

Northern Star

New information from Microsoft Research puts Minnesota at the head of the pack in U.S. academic institutions

Call it Midwestern modesty or Minnesota nice, but there's a quiet revolution going on in Computer Science and Engineering at the University of Minnesota, and the greater community is taking notice. If you look at the leadership roles in the major scientific conferences and science policy forums, if you track the distinguished contributions and best paper awards at major conferences, and if you follow where the top companies are hiring from, you will see Minnesota at every turn. This has led



our scientific colleagues – in academia, in industry, and in the government – to ask the question ‘What is going on in Minnesota?’

Our faculty members are sought after as keynote speakers at major conferences, are members of national and international advisory boards, in government and in industry, and many of them have received significant recognitions for their scientific contributions. As one marker, 23 of our faculty have been awarded the prestigious NSF Faculty Early Career Development (CAREER) Award. In addition, we are one of the very few U.S. computer science departments with 3 NSF PECASE awardees. The research being done in our labs jointly with students not only gets published in top tier forums, but has consistently been winning a large number of best paper awards. Our faculty is leading several high impact, multi-million dollar projects funded by federal agencies such as NSF, NASA, DARPA and NIH, including projects on a global population/environment data network, collaborative robotics, robotic sensor networks to track invasive fish species, human computer interaction, social computing, spatial information management, safety critical systems,

storage systems architecture, bio- and healthcare informatics, computational biology, and safety and security of medical devices; as well as a \$10 million five-year project on understanding climate change funded by the NSF Expeditions in Computing program. The total research funding awarded to the department over the past four years is well above \$60M.

The quality of training received by our students is outstanding. Not only are they in high demand in companies like Google, Amazon, Microsoft, Apple, IBM, Facebook, and Yahoo!; our Ph.D.s. are in high demand as faculty members in institutions around the world. Fortunately, we have been able to meet this demand. Over the past five years, we have graduated 129 Ph.D. students, one of the highest yields of any computer science department.

We are especially proud of the success of our graduates who have excelled in academia, research labs, and industry. Our former graduate Jeff Dean is a Google Fellow, a member of the National Academy of Engineering, and winner of the 2012 ACM Infosys award. Jeff is a key architect of Google's distributed computing infrastructure. Arvind, MIT's Johnson

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Message from the

Department Head



HIGHLIGHTS

New initiative and collaborations for the department

Remembering John Riedl

There are a number of new University-wide initiatives in which our faculty is playing an important part. Particularly noteworthy is MnDRIVE, a landmark partnership between the University and the state of Minnesota. MnDRIVE will foster innovation, cultivate strategic business collaborations, and produce breakthrough research that addresses our state's and society's greatest challenges. In 2013, the Minnesota Legislature authorized an \$18 million annual investment in four research areas: robotics, sensors and advanced manufacturing, securing the global food supply, advancing industry, conserving our environment, and discoveries and treatments for brain conditions. Our faculty is poised to contribute to all areas, but they have been asked to take a leadership role in the robotics area, given their extensive track record of accomplishments in this area. The initiative will provide support for infrastructure and research in these areas as well as for outreach to K-12 students to increase their interest in STEM fields, and several new faculty positions.

Demand for computer science and engineering graduates continues to increase nation-wide and projections for future remain equally strong. This nationwide trend is a reflection of the reality that our graduates are not only sought after by computer companies such as Google, Microsoft, IBM, Intel, but also by organizations such as 3M, General Mills, Target, United Health. This bodes well for the future of our field. This has also caused increased interest in pursuing computer science and engineering amongst younger generations and is reflected in the enrollment for our classes, which have more than doubled over the past 8 years. This enrollment growth shows no sign of slowing down (they grew 18% just this past year) and is beginning to put serious pressure on our resources.

To better team with industry leaders and address their needs for an ever increasing workforce, we introduced a new advisory group, Industry Affiliates Council (IAC), for the department. IAC is being led by alumnus Mike Rogalski of Accenture. Computer Science Associates (CSA) will continue providing important contributions to department, with a new group chair, John Borowicz. While IAC will focus more on the recruiting needs of larger organizations, CSA members will support the department as individual alumni and friends. You will see columns in future Soundbyte issues from John and Mike as they inform you on the groups' goals and activities.

There has been a great deal of excitement around massively open online courses (MOOC) that have the potential to reach a very large student body around the world and revolutionize education both in terms of cost and quality. The University of Minnesota, in partnership with Coursera, has begun offering these courses, and our faculty is at the forefront in this emerging area. This fall, Professor Joseph Konstan, along with graduate student Michael Ekstrand, co-taught "Introduction to Recommender Systems." This for-credit course introduced the concepts, applications, algorithms, programming, and design of recommender systems to 23,000 registered students, 2,500 of whom were doing concepts track assignments and 1,000 of whom were doing programming assignments. For next year, Professors Shashi Shekhar and Brent Hecht are designing another MOOC on spatial computing.

Finally, we were greatly saddened this summer by the passing of a gifted researcher, teacher and mentor, John Riedl. I want to thank all of you who joined us at our event in August to celebrate his life and career at the University. He is greatly missed.

— Vipin Kumar, CS&E Department Head
and William Norris Professor

department NEWS

Local and national news

A story in the *Minneapolis / St. Paul Business*



Journal featured Ninja Metrics, a start-up founded by Professor **Jaideep Srivastava** and University of Southern California professor Dmitri Williams.

Ninja Metrics Inc. received \$2.8 million in funding from Tech Coast Angels and Harvard Business School. Ninja Metrics analyzes online game player data to identify key traits among online gaming communities. Game developers can use the data to identify player motivations, and opportunities for game developers to generate revenue. Ninja Metrics also provides social values of players, scoring them based on their influence on other players. It can also offer insights on why some players leave the game all together.



