

MULTICAST

THE DEPARTMENT OF COMPUTER SCIENCE AT THE UNIVERSITY OF ROCHESTER



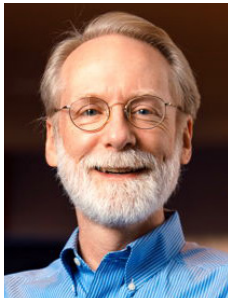
HAJIM
 SCHOOL OF ENGINEERING
 & APPLIED SCIENCES
 UNIVERSITY of ROCHESTER

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From the **CHAIR** 2020–2021 in Retrospect



Michael Scott

Greetings to all of our URCS alumni and friends! I am excited to be entering the second year of my term as department chair. The first year has certainly been different from what I once expected. We'll see how the second turns out!

Starting halfway through the spring of 2020, we've now spent almost three semesters interacting primarily in the virtual world. Our staff learned to work from home. Faculty members held lectures (and exams!) online. Researchers with physical labs and human subjects overcame significant challenges to keep their projects going. All of our seminars and conferences moved online as well. Many of us "attended" more conferences than we usually do but, typically, enjoyed them less. The Grace Hopper Celebration (GHC), to which we usually send more than two dozen students each year, was a notable case in point.

This fall we hope to see a partial return to some sort of pre-COVID "normal." As I write this, the University is planning to hold classes mostly in person at full classroom density but with everyone still masked. Our seminar series is also returning to an in-person audience, though some of attendees (and speakers!) may still be remote. Members of the department staff are back in the office three days a week. But most fall conferences (including GHC) are still planning to run online-only, and all of this could change in an instant if the Delta variant continues to surge and significant numbers of people continue to resist vaccination.

On the plus side, we've all learned to make effective use of teleconferencing technology, and this is likely to be a long-term benefit, making it easier to collaborate at a distance and helping to reduce the cost and carbon footprint of unnecessary travel. Our seminar series was able to recruit several speakers who would not normally have been able to travel to Rochester, and we'll probably continue to include such people remotely in the future. Some of us (myself among them) recorded the lectures for our courses, allowing us to "flip" the classroom going forward (ask me in January how that went :-).

Despite all the challenges of COVID, we graduated 37 BA, 87 BS, 21 MS, and 9 PhD students this year (with real, in-person ceremonies!) and we've admitted talented incoming classes at all levels. There are a host of new projects under way, with new external funding. And there are exciting internal initiatives as well. Ehsan Hoque is pioneering a new course on Technology and

Climate Change (see article on page 10). Brian Kimani and Hanjie Lyu are two of several students collaborating with University Facilities on institutional sustainability.

This has also been a year of career and life transitions.

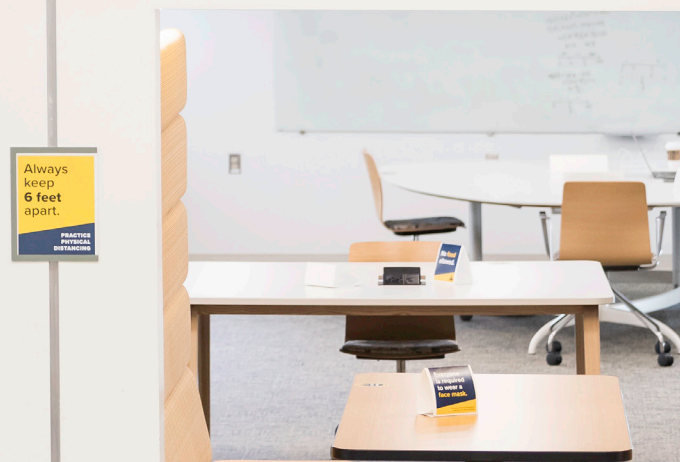
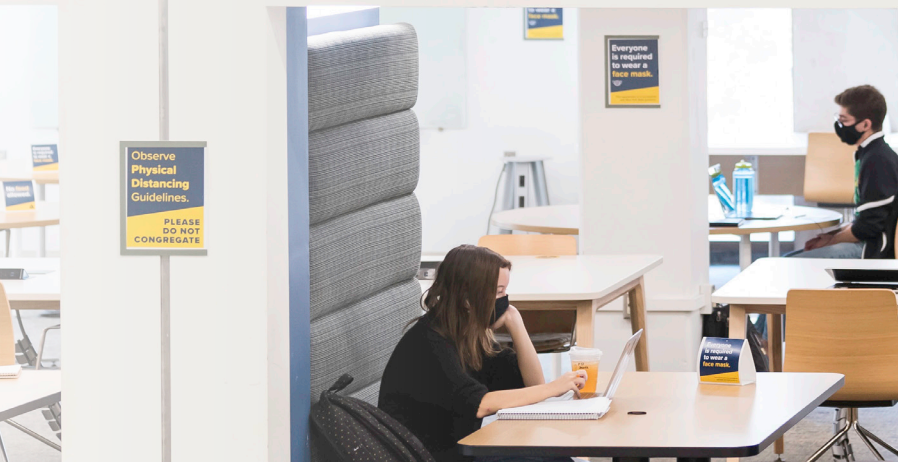
James Allen, the department's longest-serving faculty member, retired in July of 2021 (see article on page 4). James Roche, our lab manager, is retiring in October after more than 35 years with the department (see article on page 4). Muthu Venkatasubramaniam, after a decade in the department, accepted a faculty position at Georgetown University in order to solve a "two body problem." We also received word that Jill Orioli Forster, long-time department administrator and "mother hen" to generations of graduate students, died in November of 2020.

