Ashish Bora

Resume *last updated: October 2013*

Contact Information

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Education

Programme/Examination	Institute	Year	CGPA/%
Bachelors in Technology	IIT Bombay	2011-present	9.44/10
Higher Secondary School Certificate	Modern College, Pune	2011	85.00
Secondary School Certificate	Amrutvahini Model School, Sangamner	2009	88.76

Pursuing minor in **Computer Science and Engineering (CGPA: 10/10)** and honors in **Electrical Engineering**
Completed many **online courses** mainly in Computer Science and Physics

Research Experience and Relevant Projects

Investigating computational advantages of Spiking Neural Networks vis-à-vis rate based networks
Guide: Prof. Bipin Rajendran, Dept. of Electrical Engineering, IIT Bombay *[Summer '13-ongoing]*

- Implemented and studied various types of neurons and neurosynaptic learning models
- Surveyed literature about thermotaxis and chemotaxis in a nematode called C. Elegans
- Developed a framework for simulating Spiking Neural Networks (SNNs) using the AEIF model in MATLAB
- Designed and implemented SNNs that emulate thermotaxis in C. Elegans accurately
- Currently working on designing chemo-sensor driven thermal memory, quantifying the robustness of our model with uncertainty in model parameters
- Received the **Undergraduate Research Award** for this research effort

Automatic Traffic Surveillance System using traffic videos *[Sept '13-ongoing]*
Guide: Prof. Ajit Rajwade, Dept. of Computer Science and Engineering, IIT Bombay

- Developed and implemented robust algorithms for vehicle detection and tracking. Some of the techniques used include background subtraction, morphological closing, connected components analysis, and predictive tracking
- Currently working on incorporating Gaussian Mixture Models and Low-rank Matrix Recovery for improving background estimation, and Support Vector Machine based learning system for vehicle type detection

Solvers for some NP-Hard problems *[Summer '13]*

- Graph Coloring: Branch and Bound, Constraint Programming and Local Search Techniques
- Travelling Salesman Problem: Greedy Heuristic followed by Local Search with 2-OPT neighborhood

LightsOut Game and Solver on a LED Matrix *[Spring '13]*
Guide: Prof. M. B. Patil, Prof. Saurabh Lodha, Dept. of Electrical Engineering IIT Bombay

- Designed an algorithm for solving the game from any position, **proved** that all configurations are solvable
- Implemented the game and solver algorithm in Verilog using Quartus IDE. Interfaced with LED matrix
- Performed extensive optimization to fit the logic on the minimal hardware of the KRYPTON Board

Virtual Carom game – using C++ *[Autumn '11]*
Guide: Prof. D. B. Phatak, Dept. of Computer Science and Engineering, IIT Bombay

- Implemented the physics engine of the game - Predictive algorithms, Collision mechanics, friction, etc.
- Designed the graphics and user interface of the game

Spam Filter based on a Support Vector Machine *[Summer '13]*

- SpamAssassin Public Corpus of 9418 emails (26% spam) was used for training and testing
- Built a vocabulary of words using those words that occurred more than 10 times in the spam data
- Porter Stemmer was used for preprocessing. LIBSVM was used for training. Test Set accuracy was 99.8%

Textbook Companion Project - using Scilab *[Autumn '12]*

- The project aimed to port problems from standard textbooks using an open source software system
- Completed coding of the book "Basic Electrical Engineering" (ISBN: 9780070146112)

Development Surface generator *[Spring '12]*

Guide: Mr. Jitendra Shah, Research Scientist, Geospatial Information Science and Engineering Lab, IIT Bombay

Made an application using GeoGebra package which draws the development surface of the intersection of two solids with variable parameters

Touchless Switch using IR-LED-photodiode pair *[Spring '13]*

Guide: Prof. Anil Kottantharayil, Dept. of Electrical Engineering, IIT Bombay

- Characterized the IR-photodiode for a range of illumination conditions
- Designed an opamp based circuit for processing the photodiode current signal and drive a switch

Shaking movement to electricity converter *[Spring '12]*

Guide: Prof. Rangan Banerjee, Dept. of Energy Sciences and Engineering, IIT Bombay

- Electricity generated by movement of high strength neodymium magnets through an induction coil
- Conceptualized, designed and fabricated the device

Robotic Graph Plotter *[Summer '12]*

- Designed mechanisms using stepper motors driven by ATMEGA 328 on Arduino Board
- Improvised the Bresenham algorithm by adding error overflow check and correction, and implemented it

