COMPUTER SCIENCE 2016

Tufts University School of Engineering
I became chair of the Department of Computer Science on September 1, 2016. I am honored to serve in this role, and I look forward to working with students, faculty, staff, administrators, and alumni to provide for the continued health and vibrant growth of the department. Faculty and students in the department have been busy teaching, researching, and learning!

I would like to thank Professor Soha Hassoun for her three years of dedicated service as chair. She will enjoy a well-deserved sabbatical in the spring. During her tenure as chair, Soha oversaw the addition of a lecturer, two tenure-track faculty members, and Tufts’ first Bridge Professor. She also worked to strengthen alumni relations, growing the computer science young alumni group. In the coming year, Soha is co-developing and teaching a new course on computer architecture (Comp46/ECE126) with Associate Professor Mark Hempstead in the Department of Electrical and Computer Engineering. Most importantly, Soha nurtured the department through three years of explosive growth in the student body, which resulted in Computer Science becoming the largest major on campus.

An on-going challenge for the department has been to meet this rising student demand for computer science courses and degrees. In 2016, 141 students graduated with a bachelor’s degree in computer science [34 in Engineering and 107 in Arts and Sciences]; 22 students with a master’s degree; and six with a doctorate. As of spring 2016, we have 449 undergraduates working towards a bachelor’s degree [164 in Engineering and 285 in Arts and Sciences]. In addition, we have 63 students minoring in computer science. We are happy to report
that 11 new master’s and 15 new Ph.D. students are joining the department this fall. Despite the challenges of teaching so many students, the department continues to provide high-quality learning experiences.

To cope with the high level of student demand, we have been working to grow the size of the faculty and to increase the number and training of undergraduates who work as teaching assistants. Early this summer, we welcomed two new members to the faculty. JP de Ruiter is the university’s first Bridge Professor, with a joint appointment in the Departments of Psychology and Computer Science, and Laney Strange has joined us as a lecturer. Please join me in welcoming JP and Laney to the department!

In other faculty news, Remco Chang became a tenured member of the faculty and Donna Slonim was promoted to full professor. On a sad note, Chris Gregg has left us to take a position as a lecturer in the Computer Science Department at Stanford. We will miss Chris enormously—his calm efficiency, his clarity, and his enthusiasm—but wish him all the best in his future endeavors.

Finally, we’d love to hear from all alumni. Please send csadmin@cs.tufts.edu an e-mail and let us know how you are doing. We want to know what you are up to post-Tufts and Halligan Hall!

— Kathleen Fisher
RESEARCH

WHY ROBOTS NEED TO BE ABLE TO SAY ‘NO’

Disobedient robots may sound scary, but even scarier is a robot that follows every human command without fail. Researchers in Professor Matthias Scheutz’s Human-Robot Interaction Lab have taught robots how to question commands that would have negative consequences (like walking off the edge of a table) — an important step in the development of artificial intelligence. Robots can even change their minds after initially refusing a direct order, provided that a human offers a logical reason as to why the robot should override its first response. Professor Scheutz’s work has been covered in IEEE Spectrum, Inc. com, DigitalTrends.com, and Inverse.com.

CENTER FOR APPLIED BRAIN AND COGNITIVE SCIENCES

Researchers from Tufts School of Engineering and the U.S. Army Natick Soldier Research, Development, and Engineering Center are joining forces to advance our understanding of how people think, function, and interact in demanding environments. This new center represents a collaborative partnership in cognitive science research, co-directed and co-managed by researchers from both institutions.

“We hope to increase understanding of how individuals and teams adapt and sustain performance in high-stakes environments,” says Holly A. Taylor, a professor of psychology at Tufts School of Arts and Sciences, an adjunct professor in the Department of Mechanical Engineering, and lead investigator from the Tufts team. Professor Matthias Scheutz, co-principal investigator of the center, brings yet another dimension to the research in attempting to understand how people interact not only with each other in teams, but with potential robotic partners.