Chad Myers and researchers from the Mayo Clinic, and University of Toronto successfully showed that a new method for targeting mutated cells could create a major breakthrough in a personalized medicine approach to treat cancer. The team's findings were published in the October 15 issue of *Cancer Research*, a journal of the American

Association of *Cancer Research*. The new research discovers susceptible genes in the cancer cells using synthetic lethal interactions—pairs of genes in which mutation in either gene alone causes no damage to the cell, but where mutations in both cause the death



of the cell. The work of Assistant Professor **Dan Knights** was recently published in *Nature Biotechnology*. The paper, "Predictive functional profiling of microbial communities using 16S rRNA marker gene sequences," presents PICRUST, a new approach to predicting the entire set of genes in a

complex microbial community using only sequences of a single type of gene called a marker gene, combined with evolutionary models and a database of reference

genomes. PICRUST allows the research team to predict the full metagenomic content of microbial communities using only marker gene surveys, with around 90% accuracy in the human gut. With PICRUST researchers can gain new insights into the functional profiles of the thousands of published uncultivated microbial communities for which they only have marker gene surveys.

The work of **Zhi-Li Zhang**, Ph.D. student, Nan Jiang, Yu Jin and AT&T Labs was covered on the Network World website. The work covers Greystar, a method for tracking the source of spam text message within hours. The work can help reduce text traffic clogging wireless networks and causing dropped calls. Their algorithm has not been made into a commercial product but could be incorporated in software within carrier networks that tap real-time call data to pinpoint the source of SMS.



Professor **Maria Gini** and CS&E alumnus Rebecca Schatz (M.S. 1985) were featured in an article in the *StarTribune* on women in the tech industry. The article "Still outnumbered, women strive to tap into tech industry" discussed the gains that women have made in recent years in the male-dominated tech industry. The article also highlights the Grace Hopper Celebration of Women in Computing which took place October 2-5, in Minneapolis.



A new state-of-the-art Medical Devices Center celebrated its grand opening over the summer. The new 8,000-square-foot center expands upon the previous center space in Shepherd Labs. Facilities include a 3D Virtual Design Lab, Imaging Lab, SimPortal/Anatomy and Physiology Lab, Mechanical and Electronic Fabrication Labs, Wet Lab and Brainstorming Rooms. The research and technology of Assistant Professor **Dan Keefe's** lab, the 3D Virtual Reality Touch Table and novel interfaces to drive it, were the highlight of the center's tours and were featured prominently in news segments on KSTP, CBS and the *StarTribune*.



Researchers in the University of Minnesota, including CS&E student Eitan Rogin, have developed a new noninvasive system that allows people to control a flying robot using only their mind. The study goes far beyond fun and games and has the potential to help people who are paralyzed or have neurodegenerative diseases. "Our study shows that for the first time, humans are able to control the flight of flying robots using just their thoughts sensed from a noninvasive skull cap," said Bin He, lead author of the study and biomedical engineering professor in the University of Minnesota's College of Science and Engineering.

Joe Konstan will participate in a faculty-led workgroup for the University of Minnesota that will develop the vision, mission, values, goals, and strategies for the University's next strategic plan. In August, the President put out a call for nominations and received over 500 names for the 30-member team. The group is also charged with developing a meaningful, timely engagement plan to reach out to stakeholders as their work moves forward.



CS&E happenings

CS&E is offering its first MOOC course this fall via Coursera. "Introduction to Recommender Systems," taught by **Joe Konstan** and Michael Ekstrand, began September 3, 2013. The for-credit course introduces the concepts, applications, algorithms, programming, and design of recommender systems—software systems that recommend products or information, often based on extensive personalization. Students will learn how web merchants such as Amazon.com personalize product suggestions.

Jaideep Srivastava took part in an Academic Founder Event in October. This forum was organized as part of the University's efforts to bridge the gap between research innovation and impact on the industry/society. The Academic Founder Event invited University of Minnesota researchers to learn more about the opportunities that arise from commercializing technologies developed from research and gain a unique perspective on entrepreneurship. Two engaging panels were featured, each made of successful investors and academics from around the country who have founded companies with university technologies. There were networking opportunities with the panelists. Srivastava was selected for his work with Ninja Metrics.



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Faculty speaking engagements

Abhishek Chandra gave an invited talk at The 7th International Workshop on Virtualization Technologies in Distributed Computing (co-located with ACM HPDC). The talk is on "Application-Aware Virtual Machine Provisioning." **Maria Gini** gave a keynote talk on exploiting spatial locality and heterogeneity of agents for teamwork at the 2013 IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR) in Linköping, Sweden. **Brent Hecht** was an invited keynote speaker at WikiSym 2012: 8th International Symposium on Wikis and Open Collaboration. **Dan Keefe** spoke at Medicine Meets Virtual Reality 2013. **Joe Konstan** spoke at AAMAS 2013 Human-Agent Interaction Design and Models Workshop. **Shashi Shekhar** provided a talk as a part of the Distinguished Lecture Series at Aalto University, Helsinki, Finland in August.



NOTES FROM THE CHAIR

The history of Computer Science Associates (CSA) bears the distinctive markings of the finest qualities of Minnesota's best minds, community spirit and dedication to ideals. For over three decades this group of 'geeks and suits' have worked faithfully as members and leaders to provide the Department with sage counsel through input from working professionals.

CSA was founded by the first generation of the information age – scientists, engineers, and businessmen from companies like ETA, CDC, IBM and Cray recognized the need to organize and promote a new department and center dedicated to computer science at the University, and evangelized for both industry and academic leadership. They understood that a world class CS department was vital to the University and the state. We owe these folks a huge 'thank you' not just for helping to establish the department but for their mighty efforts in getting a physical home for CS&E – Keller Hall.

