

# Sugandha Sharma

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## Education

**PhD Brain and Cognitive Sciences, Massachusetts Institute of Technology** Sept 2018-Present

Co-advised by Professor Ila Fiete and Professor Josh Tenenbaum

**MASc Systems Design Engineering, University of Waterloo** 2016-2018

GPA: 92.50/100, Computational Neuroscience Research Group

Thesis: Neural plausibility of bayesian inference, Advisor: Professor Chris Eliasmith

Proposed a method for representing probability distributions in neural networks and applied it to a life span inference task in a neural network model, showing that the results match human performance better than an ideal bayesian model due to the neural tuning curves. Also proposed algorithms, neural computations and mechanisms for online learning of the priors from life experience.

Courses:

- Computational Neuroscience
- Computational Inference
- Graphical Deep learning
- Cognitive Neuroscience of Memory
- Human Neuroanatomy and Neuropathology

**BASc Electrical Engineering, University of Waterloo** 2010-2015

GPA: 85.59/100, Honours Electrical Engineering, With Distinction, Dean's Honours List.

Design Project: Intelligent Sensation and Eyesight Emulation Unit - an assistive aid for visually impaired.

Award: Baylis Medical Capstone Design Project Award (\$5000 to a group of 4).

Courses:

- Simulating Neurobiological Systems
- Physics of Electrical Eng. 1 and 2
- Calculus 1 and 2
- Advanced Calculus 1 and 2
- Linear Algebra
- Signals and Systems
- Discrete Mathematics
- Probability Theory
- Introduction to Optimization
- Fundamentals of Programming
- Algorithms and Data Structures
- Cooperative and Adaptive Algorithms

## Research Experience

**Visiting Researcher, Stanford Cognitive and Systems Neuroscience Lab** May-August, 2017

Stanford University, California; Advisor: Vinod Menon

- Working paper: Sharma, S., Eliasmith, C., & Menon, V. (2017). A Spiking Neural Model of the Oddball Deviance Detection Task: Sensory Adaptation, Evidence Accumulation, and Relation to the P300 Evoked Response.
- Observed MRI scan sessions (fMRI, rest fMRI, sMRI and DTI).

**Graduate student, Computational Neuroscience Research Group** Jan 2016-Present

University of Waterloo, Ontario; Advisors: Chris Eliasmith, Bryan Tripp

### Publications:

- **Sharma, S.**, Voelker, A., & Eliasmith, C. (2017). A Spiking Neural Bayesian Model of Life Span Inference. *Proceedings of the 39th annual conference of the Cognitive Science Society.* (3131-3136).
- **Sharma, S.**, Komer, B., Stewart, T., & Eliasmith, C. (2016). A Neural Model of Context Dependent Decision Making in the Prefrontal Cortex. *Proceedings of the 38th annual conference of the Cognitive Science Society.* (1122 - 1127).

- **Sharma, S.,** Aubin, S., & Eliasmith, C. (2016). Large-scale cognitive model design using the Nengo neural simulator. *Biologically Inspired Cognitive Architectures*. 17(2212-683X): 86-100.
- **Sharma, S.,** & Tripp, B. (2016). How is scene recognition in a convolutional network related to that in the human visual system? *Proceedings of the 25th International Conference on Artificial Neural Networks*. (9886): 280 - 287.

Methods: (1) population temporal coding in spiking neurons, (2) computing transformations of neural representations, and (3) characterizing neural dynamics in recurrent populations of neurons using control theory, (4) convolutional neural nets.

## **Research Assistant, Computational Neuroscience Research Group**

Jan-Dec, 2015

University of Waterloo, ON; Advisor: Chris Eliasmith

Worked part-time as an undergraduate from Jan-April and full time from May-Dec.

- Developed neural models of large scale systems to replicate behavioral performance on cognitive tasks.
- Developed software tools & reusable components for quickly constructing such models.

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## **Teaching Experience**

### **Teaching Assistant, University of Waterloo**

Sept 2015-Dec 2015

- Taught tutorials to a class of 96 second year Eng. students. Course: Engineering Economics of Design
- Held weekly office hours, marked assignments, quizzes and exams.

### **Instructor, Nengo Summer School on large-scale brain modelling**

June 2015 and June 2016

Computational Neuroscience Research Group, University of Waterloo

- Working Memory (2015): Attended as a participant and worked in a group of four to build a neural model of working memory. We successfully reproduced the recency and primacy effect plots as found in the human data.
- Sequence Conditioning (2016): Facilitated as an instructor and helped in building a neural model of sequence conditioning. Also served as a social convenor: organized opening BBQ, banquet and weekend social activities.

