Haoqin Deng

Phone: (+1)3107436278(US); (+86)13861785871(China) | Email: haoqinde@usc.edu

Education

University of Southern California (USC), Viterbi School of Engineering Aug 2017 - May 2022
- Undergraduate program: Bachelor of Science in Electrical and Computer Engineering
- Graduate program: Master of Science in Electrical Engineering
- GPA: 3.68/4.0 (Undergraduate); 4.0/4.0 (Graduate)

Relevant skills:
- **Programming languages:** C/C++, Python, Java, Verilog
- **Tools & Softwares**: PyTorch, Qiskit, pyQpanda, Cadence, ModelSim, Comsol,

Research Experiences

BioRC Project

*Research Assistant, supervised by **Prof. Alice Parker*** *Jun 2021 - present*
- Developed VLSI circuits of excitatory/inhibitory synapse, Axon Hillock, STDP-dopamine-noise synapse, dendritic spiking, edge detector, voltage adder
- Constructed hardware & software multi-layer neural networks incorporating local STDP update and global dopamine modulation, using Cadence & Python
- Currently developing a PyTorch library that
  - allows for convenient construction of software neural network for training & verification purpose
  - synthesizes VLSI circuits corresponding to software neural network model for deployment purpose

Khajavikhan Optics and Photonics Group

*Research Assistant, supervised by **Prof. Mercedeh Khajavikhan*** *Jun 2021 – present*
- Researched on various architectures of Optical Neural Network(ONN), with an emphasis on chip-integrable setups
- Proposed and developed PT-ONN architecture with cascading PT-symmetric couplers, based on modulations of gain/loss contrast; implemented simulations of on-chip training of PT-ONN using finite difference method with python; achieved 67% training accuracy on MNIST
- Worked on ewbm simulations of directional couplers in COMSOL; calculated system transfer matrix of PT couplers with Mathematica
- Reproduced on-chip training of MZI-based ONN with python; achieved 71% training accuracy on MNIST

USC Laboratory for Photons, Electrons and Materials

*Research Assistant, supervised by **Prof. Rehan Kapadia*** *Jun 2020 – Jan 2021*
- Researched on various architectures of mapping ANN/SNN onto hardware using semiconductor devices that mimic functions of synapses, neurons
- Simulated a temporal-encoded convolutional SNN on MNIST digit recognition task with PyTorch and GPU acceleration, incorporating InP-synapse STDP parameters; achieved 89% accuracy
- Simulated a rate-encoded SNN on MNIST digit recognition task with PyTorch and GPU acceleration, incorporating InP-synapse STDP parameters, with 71% accuracy
- Collaborated on designing Arduino/breadboard implementation of neural networks, utilizing a crossbar array of InP transistors
- Grew InP on GaAs using Low-Temperature Templated Liquid-Phase(LT-TLP) technique

USC ALCHEM Lab

*Research Assistant, supervised by **Prof. Xuehai Qian*** *May 2019 – Sept 2020*
- Developed Accelerating Quantum Optimal Control (accQOC), a comprehensive compilation methodology that accelerates pulse generation by 9X:
  - partitioned DAG of quantum circuit into sub-components under size constraint
  - generated optimized pulse for each component using QOC

    - balance partitionioned MST computing nodes for efficient parallel computation, using METIS
- Worked on optimization of VQE(Variational Quantum Eigen-solver) algorithm:
    - self-implemented VQE circuits with pyqpanda
    - optimized VQE measurement overhead through joint measurement of commuting Hamiltonians, projecting LI basis terms onto qubit computational basis using stabilizer formalism
    - attempted pulse-level optimization of VQE circuits using Qiskit open-pulse and QOC

USC IMEDE Lab

*Research Assistant, supervised by **Prof. Manual Monge*** *Mar 2019 – Mar 2020*

- Collaborated on designing a neural-signal sampling device
- Realized data transfer between FPGA and PC using Opal-Kelly's API; implemented SPI protocol to transfer data between FPGAs; visualized data on PC end with matplotlib library

Publications

- Jinglei Cheng, **Haoqing Deng**, and Xuehai Qian. "Accqoc: Accelerating quantum optimal control based pulse generation." *2020 ACM/IEEE 47th Annual International Symposium on Computer Architecture (ISCA)*. IEEE, 2020.
- **Haoqin Deng**, Mercedeh Khajavikhan. "Parity-time symmetric neural network." submitted to Optica, under review.

Internships:

Shanghai AIKE Measurement Co. *Jul 2018 – Aug 2018*

- Learned to use Labview to sample data and control hardware
- Automate a printer to print labels on a pipeline using Labview
- Assisted in designing the structure of a dispenser for lab usage

Hackthones:

Mobile App: Go Eat *LA Hacks 2019*

- Developed a cross-platform app that recommends restaurants based on users' preferences
- Developed KNN and genetic models to recommend restaurants given users' and restaurants' features
- Implemented data fetching as storage using Firebase

Desktop Game: Mind Palace *LA Hacks 2020*

- Developed a game that trains players'"Mine Palace" mnemonic technique
- Designed game stages and implemented them with SDL library
- Extracted key information from sentences with Google Cloud API for grading purpose

Class Projects:

CMOS VLSI

- Implemented a 32 bit MAC unit with Brent-kung Adder and Array Multiplier
- Created schematics and drew layouts using Cadence

Parallel Programming

- Developed grayscale-to-color image conversion using CNN
- Converted python model into C++ model using keras2cpp library
- Parallelized convolution-layer computation using OpenMP and Pthread library

Video Game Programming

- Implemented 2D classical Arcade games such as Zelda, Super Mario, PAC-MAN
- Implemented 3D games such as Mario Cars, FPS, Parkor game
- Programmed game engines using C++ and SDL libraries

FPGA Arcade Game "SPLATOON"

- Designed a 2D-board Splatoon game that runs on a Xilinx FPGA Spartan 6, implemented with Verilog
- Integrated joystick module for user control and VGA module for image display

Web Game "Mission Universe"

- Created a web-based, multiplayer jet-fighting game, using HTML, JavaScript, Java
- Utilized Phaser API to construct game elements and WebSocket to transmit data in multiplayer mode

Home Light System IoT Project

- Developed a remote light control system running on Raspberry Pi
- Fetched data from light sensor and transmit it through OpenMote
- Utilized MQTT library to transmit data and control illumination

Code Compiler

- Implemented a compiler that parses a realistic program into tree structure, with Bison and C++
- Generated assembly language and computed values of variables and memories

Accelerometer

- Developed an accelerometer running on Arduino
- Integrated a rotary encoder to set threshold and a buzzer to present speed, controlled by interrupt