BETTER BACH THROUGH BRAIN INTERFACE

Professor Rob Jacob and doctoral recipient Beste Filiz Yuksel’s BACH System—short for Brain Automated Chorales—helps beginners learn to play Bach chorales on the piano by measuring how hard their brains are working. It only offers a new line of music to learn when the brain isn’t working too hard, avoiding information overload. BACH estimates the brain’s workload using functional Near-Infrared Spectroscopy (fNIRS), a technique that measures oxygen levels in the brain. Yuksel received a best paper award at CHI 2016 for this research. She is now an assistant professor at the University of California, San Francisco.
COMPUTERS INTUIT WHEN WE’RE OVERLOADED

New Scientist magazine interviewed Professor Rob Jacob about his research into the possibilities for computers and wearable devices to read what’s going on in the brain and stimulate it in specific ways. Jacob is working on brain-computer interfaces that use fNIRS to monitor levels of oxygen in the brain. The interface can intuit how hard a user is working — high oxygen levels mean that the brain is working harder. Theoretically, if users needed to complete a task but their energy was flaking, the BCI could then use transcranial direct current stimulation to “zap” the user into performing better for a short period of time. “We want to just crank it up for a minute or two and then crank it down. We’re looking for this very fine-grained control,” Jacob told the magazine.

GOING WITH YOUR GUT

Professor Soha Hassoun was one of three recipients of a 2015 Ideas Competition award for early-stage business ideas. Hassoun’s project, “TRAG: At-Home Diagnostics System and App for Tracking the Gut Microbiota,” seeks to allow individuals to easily and frequently track and assess the impact of diet, including prebiotics and probiotics, on the gut microbiota. “The global market for prebiotics and probiotics is expected to grow steadily in the next five years,” says Hassoun. “There is currently no sure way of predicting and tracking the benefits of these products.”

DRIVING THE AUTOBAHN

A paper by doctoral student Diogenes Nunez, senior Remy Wang, and Professor and Chair Kathleen Fisher, entitled “AUTOBAHN: Using Genetic Algorithms to Infer Strictness Annotations,” will appear at the 2017 Haskell Symposium. This work, which started as a project in Associate Professor Norman Ramsey’s functional programming class, tackles the long-standing problem of how to improve the performance of Haskell programs by telling the compiler which program fragments should be evaluated eagerly. Currently, inserting the appropriate annotations is a black art, known only to expert Haskell programmers. The Autobahn tool developed by Nunez and Wang automatically suggests appropriate places to put annotations to improve a number of performance metrics.
COMBINING CLOUD AND INTERNET TO SUPPORT VR
Assistant Professor Fahad Dogar and doctoral student Osama Haq are working on providing a suitable network support for emerging real-time applications (e.g., virtual reality). They are exploring how the highly reliable, but expensive, cloud network infrastructure could be combined with the best-effort and cheaper internet paths. The goal is to provide guaranteed bandwidth and low latency for such applications. The preliminary idea and feasibility of this work appeared in ACM HotNets 2015. The ongoing research in this project also involves collaborators from Boston University’s Department of Computer Science.

COMMUNICATING HEALTH RISKS WITH VISUALIZATIONS
Associate Professor Remco Chang, students, and collaborators at Maine Medical Center (MMC) created a project to investigate how older men with prostate cancer use visualizations to better understand their own health risk information. Chang, master’s student Anzu Hakone, E16, recent graduate Nate Winters, E16, doctoral recipient Alvitta Ottley, EG16, postdoctoral researcher Lane Harrison, and MMC collaborators Dr. Paul Han and Caitlin Gutheil have a paper entitled “PROACT: Iterative Design of a Patient-Centered Visualization for Effective Prostate Cancer Health Risk Communication” appearing at the 2016 IEEE InfoVis conference. Their web-based visualization prototype, PROACT, helps patients learn about their cancer risk and the possible side effects of different treatment options.
Senior Lecturer Ming Chow won the Henry and Madeline Fischer Award recognizing him as “Engineering’s Teacher of the Year.” Judged by a vote of the graduating seniors, Fischer Award winners demonstrate teaching excellence, inspire and motivate students to rise to their best, and leave students with a profound intellectual experience. Chow also received the 2016 Tufts Teaching with Technology Award, bestowed annually upon an instructor whom students feel effectively uses technology to support teaching and learning.

Professor Soha Hassoun was selected as the recipient of the 2016 Marie R. Pistilli Women in Electronic Design Automation Achievement Award. The award was conferred at the 53rd Design Automation Conference (DAC) in recognition of her service to the Design Automation Conference "and the other communities of which she is a member, and for her contribution to research, technology, and the education of engineers in such a wide variety of fields.” She also received the IEEE CEDA Outstanding Service Award for her chairship of the DAC conference in 2014.