In the wake of Randal Nelson's unexpected death in March of 2020, the department worked with University Advancement to launch the Randal Nelson Graduate Student Fund. To date we have raised more than \$30,000, which will help to meet the needs of future generations of students. (See the box on the facing page to contribute.)

As we went to press last year, the department had just hired Elaina McKie as undergraduate coordinator. This past spring, we were delighted to hire Kaave Hosseini (PhD, UCSD 2019; postdoc, CMU) for a tenure-track position in the theory group (see article on page 7). We were similarly delighted, more recently, to recruit Anson Kahng (PhD, CMU 2021) for a joint position between CS and Data Science, starting in 2022. We will be looking to fill two new tenure-track and one instructional position this coming year.

The list of recent faculty, staff, and student awards is too long to include here in its entirety. Within the University, Eileen Pullara received the Witmer Award for Distinguished Service (see article on page 5); Chenliang Xu was awarded a Wilmot





Junior Professorship; Chen Ding received the College Award for Undergraduate Teaching and Research Mentorship; and the CS Undergraduate Council received the Excellence in Programming award “for its exceptional creativity, planning, and execution of programs that appeal to a broad cross-section of the University community.”

In the larger sphere, James Allen was named a fellow of the AAAS, Yuhao Zhu received an NSF CAREER award (see article on page 6), and at least four student-led teams took Best Paper awards at various conferences. See some of this year’s student accolades listed on page 5.

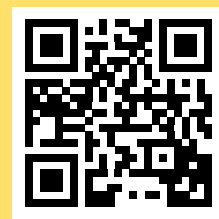
As we celebrate our past successes, remember those who have moved on, and look to an exciting if uncertain future, I wish all our readers a safe and productive year. Keep in touch. Come visit when you can. Let me know your hopes for the department.

Yours, *Michael*

To Honor Professor Randal Nelson



To honor Professor Randal Nelson, who passed away suddenly in April 2020, we have established the Randal Nelson Graduate Student Fund. This fund will provide support for graduate students in the Department of Computer Science for needs such as research funding, academic fellowships, and conference attendance costs. Nelson’s legacy will live on through this fund, and we are truly grateful for your thoughtful support in his memory. Donations in Randal’s honor can be made at <http://uofr.us/nelson>.



Two Long-Serving Department Members **Announce Retirement**



James Allen, Professor, Retires after More Than 40 Years with URCS

James Allen joined the Computer Science Department at Rochester as its fifth faculty member in 1978, after receiving his PhD from the University of Toronto. His early work focused on the development of a plan-based theory of speech acts, which still serves as one of the more influential

computational models of dialogue behavior developed to date. To further the development of this model, he focused on formal underpinnings and wrote two landmark papers, each with more than 15,000 citations, on action and time: “Maintaining Knowledge About Temporal Intervals” and “Towards a General Theory of Action and Time” published in the *Communications of the ACM* in 1983 and in the journal *Artificial Intelligence* in 1984, respectively. In 1984, he was one of the first recipients of the Presidential Young Investigator Award from the National Science Foundation. His research has always focused on exploring the connection between language understanding and knowledge reasoning, especially in natural language conversational systems. In recent times, he has focused on models of dialogue in human collaborative problem solving.

In 1983, Allen became the editor-in-chief of the *American Journal of Computational Linguistics* (now called *Computational Linguistics*). The journal flourished and grew to be the leading publication venue in the area by the time his term ended in 1993. He became chair of the department in 1987, the same year he was promoted to full professor. In 1992, he was named the John H. Dessauer Professor of Computer Science, acquiring the endowed chair originally held by Jerry Feldman, the founder of the department. Allen was director of the Cognitive Science Program from 1992 to 1996 and the co-director of the new Center for the Sciences of Language from 1996 to 1998. From 1999 to 2002, he served on the National Science Foundation’s Advisory committees for both the Computer and Information Science Directorate and the Environmental Research and Education Directorate.

In 1997, Allen won the University’s Curtis Award for Excellence in Graduate Teaching. Over the course of his career, he supervised 34 PhDs, spanning from his first student who graduated in 1981 to his final two students in 2020. Two of Allen’s former advisees, Henry Kautz and George Ferguson, are currently faculty at Rochester.

Allen was elected a Charter Fellow of the AAAI in 1990, a Fellow of the Cognitive Science Society in 2019, and a Fellow of the American Association for the Advancement of Science (AAAS) in 2020. He received the Herbert A Simon Award for Lifetime Achievement in Cognitive Systems in 2020.

Starting in 2002, Allen split his time between Rochester and the Institute for Human and Machine Cognition in Pensacola, Florida, where he served as a senior research scientist and (starting in 2006) as associate director. This led to a long series of collaborations between the two institutions funded by large research grants from DARPA and other agencies.

Looking forward, Allen is planning to devote his time to sustainable agriculture, developing a regenerative farm just a few miles south of Rochester.



