PIPELINE

Evolution Park: A New Dimension

You are about to enter another dimension, a journey into a land where robotic animals evolve before your eyes. As these new creatures come marching, swarming, swimming, and crawling toward you, you may feel like you've stepped into an episode of the old TV show *The Twilight Zone*. But you are in the evolutionary robotics laboratory in Michigan State University's Engineering Building, where CSE professor Philip McKinley and his team are at work on a research project that is multidisciplinary and truly multidimensional—3-D to be exact.

You've just crossed over into Evolution Park: An Evolutionary Robotics Habitat for the Study of Crawling, Swimming, and Flying Creatures, supported by a $305,000 grant from the National Science Foundation.

The centerpiece of this two-year grant is a 3-D printer that can print out robotic animals as well as other parts and assemblies more typically seen in manufacturing. Indeed, 3-D printing technology is spreading rapidly in many fields, from engineering, to medicine, to arts and entertainment.
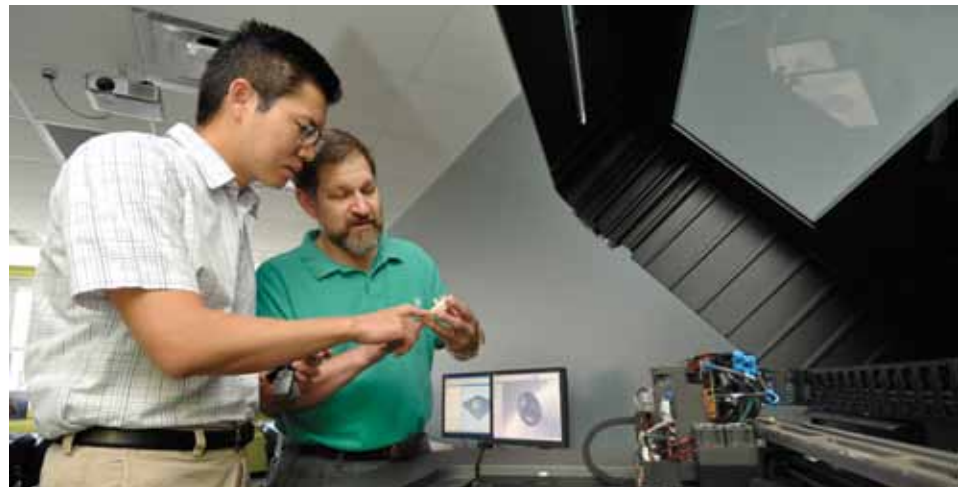
CSE professor Philip McKinley (right) and Xiaobo Tan, associate professor of electrical and computer engineering, work in the evolutionary robotics laboratory.

"This grant enables us to build an infrastructure that will support a broad range of research projects," says McKinley, who is the principal investigator on the project. "MSU is a perfect place to have this kind of facility because we already have an entire community of users—within the college and across the university—who will be able to take advantage of it."

Other Evolution Park project researchers include co-principal investigators Xiaobo Tan, associate professor of electrical and computer engineering, and Janette Boughman, associate professor of zoology. Boughman is an expert on stickleback fish, Tan's work focuses on robotic fish, and McKinley is interested in evolutionary computation and building systems that can be sent out

Technology for Detecting Altered Fingerprints

Anil Jain

If you believe that fingerprints are a sure-fire way to verify an individual's identity, think again.

As far back as the early 1930s, infamous bank robber John Dillinger altered his fingerprints by applying acid to his fingertips. More recently, three people were charged in federal court in 2010 with conspiring to mutilate fingerprints to conceal illegal aliens from detection.

The widespread use of fingerprint recognition systems today—at border crossings and during screen-ings for security access or employment background checks—has prompted a growing number of individuals to disfigure or surgically change their fingerprints so they can mask their identities.

"Government agencies worldwide encounter individuals who have gone to extreme measures to alter their fingerprints to avoid being identified by Automated Fingerprint Identification Systems (AFIS)," says Anil Jain, University Distinguished Professor of

MICHIGAN STATE
UNIVERSITY

from the Chair

MATT MUTKA

Periodically, the CSE department is asked to review its progress and submit a self-study to the upper administration of the university. Within the review, CSE answers questions such as: How well is the department meeting its mission? What metrics are used? How does the department intend to advance?