CSA has had a special role in the evolution and development of the department – supporting and advising. CSA worked closely with the department administration to establish a direction focused on academic and research excellence. CSA was integral to the creation of the department's MSSE program. CSA members have served on faculty search committees and

helped refine curriculum. CSA was instrumental in creating and planning the biennial Open House/Technical Forum and establishing the Distinguished Alumni award. The confidence, growth and accomplishments of CS&E over the past 15 years transports CSA to a new place with a new focus.

Looking back to those halcyon days in the disco era when I was a lowly computer science undergrad, I can personally testify to the phoenix-like rise of CS&E to that of a national treasure. Through my 20 years of membership in CSA, I have witnessed the evolution of CSA from its adolescent period in the 80s and early 90s, into today's action-oriented cadre of computing professionals committed to assisting the CS&E department in meaningful ways and challenging faculty, students, colleagues and partners to 'blow our socks off' with advances and discoveries.

So, what is the challenge facing CSA now? Connection.

CSA is beginning a new era, one that will serve to build connections between alumni and the Department; connections that persist and benefit all. We want CSA to become known as fun, engaging and rewarding contact point, a ready resource for CS&E alumni, corporate pros, and friends interested in computers, education

and technology. A place where people can be (re)introduced to the excitement of learning, the joy of discovery and the peace that comes with helping others.

CSA's mission is to get more of our members, alumni and friends of the department involved helping and sharing with the students via specific programs (CS&E Mentors, coding contest volunteers, career

advisors), organizations (ACM, IEEE, SWE, Grace Hopper, CodeSavvy) and events and activities (FIRST Robotic, Computer Science Education Week, Open House/Tech Forum). We aim to promote and facilitate one-to-one connections between students, the department and faculty, computing people and computing enterprises.

Our goals are to strengthen individual relationships between our CSA members, CS&E students, CS&E faculty and increase the numbers of people who will share their experience and wisdom, care about higher education, care about being a professional, and get involved to make everyone's life better, safer and happier. I hope you will join us.



CSA: John Borowicz

IAC: Mike Rogalski



If you have been tuned in to the workforce in recent years, you know that there is a huge and growing demand for computer science graduates. Some companies based in the region have needs for new recruits that are in the triple digits. Employers

are becoming more inventive in their efforts to attract students to fill those positions.

CS&E understands that those needs are out there. In an effort to work with employers more

strategically, last year the department created the Industry Affiliates Council (IAC), and asked me to serve as chair of the group. As a longtime member of CSA and a university graduate, I consider myself fortunate to have the knowledge and insight in the department, the recruiting cycles, and needs in the business community to lead this group.

At our kick-off meeting this summer, we held an open discussion about getting employers into the classroom and working directly with students. This has been a traditionally difficult task, with time in class needed to cover coursework. We looked at the successful model that CS&E created with Microsoft, a software project course. We heard from John Healy of Microsoft who has done hands on work with the students as part of that course, and received his

insights on those interactions. As a result of that discussion CS&E is now creating a proposal that would allow more project courses sponsored by employers.

Representatives from many key employers in the Twin Cities were present at the meeting. I attended with my colleagues from Accenture, we also had representatives from 3M, Best Buy, Cisco, Dell, Emerson, General Mills, Microsoft, Thomson Reuters, Symantec, Unisys and Vital Images. Though the IAC group itself is young, its members are established companies who are prepared to make an investment into recruiting and retaining the future workforce. We look forward to tackling this question, along with the issues related to getting more CS&E graduates to fuel the workforce in IAC meetings. We encourage more companies to join the discussion in the IAC.

Awards FACULTY ACHIEVEMENTS



Associate Professor **Arindam Banerjee** was selected for the 2013 Yahoo! Faculty Research and Engagement

Program (FREP) for his proposal "Contextual Ranking for Content Personalization." Suju Rajan of Yahoo! Labs will be working with Banerjee to scale contextual ranking for content personalization. The award includes a \$20,000 unrestricted gift and access to Yahoo! data to start the collaboration. The FREP initiative is designed to produce the highest quality scientific collaborations and outcomes by engaging with faculty and students conducting research in areas of mutual interest. The FREP funds help academics across the globe collaborate with Yahoo! research scientists on new, exciting internet research studies and experiments. Banerjee is also the recipient of a \$20,000 IBM Faculty Award. The IBM Faculty Awards are a globally competitive program intended to "foster collaboration between researchers at leading universities worldwide and promote courseware and curriculum innovation."



Associate Professor **Nicholas Hopper** and his collaborator, Roger Dingledine, have been awarded a National Science Foundation grant totaling \$1.1M. The four-year grant will fund their project, Measurement-Based

Design and Analysis of Censorship Circumvention Schemes, with the goal of improving the security, management, and performance of



software used to bypass Internet censorship. Assistant Professor **Brent Hecht** was selected to receive the 2013 Yahoo! Academic Career Enhancement (ACE) Award. Five young professors conducting

academic research at leading research universities around the world were selected for the honor. Hecht will receive a \$10,000 unrestricted gift. Established in 2011, the ACE award is designed to help newly hired faculty launch research programs in areas of relevance to Yahoo! Hecht joined the department in Spring of 2013. His interests lie at the intersection of human-computer interaction, geography, and big data, and his research centers on the relationship between big data and human factors such as culture. Professor **Yousef Saad** has won a 2013 Society for Industrial and Applied Mathematics (SIAM) Outstanding Paper Prize for his paper,



"The trace ratio optimization problem for dimensionality reduction," written with Thanh Ngo and Mohammed Bellalij. The award is given for outstanding papers published in SIAM journals during the past three years. Saad and his co-authors were selected for the journal SIAM Journal on Matrix Analysis and Applications for the year 2012. Saad received his award at the SIAM national meeting last July in San-Diego.