### **Instructor, Transforming Education**

Sept 2014-Dec 2014

- Taught a coursera course on Programming in Python to a group of 16 CS and Eng. students in India. Taught via Skype. One of the final projects was selected in the top 10 projects in the online class of thousands of students.

### **Tutor, Tutoring Beyond Borders**

Waterloo, ON, June 2011-June 2013

- Volunteered to provide tutoring sessions to three grade 12/10 students in Mathematics, Science and English.

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## **Industry Experience**

### **Software Developer, Advanced Micro Devices (AMD)**

Markham, ON, Sept-Dec 2014

Kernel Mode Driver Development to enable graphics chips to work with latest Windows operating system (C++).

### **Systems Engineer, Nvidia**

Santa Clara, CA, Jan-May 2014

Used Control Systems theory and stability analysis to design compensation circuits for power converters used on graphics cards. Automated existing efficiency measurement procedures (Python) which saved hours of time.

### **Systems Engineer, Nvidia**

Santa Clara, CA, April-Aug 2013

Developed a web user interface (Perl/Html) for an Asset Tracker database.

Wrote QA procedures (Perl) for a hard drive cloning system.

Took initiative to automate internal processes in PCB assembly and fabrication facilities (VBA).

### **Software Developer, Blackberry**

Waterloo, ON, Sept-Dec 2012

Developed Exception Sender and Bug Extractor tools for the Duplicate Defect Detection research project (Java). Gained experience in Information retrieval techniques, search engines and wireless communication systems.

### **Software Engineer, Phoenix Interactive Design Inc.**

London, ON, Jan-April 2012

Developed ATM applications: Asset Manager to track assets on ATM terminal and On-Screen Keyboard, a virtual touch screen keyboard displayed on the ATM machine used as an alternative to the physical pin-pad.

### **Engineering Software Tools Administrator, Christie Digital Systems**

Kitchener, ON, May-Aug 2011

Successfully redesigned the User Interface of the Product Lifecycle Management System to provide better search criteria. Delivered a Technical Presentation to train the developers in the new UI (user interface) functionality.

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## **Awards and Honours**

NSERC Canada Graduate Scholarship - Doctoral (3 yrs, declined)	\$35,000/yr	2019 - 2022
NSERC Canada Graduate Scholarship - Masters	\$17,500	2017 - 2018
President's Graduate Scholarship, University of Waterloo	\$5,000	2017 - 2018
President's Grad. Scholarship (Match Eng), University of Waterloo	\$5,000	2017 - 2018
QEll-Graduate Scholarship in Science and Technology	\$15,000	2016 - 2017
President's Graduate Scholarship, University of Waterloo	\$5,000	2016 - 2017
European Neural Networks Society Student Award	\$400	Spring 2016
University of Waterloo Graduate Scholarship	\$1667	Fall 2016
Undergraduate Student Research Award, NSERC	\$4,500	2014 - 2015
Undergraduate Research Assistantship, University of Waterloo	\$800	Winter 2015
Gerry Heckman Scholarship	\$3,000	2014 - 2015
Baylis Medical Capstone Design Project Award (grp. Of 4)	\$5,000	2014 - 2015
Ontario Power Generation Engineering Award	\$2,400	2011 - 2012
Ontario Professional Engineers Foundation Scholarship	\$1,250	2011 - 2012
Awarded UW merit scholarship, University of Waterloo	\$1,000	2010 - 2011

4 x Dean's Honours List for academic distinction, University of Waterloo  
Fall 2010, Spring 2012, Winter 2013, Winter 2015

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## **Extra Curricular Activities**

Instructor, MIT Educational Studies Program, July-August 2019  
Volunteer, MIT Museum Girls Day, March 2019  
Canada Day Executive, UW Community Relations and Events team, 2016  
Counselor, Women's Center, University of Waterloo, May - Aug 2016  
Positive role model, Canadian Mental Health Association, Oct 2015 - April 2016  
Dance Performer, UW Indian Cultural Association, 2015-2017  
Mentor, Women in Engineering, University of Waterloo, Sept 2010 – Sept 2013  
Engineering Orientation leader, University of Waterloo, 2011  
Director Year Spirit, Engineering Society, University of Waterloo, 2011  
Student Representative, UW Housing and Residences Advisory Board, Sept-Dec 2010