Assistant Professor Ben Hescott was named Professor of the Year by the Tufts Community Union (TCU) Senate. Professors are nominated for the award by the student body, and the TCU Senate’s Education Committee selects the finalists and the winner. Hescott also won a Recognition of Undergraduate Teaching Excellence (ROUTE) award presented to junior full-time faculty members who demonstrate excellence in teaching and advising, concern for students’ academic and personal growth, and the ability to convey a passion and enthusiasm for their field of study.

Professor Diane Souvaine was elected vice chair of the National Science Board (NSB), the governing body of the National Science Foundation. It’s the first time in NSF history that women hold the three top leadership positions: director, chair, and vice chair. The 24-member NSB serves as an independent advisor to both the President and Congress on policies related to science and engineering, and education in those disciplines. President Barack Obama first appointed Souvaine to the NSB in 2008 and reappointed her to a second six-year term in 2014.

Professor and Chair Kathleen Fisher was named vice chair of the Information Science and Technology (ISAT) study group at Defense Advanced Research Projects Agency (DARPA). The group brings 30 of the brightest scientists and engineers in the field together to identify new areas of development in computer and communication technologies and to recommend future research directions. DARPA established the ISAT advisory group in 1987 to support its technology offices, providing continuing and independent assessment of the state of advanced information science and technology and as it relates to the U.S. Department of Defense.

Professor Norman Ramsey’s book, Programming Languages: Build, Prove, and Compare, is in edits for publication by Cambridge University Press. The book encourages hands-on experience with great ideas in programming languages. Because during their careers, some practitioners will need to assimilate new programming-language ideas from the academic literature, the book also gives readers an opportunity to learn the rudiments of programming-language theory. Preliminary drafts of the book have been in use as a textbook in COMP 105.
NEW FACULTY

JAN P. DE RUITER

Jan P. de Ruiter joins Tufts University as the first Bridge Professor, being jointly appointed to the Department of Psychology in the School of Arts and Sciences and the Department of Computer Science in the School of Engineering. De Ruiter is a cognitive scientist and psycholinguist whose primary research focus is on the cognitive foundations of human communication. After receiving his doctorate from Radboud University, he worked as a postdoctoral researcher at the Department of Social Psychology at the University of Cologne, and later as a senior researcher at the Max Planck Institute for Psycholinguistics in Nijmegen. From 2009 to 2016, de Ruiter was chair of the psycholinguistics department at Bielefeld University, Germany, where he founded the Natural Communication HD Lab.

De Ruiter aims to improve our understanding of how humans and artificial agents can use language, gesture, and other forms of multimodal and nonverbal signals to effectively communicate with each other. He is also interested in the computational processes involved in conversational turn-taking and intention recognition in agent-agent communication. His interests include philosophy of science, artificial intelligence, and inferential statistics. De Ruiter has also initiated or been involved in several projects in social robotics, working on the encoding and decoding of communicative intentions in embodied artificial systems.

LIPING LIU

Liping Liu began his association with the department as a visiting assistant professor in the summer of 2016. He is currently completing a postdoctoral appointment at Columbia University, working with David Blei on aspects of machine learning. Liu, who earned his doctorate at Oregon State University, is interested in probabilistic modeling, classification, and clustering within machine learning. He applies these machine learning techniques to ecology studies. Liu also worked on commercial data analysis for IBM T.J. Watson Research. He is a reviewer for IEEE Transactions on Knowledge and Data Engineering and IEEE Transactions on Pattern Analysis and Machine Intelligence. He also has served as PC member of the International Joint Conference on Artificial Intelligence (IJCAI 2015 & 2016) and the AAAI Conference on Artificial Intelligence (AAAI 2017).

LANEY STRANGE

Laney Strange joined Tufts in June 2016 as a lecturer teaching the introductory computer science course COMP 11. She comes to Tufts from her position as visiting assistant professor in the Department of Mathematics and Computer Science at Rhodes College in Memphis, Tennessee. Strange's research interests are in parallel and distributed computing, out-of-core algorithms, data mining, and search. She earned her doctorate at Dartmouth College, writing her dissertation on middleware that made efficient parallel programs more efficient and easier to write, especially for programmers.
Strange has been the editor and working group chair for the IEEE Standards Association since 2014 and was the Memphis regional organizer of the National Council on Women and Information Technology. She is strongly committed to supporting women and other underrepresented groups in STEM fields. Strange led the Memphis chapter of 100 Girls of Code and developed curriculum for the Code Crew program, which introduced core computer science concepts to underserved Memphis youth.