Work led by Professor **Stergios Roumeliotis** was awarded a \$1.5M grant from the National Science Foundation.

The award is part of the National Robotics Initiative and will fund research in collaborative robotics, particularly humanoid robots designed to assist humans with carrying and manipulating large and heavy objects.

Collaborators include Aerospace Engineering and Mechanics' Associate Professor Demoz Gebre-Egziabher and faculty from the University of Delaware, Drexel University, the University of Pennsylvania, and the University of Illinois at Urbana - Champaign.



Best Paper Awards



UMSEC Program Director **Sanjai Rayadurgam** received an Outstanding Paper Award at the ACM Conference on High Integrity Language

Technology 2013 (HILT13) held in Pittsburgh. The paper, "Compositional Verification of a Medical Device System," presents a scalable approach to design and verify large software systems using an assume-guarantee style reasoning over architectural models to compose proofs for system-level properties from component-level properties verified by model-

checking. Anitha Murugesan, **Michael Whalen**, and **Mats Heimdahl** were co-authors on the paper, which was the product of a large NSF-funded project developing new techniques for assuring safety, security and reliability of medical cyber-physical systems.

Associate Professor **Arindam Banerjee** and students Huahua Wang and Qiang Fu received a Best Paper Award at the BigMine'13 workshop at KDD. Their paper, "Solving Combinatorial Optimization Problems using Relaxed Linear Programming: A High Performance Computing Perspective," was written with researchers at Northwestern University.

OUTSTANDING CS&E STUDENTS

recognized with **SCHOLARSHIPS, FELLOWSHIPS, and awards**



Graduate Student Abdeltawab Hendawi won two awards at the U-Spatial Symposium 2013, held October 21 at the McNamara Alumni Center. Hendawi was awarded both the Best Design/

Planning Poster and Best Overall Poster Awards. Each award comes with a gift card of \$50. His advisor is Mohamed Mokbel. This is the second consecutive year that Mokbel's students have received the Best Overall Poster Award. Graduate Student Mohamed Sarwat received the Best Overall Poster Award in 2012.

Ph.D. student Benjamin Heintz was awarded the Best Student Poster Award at the ACM Symposium on Cloud Computing (SOCC) 2013 held in Santa Clara, California. The poster, "Wide-Area Streaming Analytics: Distributing the Data Cube," was co-authored with Associate Professor Abhishek Chandra and University of Massachusetts at Amherst's Ramesh K. Sitaraman. The ACM Symposium on Cloud Computing brings together researchers, developers, users, and practitioners interested in cloud computing and is co-sponsored by the ACM Special Interest Groups on on Operating Systems (SIGOPS) and on Management of Data (SIGMOD).



Ph.D. student Shuo (Steven) Chang and alumnus Aditya Pal (Ph.D. 2012) were selected to receive the Best Full Paper award at the 2013 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM). Their



paper, "Routing Questions for Collaborative Answering in Community Question Answering," proposes an algorithm to intelligently route questions to appropriate answerers in Q&A sites. Both Chang and Pal are part of the CS&E GroupLens Research group.

Ph.D. student Joshua Vander Hook was selected to receive an ARCS Scholar Award for the next two academic years in the amount of \$5,000 per year. The ARCS Foundation brings financial support to graduate-level



students in the areas of science, technology, engineering and medical research. The ARCS Foundation is dedicated to helping the best and brightest U.S. scholars with the goal of advancing science in America.

Alumnus Gang Fang was awarded the University of Minnesota Graduate School's "Best Dissertation Award" in the Physical Sciences & Engineering for 2013 for "Discovering Combinatorial Disease Biomarkers." Each year the Graduate School recognizes the University's top recent Ph.D. graduates by presenting "best dissertation" awards. The recipients receive an honorarium of \$1,000. Fang is currently an assistant professor in the Department of Genetics and Genomic Sciences at the Institute for Genomics and Multi-scale Biology, Mount Sinai School of Medicine.



Ph.D. student Nan Jiang received a best paper award for her paper "Understanding SMS Spam in a Large Cellular Network: Characteristics, Strategies and Defenses" at the 16th International Symposium on Research in Attacks,

Intrusions and Defenses (RAID'13) held in St. Lucia. The paper presents Jiang's joint research



work with CS&E alumnus Yu Jin and Ann Skudlar of AT&T Labs. Research for the paper was primarily done by Jiang and her group during her internship at AT&T. Jiang's advisor is Zhi-Li Zhang.

Ph.D. student Xun Zhou received a best paper award for "Discovering Persistent Change Windows in Spatiotemporal Datasets: A Summary of Results" at the ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (BigSpatial-2013) in



Orlando, Florida. Zhou's paper presents a novel and efficient computational solution for finding the spatial and temporal footprints of persistent zonal change patterns such as desertification, deforestation and urban sprawl from big earth science datasets. The paper was co-authored with Professor Shashi Shekhar and Ph. D. student Dev Oliver. Zhou is currently working on the NSF Expeditions in Computing project "Understanding Climate Change: A Data Driven Approach."

A University of Minnesota team has once again qualified for the 2014 ACM-HPC World Finals sponsored by IBM. Team Buffer Overflow members Jiajun "Toby" Li, Yilin He and Bowen Yu travelled to Ekaterinburg, Russia this last summer for the competition. This is the fifth consecutive year that a University of Minnesota team has advanced to the World Finals under the expert mentorship of Dr. Carl Sturivant.