Although this activity triggers reflection upon what has happened in the department in the past several years, it also gives reason to reflect on how computer science has influenced society in recent years. Recall that Facebook did not exist until 2004; YouTube was first launched in 2005; and the first iPhone appeared in 2007. Computer science has been key in building new industries, changing the manner in which our society conducts business, and influencing how our daily lives are conducted. The acceleration of change provides transformative computing challenges and opportunities for computer science departments. The impact that computer science will have over the next few years may be much greater than in the past few years.

This year, the department's self-study highlighted many positive results.

• The enrollment in computer science at MSU has grown and the job market has been very healthy for our graduates.

• CSE at MSU increased its productivity measured by research expenditures (by more than 160 percent in the last four years), initiated new research directions, increased PhD student enrollment, and improved its national ranking as measured by the National Research Council.

• MSU CSE is recognized internationally for its leadership in pattern recognition and biometrics.

• The department's interdisciplinary research bridges the gap between evolutionary biology and computing via the establishment of the BEACON Center, which is a model for the scientific community worldwide. CSE faculty work across disciplines and apply data mining, machine learning, sensor networks, and network security to current problems.

• Likewise, CSE educational programs transfer critical software skills to students who work in industries across the nation, as well as fuel the revitalization of the Michigan economy by aiding the growth of information technology industries within the state. CSE is on a positive trajectory in its mission of undergraduate and graduate education, research, and service.

An important mission of the department is to provide service courses to the university, which includes the large service course, CSE 101: Computing Concepts and Competencies. We are pleased to welcome Monika Witoslawski to our staff for instruction in this course. Monika joins us from Wayne State University, where she served as a lecturer. ❖

Detecting Altered Fingerprints (continued from page 1)

computer science and engineering at Michigan State University and an internationally recognized leader in the area of biometrics and pattern recognition research.

According to Jain, some of the common methods that have been observed for altering fingerprints include burning the fingertip, applying acid or a chemical, or making an incision along the center of the finger in an attempt to alter the fingerprint pattern.

Jain's research team has developed a novel technique that can help law enforcement and border control officials detect these altered fingerprints automatically.

"We have developed an algorithm capable of automatically looking at the fingerprint image and determining whether the pattern is 'unusual' or 'normal.' If it is 'unusual,' then it is flagged as a potential altered fingerprint and the suspect's fingers will be manually examined for signs of alteration," says Jain. "Of course, it is not possible for us to determine whether the observed unusual fingerprint pattern was due to an injury to the finger or due to intentional mutilation of the fingerprint," Jain adds.

The algorithm must be extremely fast because state-of-the-art AFIS can process fingerprints at the rate of about 1 million matches per second. Therefore, he explains, "the feature extraction and decision rule used to automatically detect altered fingerprints must be simple, since this will be at the front end of the fingerprint matching system." The altered fingerprint detector also must be capable of being easily integrated into any AFIS.

Jain's collaborators on the technology include Soweon Yoon, a computer science and engineering doctoral student at MSU, and Jianjiang Feng, an assistant professor in the Department of Automation at Tsinghua University, Beijing, China, who was formerly a postdoctoral fellow at MSU.

In their research, the team utilized a database of a few thousand images of altered fingerprints that were provided by various law enforcement agencies. The FBI's Integrated Automated Fingerprint Identification System (IAFIS) and the Department of Homeland Security's US-VISIT maintain two of the largest repositories of fingerprint databases in the world, containing tens of millions of subjects in each. Both of these agencies, as well as other law enforcement and border crossing agencies around the world, will benefit from this new technology.

The technology resulting from Jain's research was recently licensed to Morpho, part of the Safran group, one of the world's leading suppliers of identification and detection solutions.

The next step for Jain's research team is to develop technology with the capability to match an altered fingerprint with the original fingerprint.

Jain's research to further improve this technology is being funded by the FBI Biometric Center of Excellence.

To learn more about Jain's work, go to biometrics.cse.msu.edu. ❖

— Laura Luptowski Seeley

Evolution Park

into the world to do a specific job. Together, they are constructing an elaborate environment for evolving creatures in a computer, printing them out using the 3-D printer, and studying them as they swim, crawl, and fly on their own.

"Evolution has done a great job in the natural world. Now we are exploring what it can do with robotic systems," says McKinley.

