

# SUSHRUT THORAT

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## CONTACT INFORMATION

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## INTERESTS

Artificial Intelligence, Cognitive Neuroscience & Neural Networks

## EDUCATION

**Masters in Cognitive Sciences (CNS track)** *Ongoing*  
CIMEC, University of Trento, Rovereto, Italy

**B.Tech. in Engineering Physics** *August, 2015*  
Indian Institute of Technology - Bombay, Mumbai, India  
*Cumulative Performance Index of 7.64 on a scale of 10.00*

## PUBLICATIONS

**Arithmetic Computing via Rate Coding in Neural Circuits with Spike-triggered Adaptive Synapses** ([paper](#))

*Co-author: Bipin Rajendran* *June 2015*

*Conference: International Joint Conference on Neural Networks, Killarney, Ireland*

We presented spiking neural circuits with spike-time dependent adaptive synapses capable of the arithmetic operations - addition, subtraction, multiplication and division, as well as other non-linear transformations - exponentiation and logarithm, for time dependent signals in real-time.

## WORK EXPERIENCE

**Content Developer**

*Employer: Avanti Fellows, Delhi*

*Summer 2013*

Researched about and developed ConceptTests as required by Avanti's Learning Centre Curriculum. The Curriculum is based on Eric Mazur's *Peer Instruction* model which he successfully employs at Harvard University.

## PROJECTS

**Implementing a Reverse Dictionary using a Node-Graph Architecture**

*Collaborator: Varad Choudhari*

*Ongoing*

We are designing a method to process any forward language dictionary to build a reverse dictionary, using a n-level reverse tree search through word definitions. The reverse dictionary takes any input phrase and outputs a set of words with high semantic correlation to the input. We are writing a paper to be submitted at ACL'16.

**Predisposition to towards-gravity periodic motion in chicks** ([report](#))

*Guide: Sang Ah Lee*

*Autumn 2015*

A predisposition to biological motion, in chicks, has been demonstrated. We presented a hypothesis which points to a towards-gravity periodic motion as the fundamental predisposition, of which biological motion is a subset. We ran a short experiment with newborn chicks to test the same. The results look promising but would take a complete experiment to be deemed significant.

**Senior Thesis: A Spiking Neural Network as a Quadcopter Flight Controller** ([thesis](#))

*Guide: Bipin Rajendran*

*Spring 2015*

We developed a model-based control scheme for velocity-waypoint navigation in the presence of wind, noisy and delayed IMU data, for a quadcopter. We built small spiking neural networks with simple spike-triggered adaptive synapses for implementing arithmetic operations. **We wrote a paper explaining these networks, which has been published in the proceedings of IJCNN'15.** We outlined a method of developing a spiking neural network for quadcopter Control to analyse the gain in computational power and stability provided by spike-based networks.

### Non-Linearity in Neural Systems ([presentation](#))

Course: *Non-linear Dynamics*

Autumn 2014

Studied Korn's review papers *Is there chaos in the brain?*, which presented a summary of the field of chaotic systems and discussed the indications and usefulness of chaos in the human brain. Studied the Hodgkin-Huxley Neuron model, and carried out a non-linear analysis of the same to describe the existence of action potentials, and the system's behavior in a variety of conditions.

### Junior Thesis: On Quantum Computation ([report](#))([presentation](#))

Guides: *Tathagat Avatar Tulsi and Suddhasatta Mahapatra*

Autumn 2013

Read the first two parts of the book Quantum Computation and Quantum Information by Nielsen and Chuang. Wrote a report on, and presented the basics of Quantum Computation viz. Quantum Circuits and Quantum Algorithms, and their applications.

### Gesture Lock ([report](#))

Guide: *Pradeep Sarin*

Autumn 2013

Designed and implemented a Gesture Lock using a matrix of Light Dependent Resistors in conjunction with an Arduino microcontroller to sense fluctuations in light intensity and thereby analyse a gesture and verify it with a predefined pattern. Designed a unique method of distributing feedback from one ambient ldr circuit to multiple input ldr circuits. Designed a 9-to-4 bit encoder as required for optimisation of the hardware. Demonstrated the prototype and wrote a report.

#### SCHOLASTIC ACHIEVEMENTS

- Ranked **721 among 450,000 students** in the Joint Entrance Examination (**JEE, 2011**) conducted towards admission to the IITs.
- Awarded the **KVPY scholarship** (2010), awarded to **150 promising young researchers** throughout India, by the Dept. of Science & Technology, Govt. of India.
- **Winner** at the **Annual All India Web-Design Contest** (2008) hosted by SJIT, Pune (India).
- Awarded the **NTSE scholarship** (2007), awarded to **1000 students** throughout India with **excellent all-round skills**, by the National Centre for Educational Research and Technology, Govt. of India.

#### TECHNICAL SKILLS

**Programming:** C++, Python, MATLAB, PsychToolbox, OpenSesame  
**Web-Design:** HTML5, CSS3, PHP, JavaScript