NEW FACULTY

CS&E welcomed two new faculty members to campus in 2013. Brent Hecht and Dan Knights work in the areas of human-computer interaction and bioinformatics.



BRENT HECHT

Assistant Professor Brent Hecht joined the department in May 2013 after completing his Ph.D. in computer science from Northwestern University, a Master's degree in geography from UC Santa Barbara, and dual Bachelor's degrees in computer science and geography from Macalester College. Hecht describes his work as "most broadly, looking at culture and geography within the context of computer science," adding, "You could say that my work is a complete intersection between my two parents. My father is a geologist, and mother is an English language teacher, so I get the interest in the spatial stuff from my father and an interest in culture from my mother."

One of his earliest projects in computer science was building semantic relatedness algorithms. "I wanted to look at how

things are related to each other. For example how related are Minneapolis and Saint Paul versus Minneapolis and Edina? Wikipedia has changed this research a lot. You can write the best algorithm, but it may not understand ad-hoc relationships." Hecht cites the example of the relationship between the city of Santa Barbara and Ronald Reagan. "In the 70s there were riots in Santa Barbara, and Ronald Reagan was the governor of California then, and he installed a curfew." He says that these connections are highly nuanced, and programs don't always pick up on them.

Hecht used the idea of semantic relatedness again in another project in the domain of exploratory web search. "Generally, search engines like Google and Bing are not good at getting information for exploratory searches. They are good at finding specific things like the University of Minnesota, but for an overview of a complex topic like nuclear weapons, Google just points you to Wikipedia."

Hecht used semantic relatedness algorithms and techniques from his training in cartography to create interactive, search query-based visualizations that improved upon the exploratory search state-of-the-art. "For instance you can have a map of the world to show locations where nuclear weapons are important." Some of the charts are geographic, i.e. a world map illustrating the concept of nuclear power shows that most of Africa is not highly related to nuclear power, whereas

Chernobyl and Fukushima are. Others are non-geographic; a search of nuclear power on the periodic table shows that plutonium is highly related to nuclear power and silver is not.

Another of Hecht's most recent papers shows the importance of social networks for information gathering. "Facebook is good for conversations. You can say, 'I need to buy a camera.' It's not an urgent query," says Hecht. He adds that social media offers an open-ended space where the user can take their time to figure something out and have a discussion. Hecht's paper showed "when given the option of using a search engine and/or social network, participants used status messages for 20% of their information needs."

This Fall Hecht was one of only five young professors at leading research universities around the world that were selected for the 2013 Yahoo! Academic Career Enhancement (ACE) Award.

Dan KNIGHTS

Assistant Professor Dan Knights officially joined the department in 2012. After completing his Ph.D. in Computer Science at the University of Colorado, Boulder, and prior to moving to Minnesota, he completed a postdoctoral fellowship in the lab of Ramnik Xavier at Harvard Medical School and the Broad Institute of MIT and Harvard. “It was an important experience,” he says, “It was a crucial step in my training to do research at the intersection of host and microbial genomics.”

Knights’s work focuses on the human gut, or more specifically, the bacteria within the human gut, the microbiome. Scientists and doctors have only recently begun to understand the importance of the gut and the microbes that live within us. Knights says, “Bacteria have been living in and on our bodies throughout human evolution, but it has only been in recent decades that scientists have used DNA sequencing to find out how diverse these bacteria communities are.” It has also only been somewhat recently that perceptions surrounding microbes were anything but negative. “People have been studying host-associated bacteria for centuries, but mostly in the context of disease and pathogenicity. There has been a slow change to view bacteria as anything other than something that we should kill. But now we know that our bacteria give us a number of important benefits. We are still trying to characterize what a healthy gut microbiome is for a given person.”

Knights is working on mapping out the complex interactions between a host and the microbiome. “It’s largely a black box right now,” he adds, “a complex community. Hundreds of bacterial species live in a person’s gut, and the mixture is constantly changing. We want to find out

what drives the structure and the variation in the community in a person. We are considering the effects of age and geography and trying to associate lifestyle and environmental factors with changes in the microbiome and how it varies in a healthy person.” Knights is also working on understanding the cross-talk between a person’s own genes and the tens of thousands of genes that belong to those bacteria.

“We don’t know all of the factors that influence the microbiome. One of the factors that can influence it is if you have some kind of impaired immune response, such as in patients with Crohn’s disease. The majority of bacteria in us are either beneficial, for example helping us to break down fibers, or they are commensal, which means they ‘hang out,’ without being good or bad. But there are dynamics between the bacteria. They support one another. There are some that stake out territory and keep out bad bacteria. It’s very diverse community and that maintains our health. When something goes wrong – for example, bad genes in the host, an immune response doesn’t work properly – the body starts some response toward bacteria that should have been commensal, or harmless. That changes the state of the gut. People get stuck in cycles of inflammation. This cross-talk between our immune system and our gut bacteria is what I’m interested in understanding. “

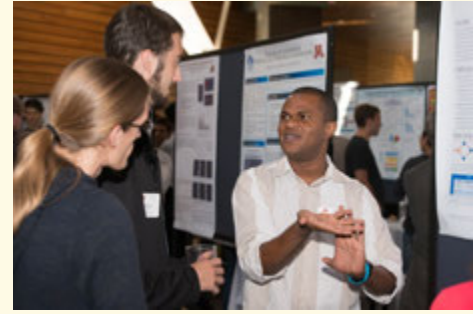
One of the people that Knights is looking forward to collaborating with at the University is Dr. Alexander Khoruts, who has been performing fecal transplants to fight *C. difficile* infections with great success. The transplant is exactly as it sounds, talking stool from a healthy donor and transplanting it in the gut of



another patient to help them re-populate the gut with healthy bacteria. Knights says, “Our ‘second genome’ – the mixture of genes in our resident microbes – has been implicated as a factor in a surprising number of diseases, including cancer, autoimmune diseases, autism, HIV, and obesity. In many of these cases we still understand little about the mechanisms of host-microbiome interactions.” It is Knights’s work to develop both theory and tools for modeling host/microbiome interactions on the genomic scale. Success could change everyone’s perceptions of germs, and change the way we treat life-threatening diseases.

