

## ALUM

## Matters

A newsletter for alumni of the Department of Computer Science



## Brodley promotes interdisciplinary research

and Dr. Lynn Broderick, and several graduate students, she developed a content-based image retrieval (CBIR) system for medical images. The current methods for analyzing difficult tomography images of the lungs require physicians to page through published books of images in order to locate a match with the query image. Brodley and her colleagues developed a system in which the physician delineates the pathology bearing

regions (PBR) in a query image (the patient of interest), which is then matched against a database of images, thus automating the process. The system returns the four images that are most visually similar to the query image. The physician uses the diagnostic information of the retrieved images to aid in his/her diagnosis of the query patient. Together with one of her Ph.D. students (Jennifer Dy, now an assistant professor at Northeastern), Brodley developed a retrieval method called customized queries, that through the use of unsupervised feature selection chooses the most visually similar images within the predicted disease class. The best features for defining visual similarity in HRCT images of the lung are disease specific, just as the features that best define similarities or differences among cars are different than those that define similarities or differences among aircraft. In 2001, they performed an evaluation trial with eleven radiologists/physicians to determine whether the CBIR system

helps doctors interpret medical images and thereby assist in diagnosing patients. In this trial, the system doubled diagnostic accuracy of non-lung specialists. The results of this trial were published in *Radiology*.

In another project, Brodley collaborated with Geography Professor Mark Friedl from Boston University to improve automated map making. Brodley created a method for identifying mislabeled features on land-cover maps using boosting decision trees. The resulting methods have been incorporated into the MODIS (the Moderate Resolution Imaging Spectroradiometer) land-cover product. MODIS is the flagship instrument of NASA's Earth Observing System, a seven billion dollar project to study the Earth's atmosphere, oceans, and terrestrial ecosystems.

After receiving tenure in 2000, Brodley became increasingly interested in computer security; and she taught a senior undergraduate course in security from a systems perspective. She investigated whether users can be identified by their command sequences and mouse movements; and she developed methods for detecting and implementing covert timing channels in TCP/IP. Most recently in a project with Prof. T. N. Vijaykumar and three graduate students, she developed a hardware solution to prevent buffer overflows. Buffer overflow attacks are the most prevalent type of attack, comprising more than half of the advisories published annually by CERT. Brodley and her colleagues' solution, SmashGuard, prevents attacks that overwrite the return address

Recently, the President's Information Technology Advisory Panel encouraged universities to promote multidisciplinary research. Professor Carla Brodley (UMass Amherst CS Ph.D. '94) has been involved in multidisciplinary research since graduating in 1994. She has developed new machine learning methods to address problems arising from a variety of applications including content-based image retrieval of medical images, remote sensing, computer security, digital libraries, astrophysics, computer vision, chemistry and pulmonary disease.

While at UMass Amherst, Brodley was advised by Professor Paul Utgoff. She joined the School of Electrical and Computer Engineering at Purdue University in 1994, earning tenure in 2000. Her research is not limited to machine learning, but includes significant contributions in other disciplines through multidisciplinary research projects.

While at Purdue, together with Prof. Avi Kak, radiologists Dr. Alex Aisen

stored on the stack, which attempt to redirect execution to an attacker's code. This work appeared in *IEEE Transactions on Computers* in October 2006.

Dr. Brodley continues to be active within the machine learning community. She served as co-program chair for the International Conference on Machine Learning (ICML) in 2001, and in 2004, she served as the general chair of ICML. In 2004-2005, she served on the Defense Sciences Study Group, a committee sponsored by DARPA, which is designed to convey to its members an understanding of the technical dimensions of national security issues. Membership in the DSSG is highly selective and achieved through nominations of senior academics and officials from government agencies (UMass Amherst Associate Professor David Jensen was selected to be on the 2006-2007 DSSG). While serving on the DSSG, Brodley not only learned about issues relating to national security, but she also jumped from a para-trooper training tower, and ventured onto submarines, helicopters, tanks, and large ships. She also serves on the Computing Research Association's Committee on the Status of Women in Computing Research (CRA-W). The goal of CRA-W is to take positive action to increase the number of women participating in Computer Science at all levels. Currently, she serves as co-funding chair with Carla Ellis at Duke University (UMass Amherst Professor Lori Clark is a co-chair of this committee).