An earlier NSF grant in 2008 established the evolutionary robotics laboratory, which includes a compute cluster, several computers for simulations, a swarm of micro-robots, and a tank that holds 18 tons of water. The tank provides an environment for experiments with robotic fish. In addition to the 3-D printer, the new grant will be used to purchase additional computers for high-fidelity simulations, as well as several smaller tanks equipped with instrumentation for monitoring purposes.

Evolutionary robotics, or using evolutionary computation to "design" the behavior of a robot and possibly its morphology, has been an area of interest for the past 20 years, according to McKinley. But recently, across the country and at MSU, there is an increasing interest in evolution-ary computing—evidenced by the establishment in 2010 of BEACON (Bio/computational Evolution in Action CONsortium), an NSF Science and Technology Center for the Study of Evolution in Action.

Located in the Biomedical and Physical Sciences Building on the MSU campus, BEACON serves as a resource for academics, educators, and industry, helping create new technologies to solve real-world problems, ranging from the development of safer, more efficient cars, to systems that detect computer intrusions, to medical applications.

McKinley refers to the "three pillars of BEACON"—biological evolution, evolution harnessed for engineering, and then applying this artificial life technology to help better understand the evolutionary process in general. "We've reached a point where computing can really serve us in this new area of engineering—evolutionary design," says McKinley.

As an initial step for the project, researchers are studying the basic locomotion and other behaviors of a natural organism, using the

The research team working on Evolution Park include (from left) Xiaobo Tan, associate professor of electrical and computer engineering; Jianxun Wang (back), PhD student; Sanaz Behbahani (front), PhD student; Brian Wright (in back), research/instructional equipment technician; Philip McKinley, professor of computer science and engineering; and Anthony Clark, CSE PhD student. Jared Moore, another CSE graduate student, is also involved in the project.

stickleback fish as a model.

The stickleback, a small fish that averages 6 cm in size, is the perfect vertebrate system for studying evolution in action because they are also amendable to lab and field experiments and they adapt rapidly to novel evolutionary pressures, giving the researchers a window on the process of evolution.

"The goal is to produce very small swim-ming robots, similar to sticklebacks in size and appearance, which will intermingle with live fish in order to help understand various behaviors and how they evolved. In turn, this knowledge will feed back into the development of robots that can adapt to adverse and dynamic conditions," says McKinley.

The engineering researchers will produce robotic fish in the computer using evolutionary computation and physics-based simulators, as well as SolidWorks 3D CAD software. "Using evolutionary algorithms, we will evolve the controllers for these robots, as well as the bodies of the robots themselves, in a computer. Evolu-tion will enable us to find the best combinations of materials, shapes, and behaviors," McKinley says. He notes that they will be able to evaluate thousands of generations in a day. "When we have a design that seems like it's performing pretty well in the simulated world, we will print it out for testing in our real tanks."

The 3-D printer uses materials that range from extremely hard plastic to extremely flexible plastic—and everything else in between. "Having our own 3-D printer is a huge advantage. Instead of having to send our designs off to be manufac-tured somewhere else, we just print them out

right here and test them on the same day. If it doesn't work the way the simulation indicated it would, we try to figure out why. We refine it and try again," says McKinley. "We could also print many different possibilities at the same time and have them compete against each other to see how they work in the real world."

The "creatures" that come out of the printer are mostly passive devices, although they may also contain gears and other physical mecha-nisms, printed in place. But they don't contain electronics. So there is one more step. After printing, the researchers need to couple the passive parts of the robots with active elements, such as microcontrollers, electroactive polymers (also known as artificial muscles), small servo mo-tors, or other compact mechanisms to actuate the devices, enabling them to move and maneuver.

There are many promising applications, both civilian and military, for these new generations of robots. "Mobile robots, working alone or in groups, are increasingly viewed as means to assist humans in remote, difficult, or dangerous tasks," says McKinley. "However, since human oversight may be limited or temporarily unavailable in these situations, such robotic systems must exhibit a high degree of autonomy."

The more autonomous these robots are, and the more capable they are of operating effectively under adverse conditions, the better. But how can software be designed to adapt to situations that can't be anticipated? That's the difficult part, says McKinley.

"We need to combine evolutionary com-putation with rigorous software engineering techniques to build very robust, but adaptable, software systems. These are the types of systems these robots will need," McKinley says. "Evolution is a wonderful search process in natural organisms. It finds solutions to complex problems. Now, we have enough power in a computer, in a cluster of computers, to truly evolve systems," says McKinley. "Let's use that great search capacity of the evolutionary process to help us engineer solutions—solutions we could never come up with on our own—to some really difficult problems."