2013 Open House and Tech Forum

The Department of Computer Science and Engineering hosted its biennial Technology Forum and Open House on October 18, 2013. The event featured exhibits highlighting current departmental research group activities and state-of-the-art demonstrations by members of industry. The Open House provides a unique forum in which people from the industry, the government, and the University interact with faculty and students in the department. In addition to research exhibits, Ron Kohavi of Microsoft provided a keynote address to a packed audience. The 2013 Distinguished Alumni Award was presented to Rebecca Schatz of Code Savvy for her outreach work to expand education in science and engineering. Afternoon sessions on robotics and big data rounded out the day.



Photos by Jessica McMillan

ALUMNI

Outstanding Alumni Award for Jeff Dean

CS&E Distinguished Alumnus Jeff Dean (B.S. 1990) received the Outstanding Alumni Award at the College of Science and Engineering's Leadership Celebration held on November 7, 2013 at TCF Stadium on the East Bank. Dean provided the keynote address for the event which honored Outstanding Alumni Awardees across the college. The award is the highest degree award conferred upon distinguished alumni by the University. Dean gave a talk, "Taming Latency Variability and

Scaling Deep Learning," earlier in the day to a full room in Keller Hall.

Dean is an ACM Fellow and member of the NAE. He received a B.S., summa cum laude from the University of Minnesota in Computer Science & Economics in 1990, and subsequently received a Ph.D. from the University of Washington. Dean is the 2007 recipient of the CS&E Distinguished Alumni Award.



Jeff Dean with University President Eric Kaler at the CSE Leadership Celebration

Alumnus Richard Weinberg honored with Endowed Chair at USC

CS&E Distinguished Alumnus Award recipient Richard Weinberg (M.S. Ph.D. 1982) has been installed as the Charles S. Swartz Chair in Entertainment Technology at the University of Southern California (USC) School of Cinematic Arts (SCA). Weinberg, a Research Associate

Professor, has focused his career on discovering and advancing the next technological steps in creating, distributing and presenting moving images. "The creation of this Chair really crystallizes the importance of entertainment technology," Weinberg said at a recent event. He

has been a part of the SCA faculty since 1985, when he joined USC to establish a masters program that combined computer animation and digital arts.

ALUMNI ACHIEVEMENTS

James Faghmous, (Ph.D. 2011) along with his wife and co-founder Zahra Aljabri won second place in the general division of the Minnesota Cup for their fashion startup Mode-sty. Mode-sty provides stylish clothes for women who chose to dress conservatively. Faghmous, who received his Ph.D. under Professor Vipin Kumar uses his data mining background to analyze thousands of data points to inform business strategy. The second place finish came with a \$5,000 prize to fund the business.

Steve Goddard, (B.A. 1985) chair of the Department of Computer Science and Engineering at University of Nebraska-Lincoln (UNL), has been appointed interim dean of the UNL College of Arts and Sciences. A member of UNL's faculty since 1998, Goddard has overseen the Department of Computer Science and Engineering since August 2008.

Jon Herlocker (Ph.D. 2000) announced a

new project in June, the VMware vCenter Log Insight. This new project allows the user to "easily perform advanced analytics on log data aggregated across your physical, virtualized and cloud infrastructure, leading to across the board improvements in IT metrics."

Anjali Joshi (M.S. 2003, Ph.D. 2008) has been promoted to senior tech lead where she is managing the core Simulink Design Verifier team based in Natick.

Wolf Ketter (Ph.D. 2006) has been appointed endowed Professor of Next Generation Information Systems at Rotterdam School of Management, Erasmus University in the Department of Decision and Information Sciences. Ketter is the founder and director of the Erasmus Center for Future Energy Business. He is also a leader of the Power TAC project. Ketter was a runner up for the European Research Paper Award of the year 2013 and

the winner of the ERIM Top Article Award 2013 for the paper "Real-Time Tactical" by Wolfgang Ketter, John Collins, Maria Gini, Alok Gupta and Paul Schrater.

Ajitha Rajan (Ph.D. 2007) got a new appointment as a Chancellor's Fellow/ Lecturer (assistant professor) at the School of Informatics in the University of Edinburgh (since December 2012).

Eugene Vasserman (M.S. 2008, Ph.D. 2010) received an NSF CAREER award on "Safety and security for next-generation world-scale real-time medical systems." Vasserman is an Assistant Professor at Kansas State University.

ALUMNI SPOTLIGHT: NZISA KIILU



Soon after Nzisa Kiilu (M.S.S.E. 2011) began working as a developer for Image Trend, she realized that more schooling would help her to build her career and do the kind of work that she wanted to do. Kiilu had completed

her CS undergraduate degree at Mankato and instead of quitting her job to go back to pursue a degree, she joined the Master of Science in Software Engineering program at the University of Minnesota.

"It was a really demanding and fun program," she says. In particular she credits Professor Mats Heimdahl as an asset, "I never knew that someone could care so much about their students. I still consult with him on almost every career move that I make."