Jim Roche, Lab Manager, Retires after 35 Years with URCS

Jim Roche has been a prominent figure within the department since he joined in 1986. Prior to URCS, he worked a few years at Computer Consoles (located in Rochester) developing software for the telephone industry shortly after his graduation from Rochester Institute of Technology.

Roche recalls, “when I joined the department, we were still primarily working on 5 VAX computers via ASCII terminals, and we were located on the third, fifth, and sixth floors of Hylan Hall as well as the basement of Morey Hall. Then, in 1987, we moved to the sixth and seventh floors of the [then] new Computer Studies Building and began the migration to SUN workstations. At that time, only one workstation was provided to each student office, which was shared among three to four students, and the software lab housed several additional workstations for student use. In those days, Labcomm meetings often consisted of discussions regarding whether to spend another \$5,000 to get an additional 800 MB disk for the server.” More recently, Roche helped move all the computer equipment (central computers and servers) once again when the department moved for a second time to the newly constructed Wegmans Hall in 2017.

Together with senior programmer Dave Costello, Roche has provided outstanding service to the department. Between moves, server crashes, COVID-19, and other such disasters, there has always been minimal interruption to the functioning of the department.

During retirement, Roche is most looking forward to spending more time with his four grandchildren—all of whom live within 10 miles—and doing some world travel with his wife, Melanie. He is also hoping to become more active in his hobbies, such as crafting furniture in his woodshop and training and racing in duathlons.

2020–2021 Student Awards

- **Wasifur Chowdhury** and coauthors received the Distinguished Paper award at UbiComp 2020.
- **Songyang Zhang** and coauthors received the Best Long Paper award at NAACL 2021.
- **Yiming Gan** received the Best Paper Award at PACT 2020.
- **Jie Zhou** took Silver in the ACM Student Research Competition at PLDI 2021.
- **Ben Kane** received honorable mention in the NSF Graduate Research Fellowship Program 2021 competition.
- **Raiyan Baten** was featured as an inspiring researcher on ResearchGate.
- **Boyu Zhang** was named a finalist in the CRA Undergraduate Research competition; **Ashely Tenesaca** and **Yipeng Zhang** received honorable mention.



Wasifur Chowdhury



Songyang Zhang



Yiming Gan



Jie Zhou



Ben Kane



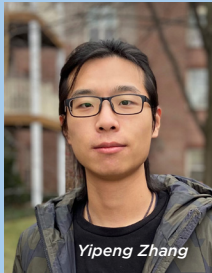
Raiyan Baten



Boyu Zhang



Ashely Tenesaca



Yipeng Zhang

Eileen Pullara, Academic Operations Manager, Receives the Witmer Award for her Distinguished Service



The University's Witmer Award for Distinguished Service is presented to staff members whose careers have made outstanding and sustained

contributions to the University, and, for nearly 50 years, Eileen Pullara's career has done just that. Since joining the University in 1971, Pullara has been a dedicated employee, most notably in her current role as only the second administrator in the Department of Computer Science, a position she has held since 2003.

Pullara has played a central role in numerous projects and transitions within the department, including balancing budgets commensurate with the department's growth, assisting in training colleagues University-wide in new financial and human resource management systems, and serving as the department's

United Way coordinator. She has also mentored countless colleagues as part of the River Campus Administrators' Group and is "often sought to be on University committees because of her breadth of understanding of how the University works in areas of research, reporting, and department administration," writes Sondra Anderson, the interim associate director of finance for University Health Service, in a letter of support.

In 2013, Pullara was awarded the Edmund A. Hajim Outstanding Staff Member of the Year honor. "Her level of caring and attention to detail truly go above and beyond," noted Sandhya Dwarkadas, the Albert Arendt Hopeman Professor of Engineering, in a nomination letter.

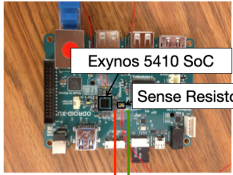
Consistently praised by her peers and colleagues for her collaborative spirit, sense of humor, dedication, and hard work, Pullara assisted the department through three transitions of department chairs—plus two interim terms. In 2013, she played a key role in the launch of the Goergen Institute for Data Science, assisting its director with grant administration, finance,

and new staff hiring. Over the last several years, the Department of Computer Science has witnessed unprecedented growth—nearly tripling its undergraduate population and doubling its graduate enrollments since 2014. "Eileen showed untiring resolve, grit, and unwavering purpose to meet the administrative challenges such transformative change and rapid growth engendered," write the Hajim School's Wendi Heinzelman, dean; Cindy Gary, assistant dean of grants and contracts; and Tim Woodward, director of finance and administration.

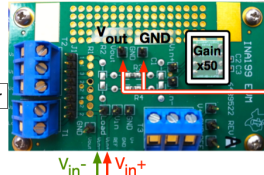
Michael Scott, the Arthur Gould Yates Professor and Chair of the Department of Computer Science, writes, "Her ethos of caring and inclusion has been particularly precious over the course of the COVID pandemic. It was Eileen who figured out how to implement our required furloughs with minimal impact on staff member lives and finances; who balanced hours, workloads, and schedules to accommodate childcare and elder care challenges; who arranged to keep the department open while keeping everyone safe."