– Laura Luptowski Seeley

Alumni Pipeline

2012 IEEE Fellows

Four former PhD students who worked in the PRIP lab under the tutelage of CSE University Distinguished Professor **Anil Jain** have been elected as 2012 IEEE fellows. They are:

- **Patrick Joseph Flynn** (PhD '90), University of Notre Dame, Notre Dame, Ind. – For contributions to biometric identification.
- **Jianchang Mao** (PhD '94), Yahoo! Inc., Santa Clara, Calif. – For contributions to pattern recognition, search, content analysis, and computational advertising.
- **Sharatchandra Pankanti** (PhD '95), IBM Thomas J. Watson Research Center, Yorktown Heights, N. Y. – For contributions to biometrics and surveillance systems.
- **Salil Prabhakar** (PhD '01), DigitalPersona Inc., Freemont, Calif., who is currently setting up a startup company – For contributions to biometrics technology.

Another of Jain's students, **Nalini K. Ratha** (PhD '96), became a fellow in 2007.

CSE Grads Team Up to Grow Their Own Business

Ryan Doom (BS '03) and **Kevin Southworth** (BS '04), president and vice president, respectively, of Web Ascender in Okemos, Mich., recently were named the winners of the Lansing Business Monthly Interactive Technology Award.

In addition, Doom was named a 2011 winner of the "Ten Over the Next Ten" award given to Lansing-area young professionals for their talent and potential to have the biggest impact on the region in the next decade.

"The goal over the next 10 years is to continue to grow the business and really help out the technology and IT industry in Michigan," says Doom. "I'd like to see every technical company take on a couple of interns." ❀

CSE Alum Dies in Plane Crash

Daniel Lee Swets (MS '91, PhD '96), age 47, of Sioux Falls, S. Dak., died December 9, 2011, as the result of a charter plane crash near Sioux Falls.

After earning his BS in computer science from Calvin College, Grand Rapids, Mich., in 1986, Swets was employed as a software engineer at Rockwell International, Downey, Calif., on the space shuttle orbiter backup flight system. He then went to work for Smiths Industries in Grand Rapids as an aerospace software engineer. From 1990 to 1991, he was an instructor at Grand Rapids Community College and at Grand Valley State University.

After obtaining his graduate degrees at MSU he worked for Augustana College in Sioux Falls, becoming an associate professor and chair of computer science and mathematics. He taught the hardware sequence for computer science majors and was responsible for many of the upper-level electives in the department, such as graphics, networks, and parallel processing. His current research interests included algorithm development for remote sensing, computer vision, content-based image retrieval, computer graphics, virtual reality, and robotics.

He is survived by his wife, Robyn; children, Joseph, 20, Kira, 18, Megan, 14, and Benjamin, 1; his parents, Kenneth and Rosemary Swets; and siblings, Keith, Paul, Lynn, Mark, and Beth.

Remembrances of Daniel Swets

Members of the CSE faculty remember Swets from his time at MSU.

From Anil Jain, University Distinguished Professor of Computer Science and Engineering:

I first met Dan when I taught a lifelong learning course for the MSU College of Engineering in Grand Rapids. Dan was working for a company in Grand Rapids and took my course.

Based on his outstanding performance in my course and his interest in pursuing graduate studies, I encouraged Dan to enroll in the PhD program in computer science at MSU. Professor John Weng and I were the co-advisers of Dan's thesis, which was on face recognition and was of exceptional quality.

Dan and I stayed in touch after he graduated, and he would occasionally recommend one of his top students at Augustana College to our graduate program. We at MSU, particularly those working in the computer vision and pattern recognition research area, are really sad to learn of this tragedy and would like to convey our sincere condolences to Dan's family.

From George Stockman, retired Professor of Computer Science and Engineering:

I remember Dan well from his PhD work in the MSU Pattern Recognition and Image Processing (PRIP) Lab. He was a kind, humble person and helpful to our group. Having industrial experience prior to his PhD program, he was already well organized and finished his program in less than three years.

It is sad to be without Dan now; I'm sure many students were fond of him and learned a great deal from him.