One of those career moves came while Kiilu was in the program. She transitioned to a position with the University at the Academic Health Center. After completing the M.S.S.E. program, she was ready for another change. "I talked with Mats about taking on contract work. We talked about me being young, and not

having a family and it being a good time to take risks with my career." That move led her to her current position as a project manager with United Health Group, a change she is really enjoying. "I'm doing the work that I wanted to do," she says. She still has time to work on making more changes, this time by encouraging high school kids to consider careers in tech.

Kiilu was introduced to the Tech IT Out! program through a friend, who had been active with the group giving 50-minute presentations to high school students in the classroom, primarily at inner-city schools. Kiilu soon began volunteering for the group as well. "We try to let students know what they can do with a tech career." The group also aims at changing the perception of what tech workers look like as well. "We have a video about Google glass that we have shown them. I try to let them know that there are cool people in my office, that I work with artists and people who have tattoos – they are creative designers."

Kiilu says that it is challenging work, but finds connecting with students encouraging, even if it is just one or two in a classroom of 30. "We try to let them know about resources. They may come from schools that typically don't have the capabilities to work with students who may be

interested in a tech career. We let them know where to start and help them connect with the right people. It can be daunting and we want to help them step by step." Kiilu says that she personally likes to emphasize the collaborative nature of beginning software work. "I know when I started I thought I would just have to sit and come up with everything myself. That is overwhelming! I like to tell students that you will never work alone."

Kiilu has also expanded her volunteer work by connecting with students through the National Center for Women & IT (NCWIT). She was recruited last year to provide a keynote address at a ceremony honoring high school ladies that applied for the NCWIT Aspirations in Computing award. The award is a talent development initiative designed to increase women's participation in computing careers by providing encouragement, visibility, community, leadership opportunities, scholarships, and internships to high-potential technically-inclined young women. "These are young women who are already ahead in their software path, but they still need assurance that they can do it, they can make a difference." Kiilu wants to encourage students to be open to chance and "just say yes" to opportunities that come their way.

ALUMNI SPOTLIGHT: JIEPING YE



Jieping Ye (Ph.D. 2005) was referred to the University of Minnesota through a friend in the University's Mathematics department.

Ye received his undergraduate degree in math from Fudan University and a Masters degree in computational science from the National University of Singapore. "I saw the field of computer science growing and having a greater impact.

I also considered it as an opportunity to use mathematics for solving real-world problems. While academic positions in mathematics were difficult to come by, the industry applications of computer science seemed more accessible in terms of finding work. When Ye researched the University of Minnesota and found the work that Professor Ravi Janardan was doing, he applied to and joined the Ph.D. program.

"I knew nothing about machine learning and data mining when I joined the department," Ye says. Ye initially pursued computer science projects that related more to his math background, and geometry. However, during his

first year he joined a project with Department Head Vipin Kumar that exposed him to data mining and machine learning. He then began taking courses from Professors Kumar and Boley and gaining more experience.

A vital turning point came after finishing his first paper in machine learning. "I thought it was good and I wanted to submit it to a conference. I wasn't even familiar with the conferences in the area." Ye did submit a paper to ICML, the International Conference on Machine Learning, an elite conference, and ended up winning a best student paper award. "That really gave me the confidence that I needed to keep going," Ye

ALUMNI SPOTLIGHT:

RON VETTER



Ron Vetter (Ph.D. 1992) has a curious habit, “I tend to completely change what I am doing every five years.” His most recent iteration is as the Interim Associate Provost for Research and Dean of the Graduate School

at the University of North Carolina Wilmington (UNCW) where he is in working on promoting research and technology transfer for the University as well as keeping the good work on track at the graduate school.

Vetter had only served for a few years as part of the faculty at UNCW when he took the helm of the computer science department and served as chair from 2000-2005. While in that position, he created a unique professional science master’s program in computer science and information systems. After his tenure as chair, he moved on to serve as the director of graduate studies, growing that graduate program to 50 students.

In 2007, Vetter saw potential in the popularity of text messaging. He requested the University partner with him to create applications that would use SMS messages to reach students.

While he says there was initially some reticence from the University, “then the Virginia Tech shooting happened, and the University saw the potential in using text messages for emergencies.” The University agreed to support Vetter’s venture, Mobile Education, LLC – a software services technology company that specializes in short message service (SMS) based applications. The group also went to New York City to raise venture capital funding for a related business entity called Powerplay Mobile, LLC in 2011. Vetter is still involved in both entities, attending weekly meetings and working with the companies on technology transfer and in business plans and marketing. “I credit working with David Du for giving me some of the skills to pursue these commercialization interests. I remember going downtown Minneapolis with David to visit US West and talk to them about collaborations with the U of M.”

More recently, Vetter took on the editor-in-chief position for the IEEE Computer Society’s flagship magazine, *Computer*, at the beginning of 2011. Vetter has the distinction of being one of the few recent editors to not have been a past president of IEEE. Right away, his goal in the position was to take the magazine digital. The magazine, now available in pdf format, has added multimedia pieces to the digital versions

says. The exposure at ICML also broadened his professional connections greatly. “I also got to meet so many people, and I realized then that I might have a chance to pursue an academic position.”

After interviewing at a number of places, both academic and in major industry research centers, Ye accepted a faculty position at Arizona State University (ASU), where he has been since 2005. He is a member of the AI Lab at ASU and a member of the Center for Evolutionary Medicine and Informatics (CEMI) of the Biodesign Institute at ASU. He is continuing work in machine learning, data mining, and biomedical

informatics. “I feel very lucky here to have good collaborators: biologists, and the people in the medical and chemistry department,” he says. “My students are good too.” Ye currently has eight Ph.D. students and five post-docs working with him on several projects including one project developing a suite of efficient and effective computational methods for annotating *Drosophila* gene expression images. Automated and efficient tools for analyzing expression images are a prerequisite for generating biological insights into gene functions, interactions and networks for the next generation of scientists. He is also working on creating tools to help the prediction and

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that are also available as iPad and Android applications. Of the process, Vetter says “there was a lot of resistance. We have a membership who is attached to the print version.” While the digital version is still too new to track readership, Vetter seems confident in the popularity of digital readers to capture the next generation of Computer subscribers.

