

ANKIT B. PATEL

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RESEARCH INTERESTS

Engineering and understanding self-organizing systems, computational models of multicellular biological systems, biologically-inspired approaches to robust multi-agent and distributed systems and their applications to sensor networks, computational complexity of local-to-global processes, self-organized resource scheduling.

EDUCATION

Harvard University, Cambridge, MA. (September 2004 – present, September 1998 – June 2002)

Ph.D. in Computer Science, expected in June 2008. Adviser: Radhika Nagpal.

Topics: (1) Modeling multicellular bio-systems, (2) Decentralized resource scheduling in sensor networks.

M.S. Applied Mathematics, B.A. Computer Science. Magna cum laude with High Honors.

Overall GPA: 14.1/15.0 (3.77/4.00). Major GPA: 14.9/15.0 (3.96/4.00).

Massachusetts Institute of Technology (MIT), Cambridge, MA. (February 2003 – June 2004)

Special Student. Graduate Coursework: Embodied Intelligence(G), Systems Biology(G), Advanced Partial Differential Equations(G). GPA: 5.0/5.0.

MIT Lincoln Laboratory, Lexington, MA. (September 2002 – August 2004)

Internal Courses. Statistical Signal Processing, Source & Entropy Coding, Feedback Control Systems, Parameter Estimation.

AWARDS & HONORS

- Nominated by Harvard for the Microsoft Research Fellowship (2006)
- National Science Foundation Graduate Fellowship (2004-2007)
- Graduated from Harvard *Magna Cum Laude with High Honors* (2002)
- All-American USA Physics Team (1998)
I was chosen as one of the *Top 25* Physics students in the nation based on my performance on the USA Physics Olympiad exam. I competed for a position to participate in the *XXIX International Physics Olympiad* in Reykjavik, Iceland.
- 2nd place Poster, Systems Biology Conference, Harvard Medical School (2005)
- National Mu Alpha Theta Mathematics Competition (1998): Integration (2nd), Advanced Calculus (3rd), Limits & Derivatives (5th), Applications (6th).
- John Harvard Scholarship (1998-2002). High Dean's List.
- Harvard Detur Prize (1998). Given to the top students in the class, based on GPA.
- Other scholarships: Judge Walter R. Mansfield, National Alliance for Excellence, Florida Engineering Scholarship, Rensselaer Medal, Pathfinder Scholarship, J.M. Rubin Scholar, Georgia Tech President's Scholar (declined), National AP Scholar with Distinction. (1998)

PUBLICATIONS

“The Emergence of Geometric Order in Proliferating Metazoan Epithelia.” **Ankit Patel**, Matthew Gibson, Radhika Nagpal, Norbert Perrimon. *Nature* **42**, pp. 1038-1041. Aug 31, 2006.

“DESYNC: Self-organizing Desynchronization and TDMA on Wireless Sensor Networks.” Julius Degeys, Ian Rose, **Ankit Patel**, Radhika Nagpal. To be submitted to the *International Conference on Information Processing in Sensor Networks*, April 2007.

“Firefly-Inspired Sensor Network Synchronicity with Realistic Radio Effects.” Geoff Werner-Allen, Geetika Tewari, **Ankit Patel**, Matt Welsh, Radhika Nagpal. In the *ACM Conference on Embedded Networked Sensor Systems (SenSys'05)*, November 2005.

"Determining the Optimal Time for Feature Aided Track Correlation Between Two Radars, [U]." **Ankit Patel**, Matthew Smith, Keh-Ping Dunn. In *Conference on Missile Defense: Sensors, Environments, Architectures*, November 2003.

In submission:

“Desynchronization: A self-organizing algorithm for desynchronization and periodic resource scheduling.” **Ankit Patel**, Julius Degeys, Radhika Nagpal. *IEEE International Conference on Self-Adaptive and Self-Organizing Systems*, July 2007.

RESEARCH (See <http://www.eecs.harvard.edu/~abpatel/> for papers & presentations)

Emergence of Geometric Order in Proliferating Epithelia (Harvard, 2004-present). We predicted the existence of a “universal” topology in 2D epithelial cells and verified this prediction in several multicellular organisms: the fruitfly, frog and Hydra. It is the first application of discrete Markov Chains to real epithelia. (See PUBLICATIONS)

Desynchronization of Pulse-coupled Oscillators (Harvard, 2004-present). I designed a decentralized resource scheduling algorithm known as Desync. Desync is simple and self-adjusts to the addition and removal of agents. It was inspired by chemical diffusion and the firefly synchronization work of Mirollo and Strogatz. (See PUBLICATIONS)

A Google-Inspired Self-Organizing Algorithm for Center-Finding in an Amorphous Computer (MIT, 2004). Invented a new biologically-inspired algorithm by modifying Google’s PageRank algorithm to find and maintain the center of an amorphous computer. Drastically improved algorithm’s robustness and used sophisticated mathematical techniques to prove convergence, robustness and other properties. Invited to present algorithm to the *Amorphous Computing Group* at the *MIT AI Laboratory*.

