# Lingkai(Harry) Zhao

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## Objective

Professional position in computer engineering or computer science.

Special interests in CPU/GPU/system architecture design, verification, or research.

## Education

**University of Wisconsin – Madison**

**B.S. Computer Engineering, B.S. Computer Science, and B.S. Data Science**

- Cumulative GPA: 3.978/4.000
- Expected Graduation: May 2023

**Specialized Coursework:**

Advanced Computer Architecture I (grad-school-level course), Computer Graphics, Digital System Design & Synthesis, Matrix Methods in Machine Learning, Intro to Algorithms, Intro to Database Management, Intro to Operating Systems

## Engineering Experience

**University of Wisconsin-Madison** September 2022 – present
**Undergraduate Student Assistant**

- Helped students to engage and solve engineering problems in Digital System Fundamental Course (ECE 352)
- Assisted the instructor of the course in managing the course.

**Western Digital**, Rochester, MN January 2022 - August 2022
**FTL Firmware Engineer co-op**

- Assisted with developing next-generation enterprise Solid State Drives (SSD) and collaborations with hardware/software engineers from around the world.
- Debugged, verified, and optimized the performance of SSD from the perspective of Flash Translation Layer (FTL).

**Binaural Hearing and Speech Lab**, Madison, WI March 2020 - January 2022
**Research Laboratory Assistant**

- Used MATLAB to analyze collected acoustic data, explicitly analyzing listeners' performance on sound localization ability with two cochlear implants. Used Machine learning to help classify the listener responses.
- Joined this lab because I am deaf in both ears, but I can hear and speak normally with the help of cochlear implants. I want to use my knowledge and engineering skills to help other people in need by doing research related to hearing and speech.

**ArdenVent**, Hobsonville, Auckland, New Zealand (Remote) October 2020 – March 2021
**Volunteer Software Engineer**

- Designed a program for display on ventilator to interact with the doctors and programmers. This company aimed to help countries that cannot afford expensive ventilators by designing their affordable ventilator to fight COVID-19 worldwide.

## Activities & Achievements

Hackathons: MadHack in 2019, HackMIT in 2020 and 2022
Tau Beta Pi Honor Society membership
Received the David Dewitt Scholarship for academic excellence in Computer Science. It is the top undergraduate honor offered by the Computer Science Department.

## Research Report & Paper

**Topic**

Solve Acoustic Study Problems using Programming and Machine Learning

**Public Presentation**

Presented at the Midwest Mini-Conference on Cochlear Implants & Mid-Atlantic Symposium on Hearing

**Publication in progress**

Dennison, S. R., Zhao, H., Kan, A., & Litovsky, R. Y. (n.d.). The effect of coordinated interaural peak-picking on the auditory motion tracking ability of bilateral cochlear implant users. In prep.

**Research Report**

- Analyze And Visualize Auditory Motion with Matlab and Machine Learning
- Use Machine Learning Classification to Distinguish Sound Direction and Location
- Analysis Of Audio Files Collected with Research Cochlear Implant Sound Processors, including Interaural Coherence Analysis

## Selected Projects

**Hardware**

- Designing an FPGA-GPU to design and simulate a GPU. The goal is to output a VGA output and play simple arcade games. Planning to finish this project before graduation.
- Designed a single-core five-stage pipelined CPU written in Verilog. It executed the 16-bit WISC-SP13 ISA (an ISA like MIPS). Designed a direct-mapped cache for this CPU. Synthesized the system on the Synopsys DC compiler with FreePDK 45nm standard cell library. Verified the functionality with a test suite of ISA instructions. Analyzed the performance of this pipelined CPU with another single cycle CPU. A four-banked memory system that hides the sequential read/write latency by doing asynchronized read/write.
- Programmed an FPGA robot to follow black lines on the track with System Verilog. This program read the response of IR sensors and controlled the motor PWD output with PID control based on the error of the IR readings. The functionality is validated with ModelSim by observing the robot's behavior when an error is introduced.
- Smart Home Hub PCB design – Designed a PCB board for a smart home hub. This board included a display, an environment sensor, a microphone, a buzzer, and a Bluetooth module. Responsible for component selection, layout design, and validation

- Programmed a game, DinoJump (reversion of Doodle Jump), on TI-MSP432R. Programmed this application with C based on FreeRTOS. Access gyroscope, buttons, light sensors and etc. through a customized library made with the specification sheet of TI-MSP432R. The library maps the GPIO pins to control these peripherals.

**Software**

- Used Neural Network to train self-collected data set for object tracking. Used Jetson TX2 as the processor for vision processing to capture the desired object in real time. This technique was used for the FRC Robotics competition to self-track the target object and used PID control to approach the desired location fast and accurately. Programmed in Java and C++. Dedicated to this team for three years.
- Implemented a page buffer manager(cache) in C. It acts like a cache for pages, using the clock algorithm for eviction. (Approximately LRU).
- Implemented a heap system with dynamic coalescing and following fit policy in C. It simulated the behavior of a heap system, including malloc and free. Used dynamic coalescing to reduce fragmentation.
- Implemented a database system with B-tree in C++. This database features bulk-loading JSON files, insert, read, and delete functions. It is constructed in a B-tree structure for best access time efficiency.

## Skills

**Programming Skills**

C, C++, MATLAB, Java, Python, Swift, JS, SQL

**Programming Tools**

Git, VS Code, ModelSim, LabVIEW, Altera Quartus, Pcbnew

**Computer Platforms**

Windows, Linux, OS X

**Hardware**

Hardware System Verilog, Synthesis Tools, VHDL, FreeRTOS

**Language**

Chinese, English