

Kyle Daruwalla

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Education

- 2016 – 2022 **Ph.D. in Electrical Engineering**,
University of Wisconsin, Madison WI, GPA – 3.79.
- 2016 – 2019 **M.S. in Electrical Engineering**,
University of Wisconsin, Madison WI, GPA – 3.79.
- 2012 – 2016 **B.S. in Computer Engineering and Continuous Applied Mathematics**,
Rose-Hulman Institute of Technology, Terre Haute IN, GPA – 3.65.
Magna Cum Laude

Publications

- Nov. 2021 **Accelerating Deep Learning with Dynamic Data Pruning**, *Preprint under review.*
Authors: R. S. Raju, K. Daruwalla, M. Lipasti
- Sep. 2021 **Information Bottleneck-Based Hebbian Learning Rule Naturally Ties Working Memory and Synaptic Updates**, *Preprint.*
Authors: K. Daruwalla, M. Lipasti
- Nov. 2019 **BitSAD v2: Compiler Optimization and Analysis for Bitstream Computing**, *ACM Transactions on Architecture and Code Optimization (TACO).*
Authors: K. Daruwalla, H. Zhuo, R. Shukla, M. Lipasti
- Jun. 2019 **BitBench: A Benchmark for Bitstream Computing**, *Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES '19).*
Authors: K. Daruwalla, H. Zhuo, C. Schulz, M. Lipasti
- Jun. 2019 **Resource Efficient Navigation Using Bitstream Computing**, *First ISCA Workshop on Unary Computing (WUC '19).*
Authors: K. Daruwalla, M. Lipasti
- Jun. 2019 **BitSAD: A Domain-Specific Language for Bitstream Computing**, *First ISCA Workshop on Unary Computing (WUC '19).*
Authors: K. Daruwalla, H. Zhuo, M. Lipasti
- Jan. 2019 **A quantitative analysis of the performance of computing architectures used in neural simulations**, *Journal of Neuroscience Methods.*
Authors: K. Daruwalla, N. Olivero, A. Plugger, S. Rao, D. W. Chang, M. Simoni

Academic Experience

Research

- Aug. 2022 – **NeuroAI Scholar**, *Cold Spring Harbor Laboratory*, Long Island, NY.
Present Working on improving machine learning and artificial intelligence techniques using observed behavior from neuroscience. More details to follow.
- Sept. 2016 – **Research Assistant**, *University of Wisconsin – Madison*, Madison, WI.
June 2022 Worked on:
- stochastic computing algorithms and paradigms
 - biological learning mechanisms (eg. Hebbian learning, STDP)
 - non-traditional architectures to facilitate low-power, online learning
- Studied:
- machine learning
 - biological learning/computational neuroscience
 - computer architecture
- 2014 – 2016 **Research Assistant**, *Rose-Hulman Institute of Technology*, Terre Haute, IN.
Developed configurable architecture for simulating Hodgkin-Huxley neural systems.

Detailed work:

- Identified computational bottle necks in solving differential equations that described the neural model
- Used numerical analysis techniques to optimize computation of bottle necks
- Designed specialized hardware units to further optimize computation of bottle necks
- Synthesized, implemented, and programmed hardware units to FPGAs for efficiency analysis
- Co-authored papers on numerical techniques and specialized hardware designs

Teaching

- Sept. 2021 – **ECE252: Intro. to Comp. Eng. Lecturer**,
Present *University of Wisconsin – Madison*, Madison, WI.
Independently responsible for instructing a course section on introductory material for computer engineering.
Detailed work:
- Teaching in flipped class room setting without TA help
 - Gives lectures to reinforce material learned in flipped setting
- Sept. 2018 – **ECE532: Matrix Methods for ML Teaching Assistant**,
Aug. 2019 *University of Wisconsin – Madison*, Madison, WI.
Instructed flipped class room course on linear algebra and machine learning.
- Sept. 2017 – **ECE315: Intro. to Microprocessor Laboratory Teaching Assistant**,
Dec. 2018 *University of Wisconsin – Madison*, Madison, WI.
Instructed lab course on designing, assembling, and programming a printed circuit board.
Detailed work:
- Performed duties of sole instructor during class hours
 - Helped develop material and teaching strategy for a new course
 - Managed lab equipment and coordinates student purchases from suppliers
- Jan. 2017 – **ECE353: Intro. to Microprocessor Systems Teaching Assistant**,
May 2018 *University of Wisconsin – Madison*, Madison, WI.
Taught as an in-class TA for a flipped-classroom course on embedded systems.

- March 2016 – **ECE530: Advanced Microcomputers Teaching Assistant**,
May 2016 *Rose-Hulman Institute of Technology*, Terre Haute, IN.
Assisted as lab TA for a graduate class on designing microcomputer systems on Dual ARM/FPGA boards.
- March 2014 – **CSSE332: Operating Systems Teaching Assistant**,
May 2014 *Rose-Hulman Institute of Technology*, Terre Haute, IN.
Assisted as lab TA for a class on designing operating systems.