Dynamic Bayesian Network Inference (MIT Lincoln Laboratory, 2004). Spearheaded an effort to create a Bayesian Network Inference Tool. This entailed researching the scientific literature and implementing a suite of Bayesian Inference algorithms, for both static and dynamic Bayesian Networks.

Multi-Sensor Fusion (MIT Lincoln Laboratory, 2003). Implemented first-of-its-kind multi-sensor fusion architecture that integrates information via satellite links from multiple sensors nationwide to get higher precision measurements. (See PUBLICATIONS section)

Satellite-Based Infrared Sensing (MIT Lincoln Laboratory, 2002). Conducted a feasibility study for the government, identifying whether satellite-based infrared sensors were a worthwhile alternative to conventional ground-based radar sensors.

WHASSUPP: A Novel Approach to Query-by-Sketch using Wavelets and Color Histograms (Harvard, 2001). Engaged in research to implement a better image search engine by combining wavelet decompositions and color histograms. Devised a novel indexing scheme for images in large databases, and developed a hybrid algorithm that improves accuracy and is more robust to distortions in the query image.

EMPLOYMENT

MIT Lincoln Laboratory, Ballistic Missile Defense Systems Analyst (2002-2004). Conducted research on topics related to Ballistic Missile Defense Systems. Lead initiative to research and implement a software suite of algorithms for inference using Dynamic Bayesian Networks and Multi-Sensor Fusion for the purposes of discriminating warheads from decoys.

Sun Microsystems, Java2D Graphics Group, Summer Internship (2001). Wrote real-time algorithms for font manipulation. Re-wrote and augmented several demos that come with the Java 2 SDK.

Scient Corporation, Summer Internship (2000). Created Web Applications to support an online Auction capability for a client. Experience with Java, EJB, SQL, WebLogic, TopLink.

INVITED TALKS

MIT Artificial Intelligence Laboratory, Amorphous Computing Group. I was invited to present a center-finding algorithm that I developed for an amorphous computer. See RESEARCH Section, *A Self-Organizing Algorithm for Center Maintenance in an Amorphous Computer*.

MIT Lincoln Laboratory, Advanced Concepts & Technology Group. I was invited to give presentations on two of my papers. See RESEARCH Section, *WHASSUPP: A Novel Approach to Query-by-Sketch using Wavelets and Color Histograms* and *Lossless Sound Compression via the Discrete Wavelet Transform*.

ENRICHMENT

All-USA Physics Olympiad Training Camp (Summer 1998)

An intensive 2-week training camp for the Top 25 physics students in the nation to compete for a chance to compete at the XXIX *International Physics Olympiad* in Reykjavik, Iceland.

Florida Atlantic University Robotics Program (Summer 1997)

An intensive study of robots and their applications including programming in several computer languages (C, Pascal, ASM) along with methods of optical sensors, detection, and binary image analysis. Also, extensive use of vectors, matrices, and transformations involved in robotic arm movement. Final Project: fully implemented robot assembly line with error protection. I was the programmer for our team and our project was rated as the most efficient and robust design, accounting for all sorts of errors (i.e. queueing delays, machinery malfunction, etc.).

University of Miami Biomedical Engineering Program (Summer 1996)

Design of artificial heart valves, prosthetics, pacemaker technology, etc. Our team designed a heart valve that could pump the most blood in the least time using techniques we learned during the program. I was in charge of designing of the pump for my team.

All-Boston Indian Folk Dance Team (2002-2005)

Co-choreographed and danced competitively for an all-Boston Indian folk dance team known as *Boston Bhangra*. Performed at exhibitions in the greater Boston area and competed internationally. Our team won 1st place at several national competitions. For further details, see <http://www.bostonbhanga.com>.

President, Boston Garba Raas Association (2004-present)

Founded an all-Boston Indian folk dance team that specializes in the *garba* and *raas* styles of Gujarati dance. Choreographed and danced in several exhibitions and competitions. Organized s Tsunami Relief show which raised over \$2,000 in funds for Tsunami victims. For further details, see <http://www.bostongarbaraas.com>.