From John Weng, Professor of Computer Science and Engineering:

Dan Swets was my first PhD student after I joined MSU in 1992. Anil Jain recommended that he co-advise Dan with me. Dan told me that he wanted to teach in the future as a professor, but he did not have a strong background in sophisticated mathematics. I had designed a new method for performing a pattern recognition technique (linear discriminant analysis). I explained this new method and its applications to content-based image retrieval and recognition to Dan. This new class of methods was later called "appearance-based vision." Dan used the topic as his PhD thesis.

Dan was the most efficient and well organized student I have ever had. He wanted to give me written weekly reports, and designed a nice format for them. I later recommended Dan's weekly report practice and his report format to my students.

I was so sad to hear that we lost him. My wife and I offer sincere condolences to his wife and children. ❀

Faculty and Staff Pipeline

New Staff

The CSE department welcomes **Monika Witoslawski** to its staff. Witoslawski is currently a teaching specialist doing instruction and curriculum development of CSE 101 (Computing Concepts and Competences). She is involved with the training and supervision of teaching assistants assigned to the course, coordinating the lab sections, serving on department committees, and participating in outreach.

Prior to coming to MSU, Witoslawski worked for 10 years as a lecturer in the Department of Computer Science at Wayne State University (WSU) in Detroit. She also served as a director of WSU's Computer Literacy Program and advised the WSU ACM and ACM-Women student chapters. She received her master's degree in computer science from WSU in 2001.

Outside of the computer science world, Witoslawski loves travel, art, and gastronomy.

Withrow Awards

Two CSE faculty members were honored with Withrow Awards at the college's annual awards luncheon in March.

Professor **Wayne R. Dyksen** received the **Withrow Teaching Excellence Award**. He is an outstanding instructor who creates within all of his students a drive to excel. A freshman orientation seminar that he introduced—Computer Science as a Profession—is now a required course for all majors. He also introduced a senior seminar designed to assist graduating seniors with their job searches and career planning. The experience gained in his capstone course has been nothing short of exceptional.

Professor **Laura K. Dillon** received the **Withrow Exceptional Service Award**. For more than 27 years, she has provided exceptional service to her profession. She is well respected for her work on behalf of the software engineering research and academic communities—first at the University of California, Santa Barbara (UCSB), and then when she joined the MSU faculty in 1997. She is widely recognized for her leadership role in promoting and measurably increasing the participation of women and underrepresented minorities in her field. She is consistently at the center of outreach and fundraising activities.

In addition to significant mentoring of students, Dillon has assumed numerous leadership positions within MSU's Department of Computer Science and Engineering, including interim chairperson (2003-2005) and department chairperson (2005-2007). She led the development of a regional conference for women in computing in an effort to address the alarming decline of American women choosing computer science professions. The first Michigan Celebration of Women in Computing (MICWIC)—a biennial event—was held in 2007. She was program chair for the 2011 Grace Hopper Celebration of Women in Computing, the premier conference series for women in computing worldwide; she will chair that conference in 2012.

Most Cited Paper Award

The editor of *Pattern Recognition Letters* has announced that **Anil Jain**, CSE University Distinguished Professor, received the 2012 Most Cited Paper Award for the article "Data Clustering: 50 Years beyond K-means", *Pattern Recognition Letters*, vol. 31, no. 8, pp. 651-666, June 2010. The article may be found at: http://www.sciencedirect.com/science/article/pii/S0167865509002323

NSF Cyber-Enabled Discovery and Innovation (CDI) Grant
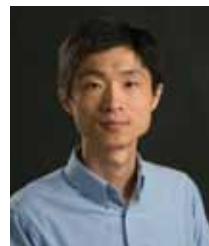
Assistant professor **Guoliang Xing** and colleagues have been awarded a four-year $1.83 million grant by the National Science Foundation to develop imaging 4D tomography of an active volcano in real-time.

The project is titled "VolcanoSRI: 4D Volcano Tomography in a Large-Scale Sensor Network."

The multidisciplinary team of this project will create a new paradigm, VolcanoSRI (Volcano Seismic Realtime Imaging). VolcanoSRI is a large-scale sensor network of low-cost geophysical stations that analyzes seismic signals and computes real-time, full-scale, three-dimensional fluid dynamics of the volcano conduit system within the active network. The computed 4D tomography model will illuminate complex, time-varying dynamics of an erupting volcano, providing a deeper scientific understanding of volcanic processes, as well as a basis for rapid detection of volcanic hazards. VolcanoSRI will potentially make the fictional holographic projector known as Virgil in the film "Supervolcano" a reality.