In the fall of 2004, Brodley joined the Department of Computer Science at Tufts University as a Professor. In addition to her wish to move back to the Boston area, she chose Tufts because of the unique environment it provides. "Tufts imparts equal importance to both education and research," says Brodley. In the 2005/2006 academic year, she became the acting chair and helped the School of Engineering to become an interdisciplinary engineering school. Perhaps the driving factor in her choice to join Tufts was the ease with which interdisciplinary research happens. Within her first year she has established collaborative research projects with the departments of Classics, Chemistry, Medicine, and Civil Engineering. She is currently working on several multidisciplinary research projects, including a project with Astrophysics at Harvard, with the Tufts Chemistry Department, and with Boston University's Medical and Dental school where the goal is to create a device that analyzes pulmonary



patients' sputum to determine whether a patient is in an exacerbated disease state or has a secondary infection. This semester she is piloting a new course with Tufts Chemistry Professor David Walt aimed at bringing together modern chemists, biologists, and computer scientists to solve computational problems in chemistry and biology. Brodley says, "My vision for the Tufts Computer Science department is to create an interdisciplinary research environment, building on the current strengths in the department to excel in all aspects of the analysis of data, including machine learning, data mining, computational biology, data bases, graphics, and visualization."

## Popplestone fellow selected

**Gary Huang (far right), the first recipient of the Robin Popplestone Fellowship in Robotics & Artificial Intelligence, poses at the CS Homecoming celebration with (l to r) Department Chair Bruce Croft, Robin Popplestone's wife Kristen Morrison, and NSM Dean George Langford. Huang joined the Department's Ph.D. program this fall after receiving an M.S. in Computer Science from Stanford University. He is working with Assistant Professor Erik Learned-Miller.**

## Our Ph.D. graduates: Where are they now?

The following people graduated with Ph.D.s in Computer Science from UMass Amherst within the past year:

**Sherief Abdallah:** "Scalable Cooperative Multiagent Reinforcement Learning in the Context of an Organization" (Victor Lesser, Advisor); Lecturer, Institute of Informatics, The British University in Dubai.

**Raphen Becker:** "Exploiting Structure in Decentralized Markov Decision Processes" (Victor Lesser & Shlomo Zilberstein, Advisors); Software Engineer, Google, Inc.

**Weifeng Chen:** "An efficient and privacy-preserving framework for information dissemination among independent entities" (James Kurose & Donald Towsley, Advisors); Assistant Professor, Department of Math & Computer Science, John Jay College.

**AnYuan Guo:** "Planning and Learning for Weakly-Coupled Distributed Agents" (Victor Lesser, Advisor); Self-employed: investment software developer; publicist; art dealer.

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## Sandholm receives award at IAAI

UMass Amherst Computer Science alumnus Tuomas Sandholm (Ph. D. '96) received the American Association of Artificial Intelligence (AAAI) Deployed Application Award for his insight and achievement in applying artificial intelligence to strategic sourcing activities. The award was presented at the Eighteenth Annual Conference on Innovative Applications of Artificial Intelligence (IAAI-06) in Boston in July. Sandholm is a professor in the Computer Science Department at Carnegie Mellon University and the founder, chairman and chief scientist of CombineNet.

Sandholm has been internationally recognized for his efforts, having received several of the most selective academic awards in the field, including the prestigious Computers and Thought Award, presented by the International Joint Conference on Artificial Intelligence (IJCAI), and the Sloan Research Fellowship, presented by the Alfred P. Sloan Foundation. He has also received the National Science Foundation Career Award and the Association for Computing Machinery Autonomous Agents Research Award.

### Ph.D.s..... (from page 9)

**Brent Heeringa:** "Improving Access to Organized Information" (Micah Adler, Advisor); Assistant Professor, Department of Computer Science, Williams College.

