University of Massachusetts Amherst

Alum Matters

Vol. 4, No. 4 • Fall 2003

A newsletter for alumni of the Department of Computer Science

Tic-tac-toe with DNA

"Playing to win at DNA computation" is how a recent issue of *Nature Biotechnology* described the work of Darko Stefanovic (Ph.D. '99). He and his collaborators developed a molecular automaton that can play tic-tac-toe. The report about the automaton was picked up by media around the world.

"It was quite surprising to see our experiment reported as far away as the *Sunday Times* of Sri Lanka," says Stefanovic. All the team set out to do was to show that they could combine many molecular logic gates to work in parallel, and tic-tac-toe was a challenging example for the researchers. "The hard part was developing a comprehensive set of gates in the first place," notes Stefanovic. "Rendering a game strategy in a single layer of logic was a curious combinatorial exercise in its own right, though."

Stefanovic has been an Assistant Professor in the Computer Science Department at the University of New Mexico since 2000. Before that, he held a postdoctoral position at Princeton University. His dissertation was in the area of memory management, with advisor Associate Professor Eliot Moss.

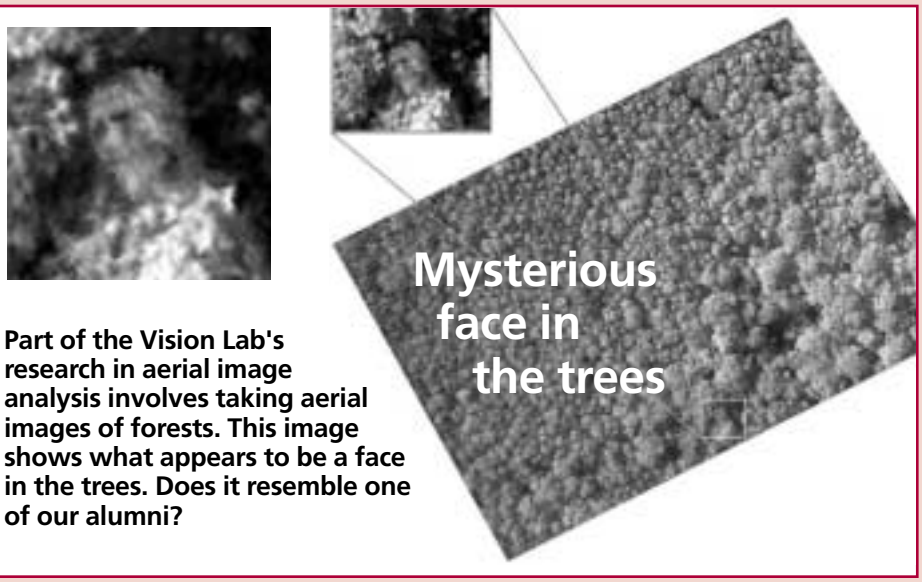
"I continue to work closely with Eliot and with [former Associate Professor] Kathryn McKinley on programming language research, but I could not resist the lure of working in a nascent field. In software systems, everything is possible; here nothing can be taken for granted. It took us a while to build a simple half-adder!" adds Stefanovic. "We have, for the first time, computational elements whose operation parallels that of silicon circuits, built of biochemical molecules. In fact, they are compatible with living cells. We can combine the decision-making gates with sensor elements to detect cell disease markers, and with actuators to release drug molecules."

The automaton uses deoxyribozymes (nucleic acid enzymes) for logic gates. High concentrations of particular oligonucleotides (short single-stranded pieces of DNA) indicate the presence of the signal, or logical 1. Oligonucleotides that serve as gate inputs bond with deoxyribozymes allosterically, and can thus activate them or in some cases inhibit them. Active deoxyribozymes produce gate output molecules, which are also oligonucleotides. Multiple gates can be connected in a variety of ways. The specificity of DNA base-pair matching ensures that each signal oligonucletide acts only upon its own gate. In principle, thousands of signals (corresponding to wires in silicon logic) can be present simultaneously in the solution.

Stefanovic's work is supported by the National Science Foundation, through the ITR, CAREER, and QuBIC (Quantum and Biologically Inspired Computation) programs.

Alumni and friends reception

We're planning a reception for Alumni and Industrial Affiliates on Friday, June 4, 2004. This coincides with the UMass Amherst Alumni Reunion Weekend of June 4 - 6. Details can be found on our web pages at **www.cs.umass.edu/reception**. We hope that you'll be able to join us.