The other researchers on the project include WenZhan Song, associate professor of computer science at Georgia State University, and Jonathan Lees, professor of geological sciences at the University of North Carolina at Chapel Hill.

New Grants for Sequencing Technology
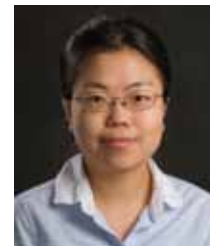
Assistant professor **Yanni Sun** and colleagues have been awarded two grants, one from the National Institutes of Health (NIH) and the other, totaling more than $1.8 million, from the National Science Foundation (NSF).

The goal of the NIH project is to utilize deep sequencing technology to characterize the full gRNA transcriptomes in the two main life cycle stages of Trypanosoma brucei. Sun is the co-investigator, with Donna Koslowski, professor in the MSU Department of Microbiology and Molecular Genetics, as the principle investigator. The grant is for $152,000.

The goal of the NSF project is to design algorithms and tools for plant genome annotation. The team working on this two-year project includes Mark Yandell, associate professor at the University of Utah; Ning Jiang, associate professor in the MSU Department of Horticulture; Shinhan Shiu, associate professor, and Kevin Childs, visiting assistant professor, in the MSU Department of Plant Biology; and Sun. ❁

Student Pipeline

CSE Sophomore Named Goldwater Scholar

Mairin Chesney, a CSE sophomore, is one of two students from Michigan State University to be named a 2012-13 Goldwater Scholar, bringing MSU's total number of Goldwater Scholars to 32.

Chesney, of Brighton, Mich., is among the 282 undergraduate sophomores and juniors from the United States who were awarded the scholarship. She is a member of the Honors College.

The Goldwater Scholars were selected on the basis of academic merit from a field of 1,123 mathematics, science, and engineering students.

"This is very exciting news for the students and their research mentors," says Cynthia Jackson-Elmoore, dean of the Honors College. "I am pleased that their early and distinguished commitment to scholarship is being celebrated and that their research is being recognized and indeed encouraged."

Chesney, a graduate of Brighton High School, combined her love of computer science and biology while working with professor Charles Ofria in the BEACON Center for the Study of Evolution in Action. She also has collaborated with a fellow undergraduate student to design a joint oral presentation and research poster that won first prize at the Michigan Celebration for Women in Computing Conference.

Chesney's passion for digital evolution grew from her fascination with how simple computer programs could exhibit many characteristics of life. It is because of the many fundamental evolutionary questions that remain unanswered that she plans to obtain a doctorate in computer science and pursue a research career in computational biology.

"Research has been one of the most unexpectedly wonderful parts of college, and I am happy to be able to continue," says Chesney, who is also a 2011-12 Von Ehr Scholar. The James Von Ehr Scholars Program was established in 2006 by James R. Von Ehr II, a 1972 computer science graduate and entrepreneur. The $1 million endowed scholarship fund benefits undergraduates of the College of Engineering.

She is the daughter of David and Jean Chesney.

Craig Pearson, an MSU sophomore from Bloomfield Hills, Mich., was also named a 2012-13 Goldwater Scholar. He is dual majoring in biochemistry and molecular biology, and English.

Started in 1986, the Barry M. Goldwater Scholarship and Excellence in Education Program seeks scholars committed to a career in science, mathematics, or engineering who display intellectual intensity and who have the potential for significant future contribution in their chosen field. The Goldwater Scholarship provides a grant toward the last year or two of undergraduate tuition and living expenses for students who are planning careers in research.

PhD Grads Win Prestigious Fellowships

Recent CSE PhD graduates **Heather Goldsby** and **David Knoester** have both won "CI TraCS" Fellowships for Transformative Computational Science using Cyber Infrastructure from the National Science Foundation. These are highly competitive and prestigious postdoctoral fellowships, with only six to eight fellowships expected to be awarded nationwide each year.

Goldsby graduated with her PhD in computer science and ecology, evolutionary biology, and behavior in May 2011. Her academic adviser was associate professor Charles Ofria. Goldsby is working with Benjamin Kerr, a biologist at the University of Washington. Her project is titled "A Digital Evolution Infrastructure for Experimental Investigations into the Evolution of Division of Labor."

Knoester graduated with his PhD in computer science and ecology, evolutionary biology, and behavior in May 2011. His academic adviser was professor Philip McKinley. Knoester is working with Christoph Adami in MSU's Department of Microbiology and Molecular Genetics. His project is titled "GENEVA: Generalizing Evolutionary Algorithms."

