# Zhiyu Jia

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## Research Interests

My research interest focuses on using multimodal, wearable, and environment-embedded sensing technologies to continuously and reliably interpret human motion, physiology, and intent in different scenarios. I aim to build natural, personalized, and embodied interaction systems grounded in a deep understanding of the body's dynamic processes.

## Education

**University of Michigan**  —  Ann Arbor, MI
*M.S. in Electrical and Computer Engineering*  —  *Aug 2024 – Present*
*Advisor: Prof. Junyi Zhu*  —  *GPA: 4.0/4.0*

**Southeast University**  —  Nanjing, China
*B.Eng. in Information Engineering*  —  *Sep 2020 – Jun 2024*
*Advisor: Prof. Zhijun Zhou*  —  *GPA: 3.73/4.0*
*Concentration: Signal Processing, Embedded Systems, Human-centered sensing*

## Research Experience

**Driver State Monitoring with Multi-modal Sensors**  —  Ann Arbor, MI
*University of Michigan – The Sensing, Intelligence and eXperience (SIX) Lab*  —  *Jul 2025 – Present*
*Advisor: Prof. Junyi Zhu*

- Developing a multi-modal sensing framework that combines IMU, EMG, and mmWave radar with vehicle data to infer driver physical and cognitive states such as fatigue and stress during real driving conditions.
- Integrating EMG electrodes into seat fabrics through smart-textile design to measure shoulder and back muscle activity, ensuring stable contact and driver comfort.
- Designing and fabricating custom 3D printed enclosures for sensor and control modules to enable reliable installation and consistent data collection in the vehicle environment.
- Investigating correlations between driver states and vehicle behavior to support adaptive driver-assistance feedback and advance human-vehicle interaction research.

**EIT Based Sensing Platform**  —  Ann Arbor, MI
*University of Michigan – The Sensing, Intelligence and eXperience (SIX) Lab*  —  *Feb 2025 – Present*
*Advisor: Prof. Junyi Zhu*

- Developing a real-time signal-processing and calibration pipeline that integrates band-pass filtering, feature extraction, and automatic current-source tuning to stabilize impedance measurements and improve overall signal quality.
- Building a systematic testing framework to evaluate measurement accuracy and verify the platform's impedance-detection capability up to the mega-ohm range.
- Evaluating AD5941 as a potential replacement for the current front-end by identifying limitations in the current platform and conducting targeted experiments to assess its practical viability, supporting future hardware optimization.

**Multi-modal Breath Detecting System for Respiratory Monitoring**  —  Nanjing, China
*Southeast University*  —  *Oct 2023 – Jun 2024*
*Advisor: Prof. Zhijun Zhou*

- Developed a multi-modal respiratory-sensing system that combines bio-impedance, thoracic strain sensing, and respiratory air-pressure signals to enable robust breathing-rate estimation across different conditions and activities.
- Designed a complete signal-processing pipeline that applies adaptive filtering to clean raw multi-modal signals and a custom peak point extraction algorithm to automatically identify respiratory cycles, resulting in significantly improved robustness and accuracy
- Conducted user studies to evaluate cross-modality consistency and validate the accuracy of the proposed detection method across diverse breathing patterns.

## Selected Project

**Thermal Camera Based Bat Movement Tracking**                                      **Ann Arbor, MI**
*University of Michigan – EECS 507 Research for Embedded System*                    *Aug 2025 – Present*

- Evaluating the feasibility of using thermal cameras to track temperature-contrast tags for bat-movement monitoring through controlled experiments varying motion speed and distance.
- Comparing thermal and RGB camera tracking results to identify conditions where thermal sensing provides improved detection stability or reduced visual ambiguity.

**Low-Power In-Memory INT4 RISC Microprocessor**                                    **Ann Arbor, MI**
*University of Michigan – EECS 427 VLSI Design I*                                   *Jan 2025 – May 2025*

- Built a 16-bit RISC microprocessor with an in-memory INT4 MAC unit for low-power edge computing.
- Designed SRAM-based compute arrays and extended ISA support for accelerator integration.

**Out-of-Order RISC-V Processor**                                                   **Ann Arbor, MI**
*University of Michigan – EECS 470 Computer Architecture*                           *Aug 2024 – Dec 2024*

- Implemented a superscalar out-of-order RISC-V core with branch prediction and load/store forwarding.
- Performed cycle-accurate simulation and synthesis to evaluate microarchitectural performance.

**Adaptive-Pruning Vision Transformer Accelerator**                                 **Ann Arbor, MI**
*University of Michigan – EECS 598 VLSI for Machine Learning & Communication*       *Aug 2024 – Dec 2024*

- Developed a hardware accelerator for Vision Transformers supporting adaptive pruning for efficient inference.
- Optimized systolic-array datapaths and developed advanced Softmax and GELU modules.

**Autonomous Electromagnetic Sensing Vehicle**                                      **Nanjing, China**
*Southeast University*                                                              *Oct 2021 – Oct 2022*

- Integrated electromagnetic sensing with a custom analog front-end for posture and location detection.
- Developed embedded PID control software enabling autonomous navigation across varied terrains.

## Academic Experience

**Grader, ECE 501 – Probability and Random Processes**                              **Ann Arbor, MI**
*University of Michigan*                                                            *Aug 2025 – Present*

- Supported a graduate-level core course by grading problem sets and providing constructive feedback to help students strengthen their understanding.

## Skills

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| **Programming:** | C, C++, Python, MATLAB, Arduino, Verilog/SystemVerilog, LaTeX |
| **Signal Processing:** | Real-time data acquisition, signal filtering, signal extraction, signal analysis |
| **Hardware:** | PCB design and prototyping, analog front-end debugging, sensor integration |
| **Machine Learning:** | Classical classifiers, model training and evaluation |
| **Tools & Instrumentation:** | Oscilloscope, signal analyzer, 3D printing, laser cutting, sewing & embroidery machine |

## Honors and Awards

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| **Sienhua New and TsuWay Shen Memorial Award Scholarship,** *University of Michigan* | *2024 – 2025* |
| **Zhishan Merit Scholarship,** *Southeast University* | *2022 – 2023* |
| **Jing Ye and Fang Liu Scholarship,** *Southeast University* | *2021 – 2022* |
| **Zhishan Merit Scholarship,** *Southeast University* | *2021 – 2022* |
| **Outstanding Student Award,** *Southeast University* | *2020 – 2021* |