PCB) for a compact wearable sensor integrating dual IIS microphones and dual IIC inertial measurement unit (IMU) to capture tracheal sounds and respiratory motion
- Implemented PSRAM-based double buffering and optimized IIS/IIC drivers to ensure continuous, lossless data logging to a microSD card

- Employed Hyak and SLURM to establish the machine learning pipeline for extubation failure detection

A Closed-Loop CPR Training Glove with Tactile Sensing and Haptic Feedback Apr 2025 - Sep 2025
Research Assistant; Supervisor: Prof. Yiyue Luo, UW Wearable Intelligence Lab

- Built a CPR self-training glove with real-time haptic feedback to guide users with various body types for correct compression rate, force, and hand pose, achieving $>$ 92% accuracy on the three criteria monitoring
- Designed a flexible printed circuit board (FPCB) wristband control circuit with analog and IIC multiplexers, haptic motor drivers, and ESP32S2, communicating with a mobile app via WIFI for feedback control
- Characterized tactile sensors for sensitivity, hysteresis, stability, and SNR
- Conducted a user study (N=5) to find the optimal haptic feedback intensities to convey guidance for correct CPR

Doppler-based Fetal Heart Rate Estimation Using Commidity Smartphones Feb 2025 - Aug 2025
Research Assistant; Supervisor: Prof. Vikram Iyer, UW Ubiquitous Computing Lab

- Developed the first smartphone-based Doppler ultrasound system for fetal heart rate (FHR) measurement with concurrent maternal heart rate (MHR) extraction, achieving $\approx$ 2 BPM MAE on FHR detection
- Designed frontend and backend of the Android app and benchmarked end-to-end frequency response across 5 phone models with two medical gelatin phantom models
- Constructed the MHR signal pipeline (band-pass, wavelet multiresolution, Hilbert envelope), achieving a 10.03 BPM MAE baseline in peak-based detection with sounds recorded near belly
- Implemented models (Lasso, RF, SVR, Gradient Boosting) using time/frequency/cepstral features with F-score and mutual-information feature selection under MAE, Pearson's r, and R^2 assessment

Real-time Breath Monitoring through Smart Fashion Sep 2022 - May 2023
Research Assistant; Supervisor: Prof. Lina Mohjazi, University of Glasgow

- Designed a smart necklace to monitor breath rates via ESP32C3 and an accelerometer, achieving $>$75% accuracy
- Performed linear regression, filtering, detrending, trapezoid integrals, and peak detection in MATLAB
- Reported users' status if apnea or hyperventilation occurs through email notification

AWARDS & HONORS

Graduate School Conference Presentation Award, University of Washington Sep 2025

Outstanding Graduate of Sichuan (Top 4% Provincial level), UESTC May 2023

National Scholarship (Top 1%), UESTC Oct 2022

Outstanding Academic Award and Scholarship, 1st Prize (Top 10%), UESTC Oct 2021, Oct 2022

PRESENTATIONS

[1] BrailleRhythm: Enhancing Braille Character Recognition and Learning via Real-time Tactile Sensing and Audio Feedback. Poster (peer-reviewed). UIST. Busan, South Korea. Sep 2025.

[2] Sickle Cell Disease Patient/Provider Match Tool. Poster. ENGINE Showcase. Seattle, US. May 2024.

PROJECT EXPERIENCE

Sickle Cell Disease Patient/Provider Match Tool, Novo Nordisk & UW Jan 2024 - Jun 2024
Team Leader, UX/UI Lead, Person of Contact (PoC); Director: John Canevari & Prof. Mahmood Hameed

- Led 7 members to develop an iOS mobile app helping SCD patients find their best-matched providers and get support from online communities
- Conducted research on Patient Personas, User Journey, and User Flow to design UX/UI prototypes via Figma
- Created dummy patient/clinic data with OPENAI API and designed a match algorithm with XGBoost

SERVICE & LEADERSHIP

Student Volunteer: UIST 2025

Leadership: Vice Minister, Navigators Abroad Society (2020-2022); Class Monitor, iArt (2020-2023)