Professor Yuhao Zhu Receives the National Science Foundation's CAREER Award

Mobile Hardware Development Board



Signal Amplification and Conditioning



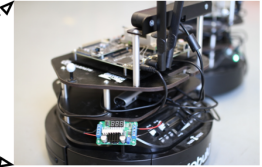
Data Acquisition and Processing



Collaborative Multi-Mobile Robots



Custom Mobile Robot Platform



(a) Smartphone/wearable testbed

(b) Mobile robot testbed.



Yuhao Zhu, assistant professor of computer science, recently received the Faculty Early Career Development

(CAREER) Award from the National Science Foundation (NSF). This prestigious award supports outstanding early-career faculty in building a firm foundation for a lifetime of leadership in integrating education and research. The award is accompanied by five years of funding that will allow Zhu to further grow his already successful research and education program.

Zhu's CAREER project addresses the very important problem of *designing software and hardware mechanisms to increase the performance and energy efficiency of smaller and smaller transistorized chips.* Such chips can be clustered with a wide variety of specialized

“The research project aims to develop programming interfaces and compiler support that expose data flow, task flow, and metadata sharing opportunities across accelerators,” Zhu writes.

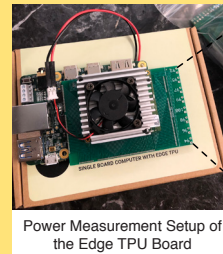
hardware components, known as *accelerators*, that can improve the performance of key applications by 10–100x. For example, the video codec is a hardware accelerator that exists

in virtually every smartphone today, compressing and decompressing videos in real time, without the user ever noticing.

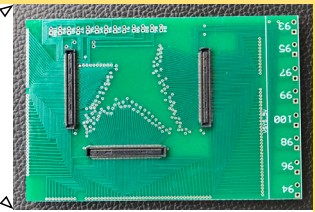
A modern computer may have to integrate dozens, if not hundreds, of such accelerators. For instance, an *augmented reality* application simultaneously exercises at least five different accelerators. This poses a major challenge. *How do we coordinate these accelerators so that we can translate the orders of magnitude efficiency gains of individual accelerators to the end-to-end application?*

Zhu explains, “This project breaks away from conventional research on individual accelerators. The key intellectual merit is the pursuit of mechanisms that globally optimize across accelerators.” The technical approach in this project is two pronged: 1) design mechanisms that approach the upper bound of acceleration by reducing the overhead of accelerator interaction, including inter-accelerator data communication and task coordination; and 2) design systems that go beyond pure acceleration to enable algorithms that share metadata across accelerators.

“The research project aims to develop programming interfaces and compiler support that expose data flow, task flow, and metadata sharing opportunities across accelerators,” Zhu writes.



Power Measurement Setup of the Edge TPU Board



Custom-Designed PCB

Zhu looks forward to including findings of the funded project in his graduate course, CSC 572 Mobile Vision Computing, to help him better train young engineers and scientists on how to identify and solve real-world problems through a software-hardware codesign. He is also excited to continue this work via the University's Upward Bound Math and Science program, where he will teach an introductory programming course to high school students from primarily low-income families. The course will be taught using Raspberry Pi devices to showcase the power of tiny computers and will consist of three modules: 1) introduction to programming, 2) simple image-processing algorithms such as edge detection and image blurring, and 3) simple digital logic circuits on FPGAs. Recorded lectures will be made available to students unable to attend the course in person as well as to the general public.

We Welcome Our New Faculty Member **Kaave Hosseini**



Kaave Hosseini joined the Department of Computer Science as an assistant professor in Fall 2021. Hosseini received his PhD in Computer Science from the University of California San Diego in 2019 and was a postdoctoral associate in the Department of Mathematical Sciences at Carnegie Mellon University before joining URCS.

Hosseini's research is in the area of theoretical computer science and discrete mathematics. Part of his research is on the theory and applications of an approximate analog of linear algebra to problems that arise in different areas of theoretical computer science. Linear algebraic objects (such as matrices) are ubiquitous in computer science, but oftentimes get corrupted in the presence of noise and, as a result, they degenerate to only approximately linear. It is crucial to be able to both classify such approximately linear objects and correct them back to their original linear form. A surprisingly high number of concrete problems in computer science can be phrased in this language of approximate linearity. Some