In fact, Vetter has proven adept at predicting future trends. “Back in the 90s, I wrote a paper about using video-conferencing. In 2003, I wrote a paper to the ACM on the future of computing using mobile devices. At the time people were using personal organizers, phones and their portable computers. I predicted that all three of these devices would be combined, with Bluetooth, wi-fi, in a novel convergence.” He has already capitalized on the future of text messaging.

Certainly with such a track record for visualizing the commercialization of innovation, he is a natural choice for his current role as Associate Provost. Vetter describes the work as an all-consuming role, and says that he does miss working with students, something that may not be entirely in the past. “I’ll complete this role and then I’ll re-invent myself again.”

progression of Alzheimer’s disease (AD), which affects nearly 5.3 million people in the United States. Such tools will accelerate the discovery of more sensitive and integrated biomarkers for early detection and prevention of AD. Ye’s joint appointment to the Ira A. Fulton Schools of Engineering, School of Computing, Informatics, and Decision Systems Engineering, and the Biodesign Institute, Center for Evolutionary Medicine and Informatics allows easy access to great collaborators not shortage of projects to work on in the future.

In Memoriam: JOHN RIEDL (1962-2013)



The Department of Computer Science and Engineering mourns the untimely death of Professor John Riedl, who passed away on the evening of Monday, July 15, 2013, at the age of 51. Professor Riedl was known worldwide as a pioneer in the field of recommender systems—a field he was instrumental in creating and nurturing—and one of the leading figures in the broader field of interactive intelligent systems. He was successful in bringing technological

advances into practice; he co-founded the company Net Perceptions in 1996 to commercialize his recommender systems research, successfully growing the company to over 300 employees and substantial influence in the field; and he worked with several industry and non-profit organizations to transfer University research findings into practical advances. The impact of John's work is extensive, both in industry practice and among the research community. Software derived from his research is run by literally tens of thousands of businesses today. His work was highly recognized by the research community, and honored with awards such as the 2010 ACM Software System Award. John's contributions did not end with his own research—he was an innovative teacher who created and led a practice-focused course where undergraduate students gain experience in designing and building interactive intelligent systems for the Web, releasing them into wide use, and supporting thousands of users. John was also a guide and mentor, and was honored with several teaching awards

including an Outstanding Teacher Award from the department, the George Taylor Award for Exceptional Contributions to Teaching from the College of Science and Engineering and the University's McKnight Distinguished Professorship. He was greatly concerned about student welfare and was passionate about quality teaching. He was a frequently-consulted mentor by our junior faculty, and a valuable resource for faculty seeking counsel on any aspect of teaching and managing students. John had a lasting, inspirational effect on so many undergraduates who, years later, comment on the formative and transformative effect John had on them.

John's influential research and his leadership in the field brought invaluable visibility to the department and the University. John is greatly mourned by his colleagues and students at the department and University, who extend their sympathy to his many friends in the broader research community. Most of all, we express our deepest sympathy to his family, especially his wife Maureen, his sons Eric and Kevin, his daughter Karen and her husband Anthony.

Contributions to the John Riedl Memorial Fund can be made at https://makingagift.umn.edu/onlinegiving/enterFund.do?fundCode=COMP_9901

NORTHERN STAR CONTINUED

(STORY CONTINUED FROM PAGE 1)
Johnson Professor of Computer Science and Engineering, and a world-renowned leader in computer languages for parallel processing, is a member of the National Academy of Engineering. Ajay Pandey is a key player in a project to issue social security numbers to the 1.2 billion citizens of India, which will enable them to provide education, health care, and financial services many families for the very first time. In addition, many of our graduates are program chairs of major conferences, editors of journals, winners of NSF CAREER and PECASE awards, and leaders in the professional community and industry. This is evidence that we are attracting the very top students, and training them well to

Amongst academic institutions, Minnesota is ranked 4th, behind Stanford, CMU and Urbana, and ahead of MIT, Berkeley, and Cornell.
—Microsoft Academic Research

make their mark in the world, and do Minnesota proud.

Although we are in the Midwest, and media focus is often on the two coasts, there are clear signs that our scholarship is being recognized, especially in forums which look at scholarship seriously. One of the most important is Microsoft Academic Search (<http://academic.research.microsoft.com>), which ranks institutions by the

quality of their research reputation. Minnesota ranks fourth worldwide out of thousands of academic institutions in data mining and in the top 20 among U.S. academic institutions in artificial intelligence, human computer interaction, networks, parallel/distributed computing, and scientific computing. Given all this, it is not surprising that the top employers are beating a path to our door.

By now you might be thinking, why didn't I know about what's happening here? To this all we can say is, Minnesotans work hard, but don't like to talk much about it; and like all good Minnesotans, we like it this way. Not content to rest on our laurels, CS&E has ambitious plans to seize the future of this exciting field. Stay tuned for details.

MANY THANKS TO OUR SUPPORTERS

We would like to express our sincere gratitude to the following companies, alumni, and friends of CS&E who have provided generous financial support for our work. We look forward to continuing this partnership.

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Please direct all questions or comments to:

Soundbyte Editor

Department: (612) 625-2424

Fax: (612) 625-0572

E-mail: newsletter@cs.umn.edu

<http://www.cs.umn.edu/newsletter>

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Maria Gini

Associate Department Head

Joseph A Konstan

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