

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 SNNs

Sep 2021 - Present

Indian Institute of Technology, Madras

Guide: Prof. Bhaswar Chakrabarti

- Currently performing literature review to identify an area for relevant research contributions.

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. Terry 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 custom neuron circuit in 65nm CMOS that exhibits behaviors shown by the Izhikevich neuron model.
- Achieved 12fJ/spike energy consumption, which is a significant improvement over state of the art for biological timescale implementations.

Motion Detection Using SNNs

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.

Quasiconvex Relations for l_0 Optimization Problems

Jan 2020 - May 2020

Indian Institute of Technology, Madras

Guide: Prof. Rachel Kalpana (Course Project)

- Proposed a new extension to an 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]

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 and 2015:** KVPY is a national competitive science examination to determine 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** received from the **HRD Ministry, Govt. of India** 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:** Shaastra is the annual technical festival of IIT Madras. May 2019-Jan 2020
 - 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 in my first year of college.
 - Recipient of NCC A-Certificate.