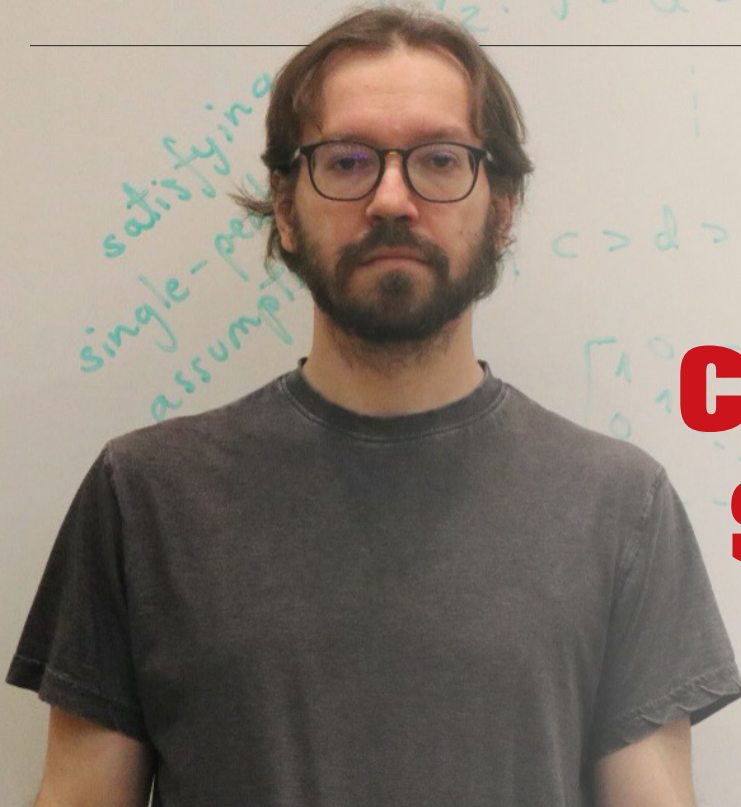
of these problems (which may seem quite unrelated on the surface) are as follows: Can data be stored in a way that when corrupted it can be detected and restored quickly? To what extent can we check the soundness of a computer program by using only a few random test cases? How can a device with limited memory (like an internet router) perform a task on a stream of massive incoming data very fast and on the go? How can computational devices jointly perform a given task with minimized communication among them? Hosseini has developed some novel techniques in the framework of approximate linear algebra and used it to answer versions of these problems. Hosseini also works on another related line of research which studies the power of having access to randomness when performing computational tasks. It is well known that some tasks can be performed efficiently if the computer algorithm has access to random bits (such algorithms are called randomized algorithms). A fundamental open problem speculates that there should be a deterministic algorithm for any problem

that can be solved with a randomized algorithm. However, to date, no such fast deterministic algorithms are known. The partial progress made so far towards this "meta problem" has been via construction of pseudorandom generators, that is, algorithms that generate a deterministic sequence of numbers that "appear" to be random. Designing pseudorandom generators has been a very active line of research over the past decades, with hundreds of papers published in the area. Hosseini and his coauthors have developed a novel framework to construct pseudorandom generators that circumvents many limitations of previous approaches and simultaneously unifies and improves upon many results in the literature.

This fall semester, Hosseini is teaching his newly designed course, Analytic Methods in Computer Science. The course focuses on tools from mathematical analysis and linear algebra and applies them to problems in a variety of areas, including clustering, coding theory, randomized algorithms, machine learning, social choice theory, streaming algorithms, and complexity theory. Even though most of the problems that arise in these areas are discrete and combinatorial in nature, researchers have come to realize that it is fruitful to treat these problems as continuous (through an analytic lens) rather than discrete. Originally developed to understand some problems in physics, this approach has had impressive success in solving problems in physics, mathematics, and, more recently, computer science. Hosseini hopes to continue expanding and teaching such courses, to make analytical tools more well known among computer science graduate students and interested undergraduates so that they can use them to identify and model problems in their own domains.

Featured Graduate Alumnus:
Piotr Faliszewski

Advancing Computational Social Choice Theory



Piotr Faliszewski is a professor of computer science at AGH University of Science and Technology in Krakow, Poland. Faliszewski was awarded his PhD degree in computer science from the University of Rochester in 2009, writing his PhD thesis on “Manipulation of Elections: Algorithms and Infeasibility Results.” His BS and MS degrees in computer science are from AGH University of Science and Technology.

Faliszewski’s research centers on computational social choice theory, broadly construed. He is an internationally recognized leader of the field, both in his research and through his organizational contributions to workshops, conferences, and journals. He has received *Polityka* news magazine’s Research Prize in technical sciences and was awarded the Friedrich Wilhelm Bessel Research Award of the Alexander von Humboldt Foundation.

For this issue, Faliszewski was interviewed by Professor Lane A. Hemaspaandra, his thesis advisor.

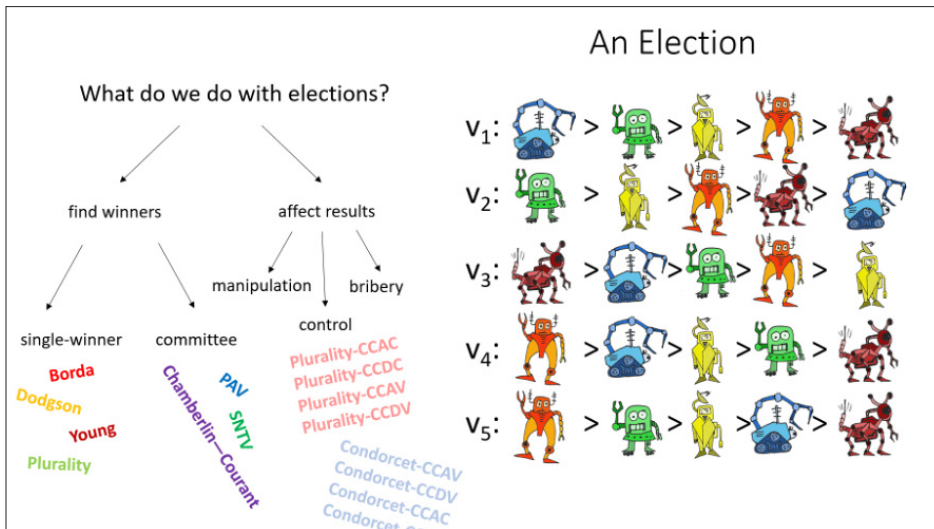
Let’s start big. What is computational social choice theory? What drew you to it? Why is it important to study?