“I’m excited to be here! It’s been a great Tufts introduction so far teaching the COMP 11 summer course. I’m also ramping up ideas and projects to bring CS to underrepresented groups, one of my driving passions in life. I will be doing my best to engage and inspire young women and underrepresented minorities to love computer science.”

STUDENT NEWS

FACEBOOK CONFESSIONAL
A study conducted by Soubhik Barari, A16, in Professor Soha Hassoun’s COMP 150 class was featured on motherboard.vice.com. Barari’s paper, “Analyzing Latent Topics in Student Confessions Communities on Facebook,” analyzed more than 20,000 posts from the Tufts Confessions Facebook page. Using a Markov topic model, Barari found that postings on “loneliness” is a highly regular pattern.

JUMBOCODE
JumboCode is a student organization with the goal of developing software for local nonprofits and charities. Team projects have included designing and implementing a ferry-scheduling app for the Boston Harbor Islands’ website, and designing and building a web app that will help mentors from mentoring organization DREAM interact with data regarding their mentees. In 2016, JumboCoders also worked on projects for the Peace Corps, Greater Boston Legal Services, and the Walnut Street Center.
COMPUTER SCIENCE EXCHANGE
The Tufts Computer Science Exchange (CSX) offers speakers, workshops, and networking events for the Tufts computer science community, bringing in student speakers, teachers, faculty, and guest lecturers from both academia and industry. In April 2016, CSX hosted Tufts alumna Alyssa Gelbard of Resume Strategists Inc. Gelbard spoke on branding and social media presence for women in computer science.

TUFTS POLYHACK
Each year, computer science students organize a hackathon to encourage students from a variety of disciplines to get together and creatively apply classroom knowledge to hacking projects. Sponsors have included Cymbal, Kayak, HubSpot, BOSE, TripAdvisor, Google, Microsoft, Twitter, and Facebook.

MIMIR INSIGHTS
Computer science students Jon Arbaugh, Gabriella Bova, Ian Leaman, Ian Luo, and Abdisalan Mohamud were part of the team that won first place in the 2016 $100K New Ventures Competition’s High-Tech / General track. Their winning company was Mimir Insights, which helps companies selling equipment and services to scientists find the best customers for their products, grow their existing customer base, and build lasting relationships.

GRADUATE RESEARCH SYMPOSIUM
In the Tufts Graduate Research Symposium, doctoral student Vasanth Sarathy won first place for his five-minute talk on his research in the Human-Robotic Interaction Lab. Cognitive science doctoral candidates Tom Williams and Helen Pu took home second place and an honorable mention for their poster presentations.
LEAGUE OF LEARNING: CSLOL

CSLOL (Computer Science League of Learning) events have the goals of promoting collaboration and outreach, connecting all Tufts graduate students, and mentoring non-CS and non-technical students in valuable CS skills that can empower them to improve their research abilities. Our two representative events for non-programmers and new CS graduate students are Python for Non-Programmers and LaTeX Workshop.

The LaTeX workshop is usually led by a TA from COMP 105 (Programming Languages) or COMP 160 (Algorithms), as these classes have homework that looks best or must be turned in as a LaTeX-generated PDF file. For our new CS graduate students, this becomes a great opportunity to meet their future TAs and walk through an existing homework template that they can keep and customize for their later classes. For non-CS students, this is a real-life example that they use to learn formatting and styling, template creation, and solutions to common typesetting problems such as mathematical notation and code/verbatim figures.

These topics are applicable not just to CS homework, but to resumes, conference papers, and other formal documents. By having TAs who are graduate student peers and letting the audience direct the proctor to what sorts of typesetting tools are useful for them to learn, we hope to make this useful coding skill less scary and more accessible.

— Matt Ahrens, Ph.D. candidate in computer science

STUDENT AWARDS

Seniors Jennifer Hammelman, Tara Kola, and Thomas Schaffner all received honorable mentions as Outstanding Undergraduate Researchers from the Computing Research Association.

