Yanghonghui Chen

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EDUCATION

University of Illinois Urbana-Champaign Urbana US
Bachelor of Science in Electrical Engineering - GPA: 3.88/4.0 September 2021 - now
Zhejiang University Haining China
Bachelor of Engineering in Electrical Engineering - GPA: 3.95/4.0 September 2021 - now
Relevant coursework: Neural Interface Engineering (A), Neural Circuits and Systems (A+), Embedded DSP Laboratory (A+), Digital Signal Processing (A), IoT and Cognitive Computing (A), Probability with Engineering Applications(A)
In progress: Applied Parallel Programming, Machine Learning, Control Systems

RESEARCH EXPERIENCES

Optimized Convolutional Layer Implementation Using CUDA
Course Project (Advisor: Prof. Volodymyr Kindratenko) October 2024 - December 2024
***Keywords**: CUDA, Parallel programming, GPU acceleration, Convolutional neural networks (CNNs)*

- Designed and implemented the forward pass of convolutional layers for a modified LeNet-5 architecture using CUDA, optimizing performance for deep learning tasks such as image classification and object detection.
- Implemented a GPU-based forward convolution with a structured Prolog-Kernel-Epilog approach, ensuring memory management, convolution computation, and output transfer, while matching CPU implementation correctness and optimizing performance using Nsight profiling tools.
- Applied advanced GPU programming techniques to optimize the implementation, including streams, GEMM kernels, and kernel fusion, to achieve a target inference time of ≤80ms for 10,000 images from the Fashion MNIST dataset.

RRAM-based Heterogeneous Processing for Multimodal Brain-Computer Interfaces
The University of Hong Kong (Advisor: Dr. Zhengwu Liu) May 2024 - July 2024
***Keywords**: RRAM, Multimodal brain-computer interface, EEG, Compute-in-memory, FDT*

- Simulated representative heterogeneous processing paradigm of P300 signal recognition in Python by using resistive random-access memory (RRAM) with and without fixed parameter disturbance training (FDT).
- Contributed to combining the BCIC IV IIa and the P300 RSVP datasets and designing an RRAM-based multimodal recognizer that integrates components of the pre-trained EEGNet, CSP (Common Spatial Pattern), and a modality-fused classifier to create the multimodal settings.
- Achieved 2.83% higher accuracy using multimodal BCI with FDT than that without FDT and significantly outperformed the MI-alone and P300-alone results by 8.19% and 13.20%, respectively.

Raspberry Pi Based IoT System as a Private Chatbot
Course Project (Advisor: Prof. Deming Chen) March 2024 - May 2024
***Keywords**: IoT System, Raspberry Pi, Machine Learning, Deep Learning*

- Developed an IoT system using Raspberry Pi 4 as a private chatbot with face detection and speaker recognition to guarantee privacy and personal conversations as well as interactions.
- Implemented MTCNN with ResNet and dlib-based face recognition, achieving better performance with the latter; trained the system with one hundred face images for live recognition.
- Built a custom residual neural network with Keras for speaker recognition, achieving 96% accuracy.
- Integrated a server-client architecture using Google Cloud for accelerated processing and implemented speech recognition and TTS for user interaction.

Multiplayer Action Game on FPGA: Crazy Arcade
Course Project (Advisor: Prof. Zuofu Cheng) March 2024 - May 2024
***Keywords**: SystemVerilog, FPGAs, System-on-a-chip, MicroBlaze CPU, VGA*

- Used FPGA for real-time operations, integrating MicroBlaze CPU for game logic and keyboard input processing.
- Developed various modules in SystemVerilog to manage player movements, bomb mechanics, life counts, and game states, interacting through a system bus.
- Incorporated background music by PWM for sound generation, featuring distinct tracks for different game stages.

Cheat-Machine for Game 2048
Course Project (Advisor: Prof. Thomas Moon) March 2024 - May 2024
***Keywords**: Embedded DSP, Real-time Signal Processing, Image Processing, Android Studio*

- Developed an app in Android Studio to analyze a live game of 2048, recognizing board digits using image processing.