How will it change and improve the world? You recently received—warmest congratulations—a 1.4-million-euro, five-year ERC (the EU’s European Research Council) Consolidator grant: What will its key directions be, and how will such a large amount of support help you and your group advance the field?

Oh, that’s a lot of questions to start with! But first things first: In short, computational social choice is an area that, on the one hand, tries to use computer science techniques to solve problems of group decision making, and, on the other hand, tries to apply these decision-making approaches within computer science. As one example, consider the problem of finding a movie that would, in some way, be related to another one. For example, if you liked some slapstick comedy, you might want to find similar ones. One approach is to collect information about the movies that people who enjoyed your comedy also liked and treat them as votes in an election. Then, depending on the voting rule you decide to use, you might either get very similar movies, such as sequels to the comedy or movies from the same makers, or, with a different voting rule, you might get movies that are related in more subtle ways. However,

computing the results of these voting rules may be computationally difficult, e.g., it may be NP-hard. Thus, we need various algorithmic tools to deal with such intractable problems. Further, to know what types of relations different voting rules would identify, we need to study these rules’ properties.

But, of course, computational social choice has many more things to offer. In my project we will focus on two main issues. The first one is to develop algorithmic tools for running advanced elections that would help people and institutions make better decisions. For example, our algorithms would help institutions choose groups of people for particular tasks, would help cities run their participatory budgeting schemes or—as indicated—would help friends choose movies to watch. The second issue is more introspective: Our field started up as a mostly theoretical one, but nowadays there is plenty of experimental work. Our goal is to lay out theoretical foundations for how experiments should be conducted so that their results give some true insights. For example, if you are to test your algorithm experimentally, what data should you consider? Should you collect real-life data, or would synthetic data be



An election and a tree of problems that one may want to solve regarding elections

sufficient? How can you know that you have tested your algorithm enough? We hope that, by the time the project is finished, not only will we have useful tools for group decision making, but also, we will be able to give convincing arguments as to why these tools indeed do their job.

Your research has been extremely fresh, creative, and influential across a very wide range of themes. To mention just a handful: the effects of various types of restricted domains on the difficulty of attacking elections; introducing new models of electoral attacks; the study of multiwinner elections; and defining and understanding a “Map of Elections” and using that to better ground experimental studies. Also, in your work, you employ a remarkably rich range of tools, ranging from multiple types of complexity to algorithms to optimization to experimentation. What advice would you give younger researchers—whatever their areas are—as to how to identify promising directions early on, or even how to, as you have done, create important new directions, drawing on a varied palette of techniques?

Perhaps one of the most difficult questions that a young researcher—or, simply, a researcher—faces is “why do you study the particular problems that you study?” The best way to ensure that your research is meaningful, going in the right direction, and likely to make an impact is

to make sure that you can always answer this question. When I was very early in my career, during graduate school or even before, all I wanted to do was to prove things, establish new results, and show something that I could publish. Doing so is a nice kind of sport that one needs to learn as a researcher, and if one is really good at it, then one can turn it into a successful career. Yet, if one wants to be a true leader, one must be able to conjure dreams and show credible paths that go from the problems one is currently solving to fulfilling these dreams. These paths may not always work out. Indeed, often they do not, but they offer guidance, and they keep us on track. By the time we find that our original plans were not as realistic as we might have hoped, we usually see a myriad of ways to sidestep the difficulties and to go on. So, in other words, if you are a researcher working on some topic, you better be able to explain why, and you better be convincing! Of course, your answer will likely evolve over time. Indeed, you should be willing to question it and rethink it. But if you do have the answer, then all the other issues are secondary.

Your illustrations for your papers are spectacular, utterly unmistakable, and both detailed and exuberant. We have included on this page an example that you kindly provided. How did you develop your artistic style, and how much time does it take to plan and execute such an illustration?

Actually, it is all your fault! As my advisor, you once gave me a presentation to prepare based on a handwritten draft. I tried following this draft, but there were numerous pictures with various characters appearing, and I somehow had to insert them into the presentation. Unfortunately, I could not find satisfying pictures anywhere. So, on the spur of the moment, I simply drew them by hand, scanned them in, and colored them with some basic graphics program. It all just took a few minutes, and I had nice characters for the presentation. The effect was so appealing that, somehow without me really aiming for it, it became the standard way for me to make presentations. Regarding the style, there is nothing to it—I simply cannot draw anything else. My pictures look the way they do because I literally cannot draw anything else! I can’t even draw the same character twice!