Junior Khuyen G. Bui won the 2015 Global Peter Drucker Challenge. He was selected from among 148 students from dozens of countries in an essay contest focused on managing oneself in the digital age.

Arthur Berman won the James Schmolze Prize for Excellence in Computer Science, which is awarded annually to a junior or senior. The award is named in honor of Professor of Computer Science Jim Schmolze, who passed away in 2006.
DOCTORAL RECIPIENTS

DAN AFERGAN
Dissertation advisor: Rob Jacob
Dissertation title: Implicit Brain-Computer Interfaces for Adaptive Systems: Improving Performance through Physiological Sensing
Future plans: Software engineer, Google

ALVITTA OTTLEY
Dissertation advisor: Remco Chang
Dissertation title: Toward Personalized Visualizations
Future plans: Assistant professor, Washington University in St. Louis (Department of Computer Science and Engineering)

BILL AHMED
Dissertation advisor: Carla Brodley
Dissertation title: Decrypting Cryptogenic Epilepsy: Machine Learning Methods for Detecting Cortical Malformations
Future plans: Data scientist, Metromile Inc.

GORDON BRIGGS
Dissertation advisor: Matthias Scheutz
Dissertation title: Toward Dialogue and Reasoning Mechanisms to Enable More Natural and Socially-Appropriate Human-Robot Interactions
Future plans: NRC postdoctoral fellow, U.S. Naval Research Laboratory

ELI BROWN
Dissertation advisor: Remco Chang
Dissertation title: Learning from Users’ Interactions with Visual Analytics Systems
Future plans: Assistant professor, DePaul University (College of Computing and Digital Media)

MENGFEI CAO
Dissertation advisor: Lenore Cowen
Dissertation title: New Graph Metrics Improve Network-based Protein Function Prediction
Future plans: Applied scientist, Amazon

MASTER’S RECIPIENTS

Min Bu
Jared Bronen
Sean Butze
Dylan Cashman
Ryan Dougherty
Bradley Frizzell
Robert Lasell
Yu Lei
Xu Liu
Yunjie Lu
Hamid Mansoor
Evan Parton
Christopher Pike
Mamoon Raja
Jerett Sierad
Ryan Vasios
Fumeng Yang
WEARABLE DEVICES

In spring 2016, seniors Kate Wasynczuk and Raewyn Duvall worked with Lecturer Chris Gregg to design and pilot a course on wearable devices. The course introduced students to the basics of digital and analog circuits, Arduinos, and device miniaturization, and was intended for students who had a stronger background in software than in electronics or hardware. By the end of the course, every student had designed electronic circuits, learned how to solder, and become familiar with basic circuit design.

Many of the projects had an iPhone application integrated into the design, and all projects included an Arduino wirelessly connected through the Bluetooth protocol. Students had to ensure that all devices could be miniaturized, and as a result, a major portion of the course was dedicated to designing and building surface mount printed circuit boards (PCBs). The PCB designs were fabricated remotely, and each team was responsible for ensuring that their designs were completely tested beforehand. As one student said, “When you compile a program and there is an error, you can simply re-compile. When you send a PCB away for fabrication and there is an error, the turnaround for a new PCB is two weeks!”

Six teams presented their final projects at Artisan’s Asylum, a maker space in Somerville. Teams and projects included:

- HeartBEATs, which used a heart rate monitor to choose a Spotify song playlist for a user, based on their current level of physical activity;
- SunEmoji, which created a device that measures ultraviolet radiation and alerts both the child (audibly) and a nearby parent (through an iPhone) when it is time to apply more sunscreen;
- Knockout, which placed vibrating motors in boxing gloves and a shirt and timed them to buzz in synchronization with blows landing in a boxing video;
- Rememberall, which designed a system for keeping track of items, like keys or a wallet, based on proximity-sensing technology housed in a 3D-printed case;
- PlayGrnd, which created a touch-responsive vest with flashing lights for children to use in playing freeze tag; and
- Dumos, which designed a wrist-based near field communication system that allowed the wearer to scan and purchase items with a simple tap.
Wasynczuk and Duvall helped co-design and teach the course, which they used as their senior capstone project. They worked with Gregg to create a controlled environment in which students could learn by tinkering and “breaking things,” then figuring out how and why they broke (and how to fix them). “I was super proud of all of my teams,” says Wasynczuk. “They gave us good feedback [for the pilot course] that helped us create useful handouts to enhance their learning, and they created awesome projects at the end.”