Presentations

Oral

- Feb. 2022 **Building Energy-Efficient Computers**,
Invited talk: *Cold Spring Harbor Lab NeuroAI Seminar*, Long Island, NY.
- Jan. 2020 **BitSAD v2: A Domain-Specific Language for Bitstream Computing**,
High-performance Embedded Architecture and Compilation Conference (HiPEAC '20), Bologna, Italy.
- Oct. 2019 **BitSAD v2**,
Industry Affiliates Meeting, Madison, WI.
- Jun. 2019 **Resource Efficient Navigation Using Bitstream Computing**,
First ISCA Workshop on Unary Computing, Phoenix, AZ.
- Jun. 2019 **BitBench: A Benchmark for Bitstream Computing**,
Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES '19), Phoenix, AZ.
- Oct. 2018 **BitSAD: A Domain-specific language for Bitstream Computing**,
Industry Affiliates Meeting, Madison, WI.
- Oct. 2017 **Seeing Through the FoG: A Biologically Inspired Navigation System**,
Industry Affiliates Meeting, Madison, WI.

Poster

- Nov. 2021 **A Biologically Plausible Learning Rule Based on the Information Bottleneck**,
Spiking Neural networks as Universal Function Approximators (SNUFA '21), Virtual.
- Oct. 2019 **BitSAD v2**,
Industry Affiliates Meeting, Madison, WI.
- Jun. 2019 **BitBench: A Benchmark for Bitstream Computing**,
Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES '19), Phoenix, AZ.
- Oct. 2018 **BitSAD: A Domain-specific language for Bitstream Computing**,
Industry Affiliates Meeting, Madison, WI.
- Oct. 2017 **Seeing Through the FoG: A Biologically Inspired Navigation System**,
Industry Affiliates Meeting, Madison, WI.
- Nov. 2016 **Drone Control with Map-Seeking Circuits**,
Industry Affiliates Meeting, Madison, WI.

Industry

Jun 2020 – **Research Co-op Intern, AMD, Austin, TX.**

Dec 2020 Explored neural network sensitivity to input perturbations.

Detailed work:

- Characterized neural network sensitivity to input perturbations based on matrix decompositions of the parameters
- Worked on an independently driven research project
- Presented progress to AMD Research team

May 2017 – **Digital Design Intern, Texas Instruments, Dallas, TX.**

Aug 2017 Performed IP design for multimedia IPs.

Detailed work:

- Fully responsible for designing two video encoding IPs – H.264/265 video encoder and decoder
- Worked with SoC designers to make IP functionality and black box model compatible with overall architecture
- Worked with third party IP vendors to relay issues and RTL fixes
- Automated tools and flows used by design team, and created documentation for the toolsets

June 2016 – **Digital Design Intern, Texas Instruments, Dallas, TX.**

Aug 2016 Performed design verification for high speed I/O IPs.

Detailed work:

- Interfaced with designers to debug RTL issues and modify IP specs
- Worked with third party vendors to debug integration issues
- Helped develop and improve internal IP library
- Created flow to replay third party vendor test sequences in internal environment, greatly reducing design verification timeline

Sept 2015 – **Project Intern, Rose-Hulman Ventures, Terre Haute, IN.**

May 2016 Worked with project team to design various products for several clients.

Detailed work:

- Interfaced with clients on a regular basis through face-to-face and telecom meetings
- Helped clients understand requirements within technical limitations
- Assisted clients to develop an efficient path to meet product deadlines
- Optimized image processing code for corn stalk detection
- Researched radar systems for FPGAs
- Converted traditional radar algorithms for DSPs to FPGAs

June 2015 – **Digital Design Intern, Texas Instruments, Dallas, TX.**

Aug 2015 Performed design verification for high speed I/O IPs.

Detailed work:

- Designed workflows and simulation environments for design verification engineers
- Performed design verification for different IP modules
- Organized and led team meetings
- Produced documentation for IP design verification workflows
- Worked with management, designers, and design verification engineers

- Sept 2013 – **Project Intern**, *Rose-Hulman Ventures*, Terre Haute, IN.
May 2015 Worked with project team to design various products for several clients. Contact for details.
- Sept 2012 – **EE Shop Assistant**, *Rose-Hulman Ventures*, Terre Haute, IN.
Sept 2013 Performed various duties as EE shop assistant at engineering solutions firm. Contact for details

Awards

- Sept. 2021 Second place – AFRL xView2 Overhead Imagery ML Hackathon
May 2018 Gerald Holdridge Teaching Excellence Award
Feb. 2016 Honor Student Award
Undergrad Made the Dean's List every quarter

Service and Leadership

- 2021 – 2022 Graduate student representative on departmental committee – Advises faculty members on graduate concerns relevant to the department
2021 – 2021 Google Summer of Code Mentor – Co-mentored an undergraduate student project building machine learning frameworks
2019 – 2020 Vice-President of ECE Graduate Student Association – Assisted with presidential duties, plans events
2017 – 2019 President of ECE Graduate Student Association – Coordinated meetings, events, and acted as face of graduate student body in the department
2012 – 2016 President of Linux Users Group – Gave presentations, organized meetings, interfaced with administration
2014 – 2016 Operations Manager of Rose Tech Radio Club – Took inventory of equipment, organized presentations on ham radio, interfaced with local community organizations
2015 – 2016 Founder of Rose Maker Lab – Coordinated with administrative and safety personnel to create a novel club benefitting all students in the Rose-Hulman community

Hardware Skills

- Basic Semiconductor fabrication
Intermediate Analog IC layout, VLSI
Advanced FPGA development, digital design verification, design for test (DFT)

Software Skills

- Basic Windows development, HTML
Intermediate Python, Java, VHDL, Scala, Csh
Advanced Verilog, SystemVerilog, C/C++, Matlab, Linux, Bash, \LaTeX , Julia