Internship in Germany

Kathryn "Kate" Bonnen, who graduated in December 2011 with degrees in CSE and psychology, was an intern at the Max Planck Institute (MPI) for

Biological Cybernetics in Tübingen, Germany, during the summer of 2011.

Bonnen works for CSE professor Anil Jain in the Pattern Recognition and Image Processing Lab.

Jain made the contacts that helped Bonnen to get the internship, which involved the management and statistical analysis of a 3-D database of faces. "After performing the statistical analyses, I used this information to conduct a psychological experiment examining implicit human knowledge of faces," says Bonnen.

Even though she graduated in December, Bonnen has stayed on at MSU for the spring semester to continue a research project. She will spend this summer interning at Microsoft and plans to begin graduate school in computer science in the fall.

"I chose to major in computer science because I love math and problem solving but I also really liked the applied aspect of computer science. Computer science allows people to build programs and systems that can make an impact on people's lives," says Bonnen. "My advice for students would be to get involved and experience everything you possibly can in college. You never know what new interests you might discover."

Graduate Research Symposium

The first Engineering Graduate Research Symposium was held November 3, 2011, at the MSU Union. Satish Udpa, dean of the College of Engineering, provided opening remarks as more than 270 graduate students from across the college presented posters to faculty and peers. Department-level poster competitions were held with each department identifying their top posters.

The top three CSE posters were:

First Place: **M. Zubair Shafiq**, Modeling Structure of Cascades in Online Social Networks Using Multi-order Markov Chains;" thesis adviser is Alex Liu; supported by the National Science Foundation.

Second Place: **Soweon Yoon**, "Altered Fingerprints: Analysis and Detection;" thesis adviser is Anil Jain; supported by the Federal Bureau of Investigation Biometric Center of Excellence.

Third Place: **Eric Norige**, "Ternary Tries for TCAM Ruleset Compression;" thesis adviser is Alex Liu; supported by the National Science Foundation.

Honorable Mention went to **Stephen Paslaski** and **Couri VanDam**, "Modeling How You Like /Dislike a Visual Face: A Brain-Inspired Model;" **Brendan F. Klare**, "Heterogeneous Face Recognition using Kernel Prototype Similarities;" **Prakash Mandayam Comar**, "LinkBoost: A Novel Cost-Sensitive Boosting Framework for Community-Level Network Link Prediction;" and **Jun Huang**, "Beyond Co-existence: Exploiting WiFi White Space for ZigBee Performance Assurance."

Fitch H. Beach Awards

Brendan Klare, a CSE doctoral student, received second place in the Fitch H. Beach Award competition. His adviser is CSE professor Anil Jain. This endowed award annually recognizes the most outstanding graduate researchers within the College of Engineering. ❖

MSU Women in Computing Hosts Workshop for 40 Girls

More than 40 girls in 4th-8th grades from area schools spent a recent Saturday participating in a Technology Workshop sponsored by MSU Women in Computing.

Fifteen MSU student volunteers led sessions on creating web pages with HTML and CSS, as well as basic programming concepts using Scratch. The girls overwhelmingly rated the workshop as being fun and informative. This workshop, which has been offered twice a year for Girl Scouts for the last five years, was expanded this semester to include others.

During the March 24 workshop, Satish Udpa, dean of the College of Engineering, paid a visit to the classrooms and talked to the girls about careers in computer science and engineering.

"There is a high demand for computer scientists everywhere in the United States," says Teresa Isela VanderSloot, coordinator of the program. "It is important for girls to consider the wide variety of job options in computing. If they have a passion for a particular industry or want to make a difference in some way, computer science is definitely a field they should consider."

Satish Udpa, dean of the College of Engineering (right), talks with girls in 4th-8th grades about careers in computer science and engineering.

"We need to reach girls in middle and high school, when they are forming an image of what they want to be and what they like and are good at, if we are going to increase the numbers choosing computer science," says Laura Dillon, professor of computer science and engineering. "And we need their talents and insights to remain competitive in a world increasingly dependent on information technology. The MSU WIC Technology Workshop gives young girls positive role models they can relate to. It piques their interest, empowers them to learn and play with computing, and builds confidence." ❖

Urban Science Sponsors Capstone Experience Lab

Urban Science, based in Detroit, Michigan, provided a $30,000 grant to the CSE Capstone Experience Lab to upgrade the 12 desktop machines to powerful Apple iMacs. Installation of the new computers was completed in December 2011.