Following the pilot course’s success, the department hopes to offer the Wearable Devices course again in the near future.

Kate Wasynczuk won the inaugural David Krumme Award for Excellence in Experimental Computer Science, which honors excellence in experimental computer science and software development, as well as outstanding departmental contributions in enhancing the hands-on software development skills of other computer science students.

**WOMEN IN COMPUTER SCIENCE**

**WOMEN IN COMPUTER SCIENCE**

Student-run groups on campus are nurturing a community for women in computer science at Tufts. Tufts Women in Computer Science (WiCS) is the student chapter of the Association for Computing Machinery’s Committee on Women in Computing. Advised by Professor Lenore Cowen, Tufts WiCS seeks to foster mentorships and friendships between female students in different class years.

**LESBIANS WHO TECH**

Sponsored by the Department of Computer Science, the Office of the Provost, and the Dean of Undergraduate Education, five students attended the 2016 Lesbians Who Tech summit in San Francisco. Lesbians Who Tech is an organization that supports LGBTQ women in STEM fields, to increase the enrollment and retention of a diverse student body by providing networking, job and internship opportunities, and mentoring. This year, the focus of the summit was on space, science, and hardware, and also covered topics such as data science and software engineering. One Tufts student reported, “It was empowering to be in a space of queer women in technology – a very different demographic than my typical computer science classes.”
GRACE HOPPER CELEBRATION
Twenty-six computer science undergraduate and graduate students attended the 2015 Grace Hopper Celebration of Women in Computing. Representatives from the department's Association for Computing Machinery - Women (ACM-W) chapter and other CS groups attended the three-day meeting in Houston. As one student said, “Grace Hopper brings together an amazing community of women in technology. Every day at lunch, I sat down with different people, and heard about how women make inroads into an industry that had been driven by men, and the stories behind them. Those are the things I would not have learned anywhere else.”

CLARE BOOTH LUCE SEMINARS
The Department of Computer Science is the recipient of two prestigious Clare Boothe Luce Graduate Fellowships, which support two female students with an annual stipend for two years, along with a full tuition scholarship. In addition, Professor Lenore Cowen received additional funding from the Luce Foundation for hosting a seminar series. Speakers included alumna Orit Shaer, associate professor of computer science and co-director of the Media Arts and Sciences Program at Wellesley College. Shaer also founded and directs the Wellesley College Human-Computer Interaction (HCI) Lab.
BLUE APRON AND CYMBAL

Tufts Computer Science alumni gathered at the Blue Apron headquarters in New York City to network and hear alumni success stories. Ilia Papas, Chief Technology Officer of Blue Apron, discussed how Tufts Computer Science gave him the skills to build his successful startup.

In addition, Mario Gomez-Hall, Amadou Crookes, and Gabe Jacobs, the founders of Cymbal, gave a presentation about their music app that allows users to share songs from Soundcloud and Spotify to their profiles.

PROFILES

Amadou Crookes (pictured), Mario Gomez-Hall, and Gabe Jacobs, all A15, were included in BetaBoston’s 25 Most Innovative People Under 25 list for their social music-sharing app Cymbal, which has raised key seed funding.

Noah Daniels, A01 and EG13, accepted a tenure-track assistant professor position in the Department of Computer Science and Statistics at the University of Rhode Island.

Leanne Hirshfield, EG10, a research associate professor at Syracuse University, received a research grant from the Air Force’s Young Investigator Research Program, for her work on “Understanding the Effects of Cyber Attacks on Human Operators.”

Max Leiserson, A11, received his doctorate from Brown University. He was the first Ph.D. to complete the Center for Computational Molecular Biology’s program in Computational Biology.

Erin Solovey, EG12, an assistant professor of computer science at Drexel University, was the guest co-editor of a special issue of IEEE Computer, titled “Physiological Computing.”

Andrew Winslow, EG14, recently accepted a position as assistant professor of computer science at University of Texas, Rio Grande Valley.

Michael Horn, EG09, is an assistant professor at Northwestern University and received a National Science Foundation CAREER Award for a project designed to increase diversity in postsecondary computer science programs.