Key Scholastic Achievements and Awards

- Received the **Undergraduate Research Award** for the work on Bio-inspired Neural Networks *[2013]*
- Scored a **perfect** Semester Performance Index (**SPI**) of **10.0** in the second semester *[2012]*
- Awarded an **AP grade** for outstanding performance in the course **MA 106 (Linear Algebra)** *[2012]* (given to 6 out of about 850 students)
- Currently ranked **10th** in the department out of 137 students
- Secured **All India Rank 400** in **IIT-JEE** out of about 460,000 candidates *[2011]*
- Secured **All India Rank 58** in **AIEEE** out of about 1.1 million candidates *[2011]*
- Secured **All India Rank 1** in **National Science Olympiad** 2006 and consistently in top 100
- Secured **All India Rank 14** in **National Cyber Olympiad** 2010 and consistently in top 100
- Recipient of the **National Talent Search Scholarship** awarded to 1000 out of about 150,000 applicants *[2007]*
- Recipient of the **Maharashtra Talent Search Scholarship** in 2007- **Rank 10** and in 2008 - **Rank 8**

Technical Proficiency

- **Languages**: C, C++, Assembly, Verilog HDL, HTML(Basic)
- **Packages and Tools**: MATLAB, Scilab, MiniZinc (CP Solver), LTSpice, Eagle, SketchUp
- **Operating Systems**: Windows, GNU/Linux (Ubuntu distribution)

Summary of Theoretical Courses

Electrical Engineering	Adaptive Signal Processing* , Wavelets*, Information Theory*, Error Correcting Codes*, Communication Systems*, Digital Communications*, Digital Signal Processing*, Signals and Systems, Control Systems*, Network Theory, Electromagnetic Waves*, Analog Circuits, Digital Systems, Electricity and Magnetism, Power Systems*, Electrical Machines and Power electronics, Microprocessors*, Electronic Devices
Mathematics and Statistics	Probability and Random Processes*, Linear Algebra, Calculus, Ordinary and Partial Differential Equations, Complex Analysis, A first course in Optimization, Data Analysis and Interpretation
Computer Science	Digital Image Processing*, Machine Learning†, Computer Vision*, Data Structures and Algorithms, Design and Analysis of Algorithms-I†, Discrete Structures, Quantum Mechanics and Computation†, Computational Neuroscience†

*Will be completed by April 2014 †Online course on Coursera/ edX

Lab Experience (as a part of curriculum)

Communication Systems Lab

- Implementation of various modulation and demodulation techniques
- Small scale implementation of a complete communication system involving Convolutional Trellis Coded Modulation, generation and transmission of PSK pulses, PSK Receiver and demodulator, and Viterbi decoder

Microprocessors Lab

- Intricate details of microprocessors (8051, 8085) - Assembly and C programming
- Implementation of motor and display controller, music sequencer and user playable keyboard, interfacing for serial communication, master-slave multiprocessor system protocol implementation

Digital Circuits Lab

- Implementation of basic digital circuits: Comparator, Adder/Subtractor, Multiplexer, binary-BCD convertor, counters, shift registers, DAC, ADC
- Design and implementation of logic circuits on CPLD board using Verilog HDL

Analog Circuits Lab

- Implementation of opamp based circuits : Amplifiers, Differentiator, Integrator, Schmitt Trigger, Multivibrators, Precision rectifiers, Antoniou Inductor Emulator
- Design and implementation of an opamp and one opamp based application

Programming and Computer Utilization Lab

- Introduction to programming paradigms using C++
- Design and implementation of a game using EzWindows graphics library

Electronic Devices Lab

- Implementation of various circuits involving diodes and transistors like clipper and clamper circuits, measurement of electrical properties like minority carrier lifetimes

Experimentation and Measurements Lab

- Various measurement experiments
- Designed and performed optimization experiments using Taguchi methods

Extracurricular Activities

- Founder and head of the school Science Club *[2008-10]*
  Edited and published a wall magazine, conducted science quizzes, conducted sessions to remove superstitions by scientifically explaining them, etc.
- Stood first in Math and Logic General Championship open for everyone at IIT Bombay *[2012]*
- Stood first in Electronics General Championship open for everyone at IIT Bombay *[2013]*
- Discovered and developed many algorithms and formulas on my own
- Inquisitive reader, like to solve puzzles, play badminton and table tennis
- Avid guitarist and like to listen to music. Performed in Surbahaar, Institute's annual musical night