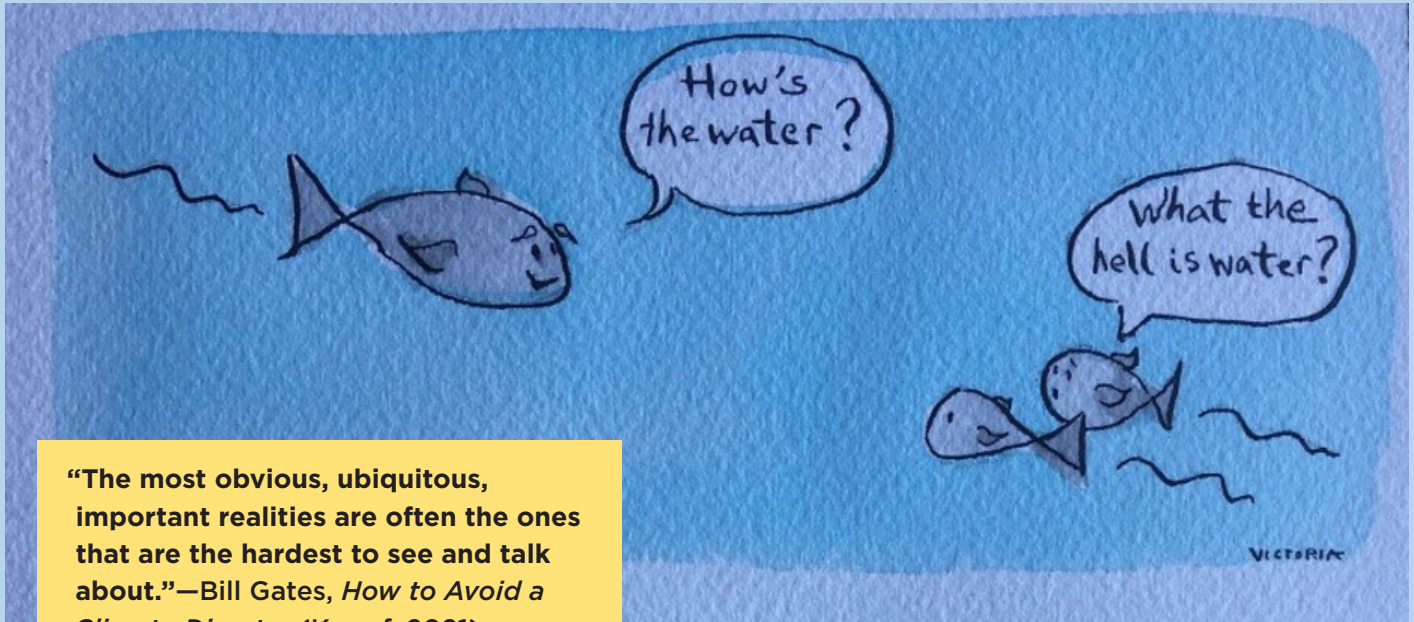
You came to URCS from AGH University of Science and Technology and then returned there as a faculty member. How did you choose URCS? How did you come to return to AGH afterward? What was it like returning to the beloved department where one was trained but as a colleague to one’s former professors?

Oh, it feels like much more than forever! I sometimes joke that I’m currently living my third life. The first one was before URCS, the second happened in the United States, and the third one is now. Indeed, I wonder what the fourth one will look like! Regarding final thoughts for today’s PhD students, all I can say is to not worry too much. While graduate school can be tough, frustration can creep in, and the prospects of seeking a job can be scary, there is also a lot of fun to be had. So, simply do your job well and make sure to enjoy yourself while you do it. I would probably have put here some motivational quote, if I could think of one quickly enough, but maybe let’s finish it at this!

Your fault again! At least for URCS! During my BS/MS program (in Poland these used to be joint five-year programs, so anyone who wanted to get a university degree

continued on pg. 11

Professor Hoque Designs New Course on Technology and Climate Change



“The most obvious, ubiquitous, important realities are often the ones that are the hardest to see and talk about.”—Bill Gates, *How to Avoid a Climate Disaster* (Knopf, 2021)



During the ice age—2.4 to 2.1 billion years ago—the average temperature was only six degrees Celsius lower than today. During the

era of dinosaurs—245 and 66 million years ago—the average temperature was just four degrees higher than today. If we don't do anything about climate change, the earth's average temperature is projected to rise by four degrees by 2100. Global temperature rise will raise global mortality, marking climate change as deadly as COVID by 2050. By 2100, it would be five times deadlier.

We typically add 51 billion tons of greenhouse gases to the atmosphere every year. To stop global warming and to avoid its worst effects, we need to

lower it to 0. It is the biggest challenge we face today. Pretty much everything we do involves releasing greenhouse gases. The solution will require a fundamental shift in how we live.

The world has never solved anything quite so significant yet, and breakthroughs are necessary for zero-carbon energy and for reducing net emission to zero.

Now what does this have to do with computer science? A brand-new class called Technology and Climate Change has been designed precisely to address this question.

Before explaining what is covered in this class, it is perhaps worth noting what is not covered. This class is not about applying data mining techniques to climate datasets and generating happy graphs. Instead, this class introduces how humans change the climate and how our lifestyles contribute to air and water

pollution, changing land and wildlife and threatening coastal life. The class is structured around three fundamental strategies: 1) Mitigation, 2) Adaptation, 3) Prediction.

Mitigation

One of the fundamentals of computer science is learning how to measure the complexities of algorithms. A recent wave of research also calls for evaluating the carbon footprint of an algorithm/platform to the environment. For example, training a single AI model can emit as much carbon as five cars in their lifetime (Strubell, Ganesh, McCallum, 2019). In this class, students learn to use cost, CPU, and RAM consumption (particularly in the cloud) as a proxy to define operational boundaries to minimize any unintended consequence to the environment. Students are also exposed to “Green AI” (redefining *efficiency* by reporting the number of floating-point operations to generate results) and “Red AI” (maximizing

accuracy by deploying massive computational power leading to a larger carbon footprint). As computer scientists, we can learn to contribute to equity and access, leading to a greener world.