**Matthew Hertz:** "Quantifying and Improving the Performance of Garbage Collection" (Emery Berger, Advisor); Assistant Professor, Department of Computer Science, Canisius College.

**Bryan Horling:** "Quantitative Organizational Modeling and Design for Multi-Agent Systems" (Emery Berger, Advisor); Software Engineer, Google, Inc.

**Anders Jonsson:** "A Novel Approach to Abstraction Discovery in Reinforcement Learning" (Andrew G. Barto, Advisor); Department of Technologies, University of Pompeu Fabra in Barcelona, Spain.

**Huan Li:** "Resource Management for Distributed Real-Time Systems" (Prashant Shenoy & Krithi Ramamritham, Advisors); Associate Professor, Beihang University, China.

**Xiaoyan Li:** "Sentence Level Information Patterns for Novelty Detection" (W. Bruce Croft, Advisor); Visiting Assistant Professor, Department of Computer Science, Mt. Holyoke College.

**Dimitri Lisin:** "Image Classification with Bags of Local Features" (Erik Learned-Miller, Advisor); Post-doctoral Research Fellow, Department of Computer Science, Boston College.

**Xiaotao Liu:** "System Support for Pervasive Multimedia Systems" (Prashant Shenoy & Mark Corner, Advisors); Senior Research Scientist, EMC.

**Ramesh Nallapati:** "The Smoothed Dirichlet Distribution: Understanding Cross-entropy ranking in Information Retrieval" (James Allan, Advisor); Post-doctoral Fellow, Machine Learning Department, Carnegie Mellon University.

**Jennifer Neville:** "Exploiting Autocorrelation to Improve Statistical Models of Relational Data" (David Jensen, Advisor); Assistant Professor, Departments of Computer Science and Statistics, Purdue University.

**Vanessa Murdock:** "Aspects of Sentence Retrieval" (W. Bruce Croft, Advisor); Postdoctoral Position, Yahoo! Research.

**Robert Platt, Jr.:** "Generalized Robot Grasping and Manipulation" (Roderic Grupen & Andrew Fagg, Advisors); Robotics Engineer, Dexterous Robotics Lab, Johnson Space Center, NASA.

**Khashayar Rohanimanesh:** "Concurrent Decision Making in Markov Decision Processes" (Sridhar Mahadevan, Advisor); Postdoctoral Associate, CSAIL, Massachusetts Institute of Technology.

**Frank Stolle:** "Multi-image surface reconstruction from aerial images and sequences" (Allen R. Hanson, Advisor).

**David J. Stracuzzi:** "Scalable Learning in Many Layers" (Paul E. Utgoff, Advisor); Postdoctoral Research Scientist, CSLI, Stanford University.

**Vijay Sundaram:** "Self-managing Techniques for Storage Resource Management" (Prashant Shenoy, Advisor); Software Development Engineer, Microsoft.

**Sudarshan Vasudevan:** "Self-Organization in Large-Scale Wireless Networks" (James F. Kurose and Donald F. Towsley, Advisors); Director of Search Engine Research, Adverflex Inc.

**Wei Wei:** "Inference of Network Properties from Active and Passive Measurements on Wired/Wireless Networks: A Modeling Approach" (James F. Kurose and Donald F. Towsley, Advisors); Senior Research Engineer, United Technologies Research Center.

**David Yates:** "Scaleable Data Delivery for Networked Servers and Wireless Sensor Networks" (James F. Kurose, Advisor); Assistant Professor, Bentley College.

**Chun Zhang:** "On Routing Optimization in Wired and Wireless Networks" (James F. Kurose & Donald F. Towsley, Advisors); Research Staff, IBM.

**Haizheng Zhang:** "Learning based organizational approach for Peer-to-Peer based Information Retrieval Systems" (Victor Lesser, Advisor); Postdoctoral Research Associate, Pennsylvania State University.

**Honggang Zhang:** "On the Interactions among Self-interested Users of Network Resources" (Donald Towsley, Advisor); Assistant Professor, Math and Computer Science Department, Suffolk University.