Part of the Vision Lab's research in aerial image analysis involves taking aerial images of forests. This image shows what appears to be a face in the trees. Does it resemble one of our alumni?

Where have they gone?

The Department is proud to have graduated ten students with Ph.D.s over the past year. They include:

- Zihui Ge: "Interest-Based Content Retrieval and Dissemination in Distributed Environments" (Jim Kurose and Don Towsley, Advisors); Senior Postdoctoral Research Associate, Computer Science Department, UMass Amherst
- Bill Hesse: "Dynamic Computational Complexity" (Neil Immerman, Advisor); Assistant Professor, Department of Math and Computer Science, Clarkson University
- Ping Ji: "Design, Analysis and Signaling for Advanced Distributed Network Services" (Jim Kurose and Don Towsley, Advisors); Assistant Professor, Mathematics Department, John Jay College of Criminal Justice, City College of New York, City University of New York
- Dawn Lawrie: "Language Models for Hierarchical Summarization" (Bruce Croft, Advisor); Assistant Professor, Department of Computer Science, Loyola College
- Benyuan Liu: "Design and Performance Modeling of Wireless Networks" (Don Towsley, Advisor); Assistant Professor, Department of Computer Science, City College of New York, City University of New York
- Anita Raja: "Meta-Level Control in Multi-Agent Systems" (Victor Lesser, Advisor); Assistant Professor, Department of Software and Information Systems, University of North Carolina, Charlotte
- Srinivas S. Ravela: "On Multi-Scale Differential Features and their Representations for Image Retrieval and Recognition" (Allen Hanson, Advisor); Postdoctoral Research Associate, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology
- Michael T. Rosenstein: "Learning to Exploit Dynamics For Robot Motor Coordination" (Andy Barto, Advisor); Senior Postdoctoral Research Associate, Computer Science Department, UMass Amherst
- Jonathan K. Shapiro: "Directions in Optimization-Based Congestion Control" (Don Towsley, Advisor); Assistant Professor, Department of Computer Science and Engineering, Michigan State University
- Hariharasubrahmanian Shrikumar: "Dynamic composability- Building Flexible Complex Real-time Systems" (Krithi Ramamritham, Advisor); CTO of Ipsil, Inc.

Alumni Connections

Jamie Callan (Ph.D. '93) became a tenured Associate Professor in the School of Computer Science at Carnegie Mellon University. Prior to joining CMU, Callan was a UMass Computer Science Department Research Assistant Professor and the Assistant Director of the Center for Intelligent Information Retrieval (CIIR). Professor Bruce Croft advised Callan while he was a student at UMass.

Columbia University Associate Professor **Henning Schulzrinne** (ECE Ph.D. '93), advised by Professor Jim Kurose while a graduate student at UMass, was honored with the 2003 New York City Mayor's Medal for Excellence in Science and Technology. The award recognizes outstanding achievements in science and technology by individuals who live or work in New York City. Mayor Michael Bloomberg presented the medal to Schulzrinne at the Brooklyn Botanical Garden in October.

Ping Xuan (Ph.D. '02), advised by Professor Victor Lesser, has taken an Assistant Professor position in the Department of Math and Computer Science at Clark University in Worcester, MA.

Daniel J. Barrett (Ph.D. '98) just published his fourth computer book, *Linux Security Cookbook*, with O'Reilly & Associates. Co-authored with Richard Silverman and Robert Byrnes, the book presents targeted solutions to computer security problems on Linux systems. Barrett and his family live in Boston, where he is a senior technology manager at VistaPrint (**www.vistaprint.com**). He can be reached at dbarrett@blazemonger.com.

Advised by Victor Lesser while a student at UMass, **Frank Klassner** (Ph.D. '96) became a tenured Associate Professor at Villanova University this fall. In addition, Klassner has been awarded an Education Innovation grant from the CISE Directorate at the National Science Foundation. In this project, Klassner will develop software and laboratory modules to use LEGO® MindStorms™ robotics to enhance undergraduate Computer Science curricula across the United States. This past year, Villanova began a co-op program with the Vatican's Web Development Office. Klassner is looking forward to both training students for work at the Vatican office and to working there himself as a scholar.

Alumni updates needed!

What have you been up to lately? Keep in touch with other alumni. Tell us where you are living and working and we'll include your information in **Alumni Connections**.

Email us at: alumni@cs.umass.edu. Thanks!