Karthi Srinivasan

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Education

Bachelor of Technology + Master of Technology **Jul 2017 - Present**

Department of Electrical Engineering, Indian Institute of Technology, Madras

CGPA: 9.14/10.00

Research Interests: Neuromorphic Computing, Analog Design, Neuroscience

Relevant Courses: Neuromorphic Computing, Computational Neuroscience, Analog IC Design, RF IC Design, Information Theory, Convex Optimization, Nonlinear Control, VLSI Data Conversion Circuits, LPTV Systems Analysis, Phase Locked Loops

Research Experience

Master's Thesis Project

Unsupervised Learning in Spiking Neural Networks **Sep 2021 - Present**

Indian Institute of Technology, Madras

Guide: Prof. Bhaswar Chakrabarti

- Exploring the use of lateral inhibition in shallow spiking neural networks to create self-organizing maps.
- Designing SNN models for low-power classification of tactile datasets.

Research Projects

Silicon Retina Chip Design **Aug 2021 - Present**

Johns Hopkins University, Baltimore

Guides: Prof. Andreas Andreou, Prof. Gert Cauwenberghs

- Designing and implementing analog circuits for a silicon retina using open-source tools.

Legendre Memory Units for Silicon Cochleas **Jul 2021 - Sep 2021**

University of Waterloo

Guide: Dr. Terrence C. Stewart

- Implemented and tested LMU networks on audio and spiking datasets (tonic datasets, ST-MNIST).
- Implemented winner-take-all mechanisms for emulation of cochlear processing.
- Network is to be used in a silicon cochlea for the SSCS PICO Design Contest 2021. [GITHUB]

Izhikevich Neuron CMOS Circuit Design **May 2021 - Aug 2021**

Concordia University, Montreal

Guide: Prof. Glenn Cowan

- Designed and implemented a neuron circuit in 65nm CMOS that emulates the Izhikevich neuron model.
- Achieved 12fJ/spike energy consumption, which is a significant improvement over state of the art for biological timescale implementations.
- Manuscript under review at ISCAS 2022. [MANUSCRIPT]

Motion Detection Using Spiking Neural Networks **Dec 2020 - May 2021**

Indian Institute of Technology, Madras

Guide: Prof. Bhaswar Chakrabarti

- Proposed an SNN architecture to detect motion in a 2D visual field.
- Simulated the network using the BRIAN2 simulator on a biological timescale.
- Implemented the network in SPICE, using CMOS LIF neurons and RRAM synapses.
- Manuscript under review at ISCAS 2022. [MANUSCRIPT]

Quasiconvex Relaxations for l_0 Optimization Problems **Jan 2020 - May 2020**

Indian Institute of Technology, Madras

Guide: Prof. Rachel Kalaimani (Course Project)

- Proposed a new algorithm to convert l_0 optimization problems to more tractable quasiconvex forms.
- Implemented the algorithm in MATLAB for an image compression task.
- Demonstrated superior performance compared to conventional l_1 relaxation on some tasks. [REPORT]

Multiple-Output Switching Power Regulator **May 2019 - Jul 2019**
Indian Institute of Technology, Madras
Guide: Prof. Sankaran Aniruddhan
- Designed, simulated, built and tested a constant-on-time based control system, with frequency regulation loop for single-input multiple-output switched mode power supplies.
- Achieved 2mV output ripple at 100 kHz and output ranges from 30% to 70% of input level.

Modular Object Tracking Gimbal **May 2018 - Dec 2018**
Indian Institute of Technology, Madras
Computer Vision and Intelligence Club
- Developed a 3-axis object tracking gimbal system with particle-filter-based object tracking algorithm and cubic time regression.
- Developed the tracking algorithm, mobile app and motor control algorithm.
- Achieved close to state-of-the-art fidelity in non-occluded tracking and good occlusion handling. [GITHUB]

Professional Experience

Teaching Assistant, EE6347: Neuromorphic Computing **Aug 2021 - Present**
Indian Institute of Technology Madras
Instructor: Prof. Bhaswar Chakrabarti
- Presented basic concepts related to SNNs.
- Conducted tutorial sessions on the usage of the BRIAN2 and Nengo simulators. [SLIDES]

Analog Intern, Texas Instruments, Bangalore **May 2020 - Jul 2020**
Manager: Sarangan Valavan
Mentors: Manasa Gadiar, Madhu Sudhan
- Analyzed parametric and multiprobe wafer test programs for two ICs
- Proposed improvements, on the basis of statistical analyses, to the test program to increase efficiency and reduce testing time for these parts.
- Designed a passive high-voltage ESD testing circuit to convert an input IEC standard waveform to the HBM standard waveform while maintaining constant output resistance.
- Simulated the ESD testing circuit in SPICE to verify functionality and compliance with standards. [REPORT]

Awards and Fellowships

MITACS Globalink Research Fellowship **2021**
- The MITACS Globalink Research Fellowship is offered to **meritorious undergraduate or graduate students** from foreign universities to pursue their research at a Canadian university for a period of 12 weeks.

Winner, TATA Makerthon **2018**
- Won a national competition organized at the Indian Institute of Technology Bombay, by the TATA group, to develop a object detection and tracking gimbal system.

Branch Upgrade Awardee **2017**
- Awarded to freshman students with the **highest GPAs** at the end of one semester in each stream to change their stream to one of their choice.

KVPY Fellow **2016, 2015**
- KVPY is a national competitive science examination to select and fund students intending to pursue undergraduate degrees in pure science at IISc and IISER.

National Qualifier, INOI **2015**
- Indian National Olympiad for Informatics is an olympiad that serves as a qualifier to the International Olympiad in Informatics.

Certificate of Merit, HRD Ministry, Govt. of India **2015**
- Awarded for excellent performance in the CBSE Class X Examination, 2015.

Skills and Tools

- **Circuit Design**: Cadence Virtuoso/Spectre, LTSpice, Mentor Graphics Eldo, Verilog HDL, Magic, Xschem, Ngspice, KiCAD, ARM Assembly
- **Programming Languages**: Python, C++, Bash, TeX, Julia
- **Software Tools**: Nengo, BRIAN2, MATLAB, Octave

Extracurricular Activities

Shaastra Super-Coordinator **May 2019-Jan 2020**

- Shaastra is the annual technical festival of IIT Madras.
- Managed a team of 5 coordinators and hosted various competitive events.
- Oversaw events with a total participation of 1,000+.

Convenor, IITM Quiz and Word Games Club **May 2019-May 2020**

- Managed a team of 20 coordinators and hosted intra-institute quizzing and word-games events throughout the academic year.

National Cadet Corps **Aug 2017-May 2018**

- Part of National Cadet Corps, the youth wing of the Indian Armed Forces.
- Recipient of NCC A-Certificate.