- Employed efficient template matching for multi-digit recognition, using grayscale conversion, Canny edge detection, and perspective transformation to preprocess images. Used python packages to evaluate the workflow of the application.
- Built an AI engine with an Expecti-max Search algorithm to recommend the optimal move, focusing on corner placement strategies.
- Achieved high accuracy in digit recognition (100% when properly aligned) and consistent AI performance, reaching 1024 tile in 75% of simulations.

Simulating Neuron Circuit Design

Course Project (Advisor: Prof. Jont Allen) December 2023

***Keywords**: Neuron Simulation, Hodgkin-Huxley Model, Circuit Simulation*

- Designed an electronic circuit based on the Hodgkin-Huxley model to simulate neuron action potentials.
- Conducted electrical pulse stimulation to observe and analyze neuronal signaling pathways.
- Optimized circuit performance by adjusting component parameters to achieve clear action potential observations.

Hook&Hair Structure 3D-Printing based on Path Control and 4D Printing Experiment Exploration

Zhejiang University (Advisor: Prof. Guanyun Wang) June 2023 - August 2023

***Keywords**: 3D printing, Grasshopper, Rhino, FDM, Path-planning, 4D printing*

- Developed 3D printing techniques for complex hook and hair structures using Rhino and Grasshopper for path planning, generating G-codes for customized printing paths instead of traditional FDM (Fused Deposition Modeling) methods.
- Accomplished applications including hooked ball-mitten toys and hairy objects, requiring precise path control to avoid defects and achieve intricate designs.
- Conducted experiments in 4D printing, modeling deformable planar objects in Fusion360 that transform into stereoscopic shapes when heated.

Over-the-Air-Computation Based Federated Learning Model Establishment & Simulation

Zhejiang University (Advisor: Prof. Howard Yang) April 2022 - April 2023

***Keywords**: Edge Computing, Federated Learning, OFDM, Over-the-air Computing, Simulink, Machine Learning, Neural Networks*

- Explored an innovative approach to utilizing private data from distributed databases to train shared models, ensuring user privacy while making use of the data.
- Set up an over-the-air-computation-based communication model in Simulink which could transmit and receive massive data gradients between federated users effectively.
- Combined Machine Learning models like Linear Regression and Deep Learning models like neural networks in MATLAB codes with communication models in Simulink to implement effective edge-computing models.
- Improved the model to adapt to the Large-scale applications by exploiting and modifying existing OFDM Communication Systems.

HONORS

Dean's List (Top 20%)	*UIUC*	Fall 2023
Scholarship from Zhejiang University (Top 8%)	*Zhejiang University*	2021-2022, 2022-2023 and 2023-2024 Academic Years
Academic Excellence Award	*Zhejiang University*	2021-2022, 2022-2023 and 2023-2024 Academic Years
Outstanding Performance in Social Work Award	*Zhejiang University*	2021-2022 Academic Year
Recognition for Outstanding Performance, 2022 Undergraduate Summer Research Program	*Zhejiang University*	Summer 2022
Recognition for Academic Poster Exhibition, 2022 Undergraduate Summer Research Program	*Zhejiang University*	Summer 2022

SKILLS

Programming Languages: Python, C/C++, MATLAB, System Verilog, CUDA, LC-3 assembly
Softwares: Visual Studio Code, Jupyter Notebook, MATLAB, Rhino, Android Studio
Hardwares: 3D Printing, PCB design

EXTRA-CURRICULAR ACTIVITIES

Drone Club *Zhejiang University* September 2021 - now

- Collaborated with a diverse team to design and develop an autonomous drone.
- Led the mechanical group, honing skills in manufacturing drone components using carbon fiber.

Illinois Space Society *University of Illinois at Urbana-Champaign* September 2023 - May 2024

- Built my own L1 rocket from designing the rocket structure in Open Rocket, modeling and 3D printing the nosecone & fin sets, installing all the parts, and evaluating the functionality to the final launch.