On February 22, representatives from Urban Science helped with the official "grand opening" of the lab during a ribbon-cutting ceremony. The Urban Science representatives attended the capstone all-hands meeting and heard an update

on their current capstone project titled "Infographics Generator."

"At Michigan State University, we're committed to partnering with Detroit and Michigan-based companies," says Wayne Dyksen, CSE professor and director of the Capstone Experience Lab. "Our strategic relationship with Urban Science is a prime example of how companies and universities can work together for the benefit of everyone."

Urban Science works with most major global automotive manufacturers and more than 10,000 automotive dealers worldwide to help them increase market share and improve profitability by planning their retail networks effectively, defining and measuring performance, and developing sales and marketing programs that deliver results.

Crain's *Detroit Business* recently named Urban Science one of the top 25 companies to watch in professional services and retail. Urban Science has been sponsoring capstone projects as part of the

CSE 498 course since the spring of 2009.

Urban Science representatives on hand for the event included Greg Davidson, vice president and chief information officer; Matt Bejin, director of global recruiting; Ryan Hespenheide, global systems director; Randy Berlin, global practice director; and Shannon Muldowney, senior recruiter. Tom Wolff, associate dean of the MSU College of Engineering; Matt Mutka, chairperson of the CSE department; and Dyksen also joined in the festivities.

Dyksen believes that the support will make a difference for students. "Urban Science's generous support of the Capstone Experience Lab with 12 Apple iMac computers gives MSU capstone students the ability to develop software for any hardware or software platform including iPhone, iPad, and Android apps." ❖

From left: Greg Davidson, vice president and chief information officer, and Mark Colosimo, global director of integrated analytics, both with Urban Science, discuss capstone projects with CSE professor Wayne Dyksen.

KEEPING IN TOUCH

NAME
_____

STREET ADDRESS
_____

CITY / STATE / ZIP   IS THIS A NEW ADDRESS?   ☐ YES   ☐ NO
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OFFICE TELEPHONE   HOME TELEPHONE
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E-MAIL
_____

GRADUATION YEAR   DEGREE
_____

CURRENT OCCUPATION
_____

EMPLOYER   LOCATION
_____

News of recent accomplishments, awards, or promotions (Use separate sheet if needed):

_____

_____

_____

We want to know what's happening with you! Update us by mail at Attn: Publications, MSU, Engineering Bldg., 428 S. Shaw Lane, Room 3412, East Lansing, MI 48824-1226; by e-mail at editor@*egr.msu.edu*; or by fax at 517.355.2288.

GIFT INFORMATION

☐ I/we wish to make a gift/pledge in the amount of $ _____
   designated for: _____

My/our total gift will be paid as indicated:
☐ Check payable to "Michigan State University"
☐ Credit card charge to: ☐ MasterCard   ☐ Visa   ☐ Discover   ☐ AmEx

_____
CARD NUMBER   EXP. DATE

_____
NAME AS IT APPEARS ON CARD

_____
SIGNATURE

☐ A pledge of the following duration (maximum 5 years): _____
   Enclosed is my first payment of $ _____
   Please send pledge reminders: ☐ Annually   ☐ Quarterly   ☐ Semiannually
   beginning: _____
                    MONTH   YEAR

☐ This pledge replaces all other outstanding pledges.
☐ This is a joint gift with my spouse: _____
                                                    SPOUSE'S NAME

☐ I or   ☐ my spouse (*check one*) works for a matching gift company:

_____
EMPLOYER(S)

Please return to: Engineering Development, MSU, Engineering Building, 428 S. Shaw Lane, Room 3536, East Lansing, MI 48824-1226, or make your gift online at *www.givingtomsu.edu.*

Representatives of Urban Science and the College of Engineering helped with the official "grand opening" of the CSE Capstone Experience Lab, including (from left) Matt Mutka, chair of the CSE department; Thomas Wolff, associate dean for undergraduate studies for the college; Matt Bejin, global director of recruiting and staffing for Urban Science; and Greg Davidson, vice president and chief information officer with Urban Science. See story on page 7.

Devan Sayles, CSE senior and president of MSU Women in Computing, works with students during a recent Technology Workshop for girls in 4th through 8th grades. See story on page 7.