Adaptation

There is a significant opportunity for AI to aid people with the adversity of climate change. This is particularly important for countries that have many victims of climate change but that don't have the resources to address that change. The course introduces the important topic of *climate justice*—a movement that acknowledges that climate change often has disproportionate effects on historically marginalized or underserved communities. There is also an opportunity to use AR/VR technologies to create awareness and educate people about climate change.

Prediction

Computation can play a significant role in our response to climate change, from predicting extreme weather to figuring out the optimal eco-friendly route to a destination. Applying remote sensing to automatically determine suspicious changes in biodiversity will be critical to preventing the next pandemic.

Discussion in the class is grounded in ethics. Very few companies have incentives to disclose their carbon footprints. As CS graduates are hired by many of those companies and eventually take on leadership positions, they need to have the knowledge, awareness, and ethical rigor to impose transparency and promote sustainability.

Another unique aspect of the course is an emphasis on the impact of climate on human health and well-being. This emphasis allows the class to benefit from much of the existing research at URMC and could potentially help us start a new research program on climate computing. We hope this class will be an example of classroom instruction inspiring new research activities, much as our research activities constantly influence our teaching.

Social Choice continued from pg. 9

had to go for an MS), I got very interested in computational complexity theory. The courses I took were not challenging enough, and I started getting “Western” books on the topic. While they were not very easy to obtain, I got my hands on a few, including *The Complexity Theory Companion* by you and Ogiwara. I read it, and since you made the mistake of encouraging people to send you typos and comments on the content, I sent you mine. The response I got was, “Great! Come do a PhD with me!” (Possibly not in exactly those words but pretty close to them). And that was it: I did not look for any other advisor or school—I applied to URCS, got in, and got a PhD with you!

Regarding the return to AGH, I stayed in touch with my MSc advisor (indeed, I still see him regularly), and each time I visited home I would also meet with him. It turned out that he was retiring just when I was about to graduate, and he suggested that I return. I thought, “Why not?” I decided that I would see whether I could make a happy life back in Poland, but under my own conditions—making a living by doing science. It turned out to be possible, and here I am!

As to what it's like working at the place where I got my training, that's a tricky question. I no longer really remember how it was before I became a faculty member! All I can say is that I was lucky that I started working at AGH shortly *before* the department moved to a new building. As we moved, a lot of new friendships were formed because everyone was put under new conditions.

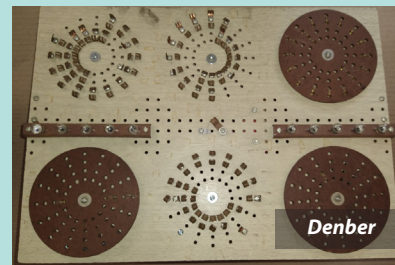
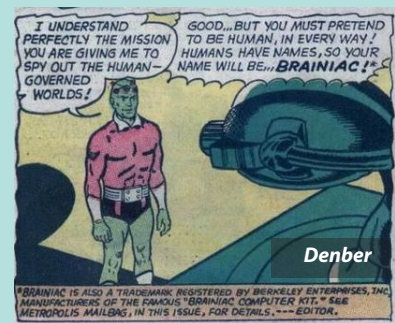
URCS Professor Randal Nelson, whose “CSC 400” problem seminar shaped generations of URCS PhD students, tragically passed away from complications of cancer treatment in 2020. Do you have any memory of or lessons from Randal that influenced your career?

Randal was a great man and a great teacher. He really made the experience of the first semester and first year at URCS very exceptional and, with all its hard work, very rewarding. His class had the effect of taking a bunch of kids and turning us into a team that would focus on its goal but that would also take care of each other. But one sight that I probably will always remember is the following. Once, I was going from the kitchen (seventh floor) down to my office (sixth floor); I gazed down between the flights of stairs and saw Randal climbing up vertically, between handrails, like Spiderman! I do not think he saw me, and I never asked him about it. Sometimes I am not even really sure if I remember it correctly, but that's the image of Randal that I will have forever. Someone always willing to explore without worrying whether others would find it strange.

You graduated from URCS a dozen years ago. Does it seem like yesterday or forever? And do you have any final thoughts or suggestions that you'd like to share with today's URCS PhD students to help them as they undertake their thesis research and then embark on careers in academia and industry?

Oh, it feels like much more than forever! I sometimes joke that I'm currently living my third life. The first one was before URCS, the second happened in the United States, and the third one is now. Indeed, I wonder what the fourth one will look like! Regarding final thoughts for today's PhD students, all I can say is to not worry too much. While graduate school can be tough, frustration can creep in, and the prospects of seeking a job can be scary, there is also a lot of fun to be had. So, simply do your job well and make sure to enjoy yourself while you do it. I would probably have put here some motivational quote, if I could think of one quickly enough, but maybe let's finish it at this!

Graduate Alumni Notes



Joseph Bryan Lyles (MS '77)

I recently retired from Oak Ridge National Lab at the end of May, where I had been working on issues associated with security of critical infrastructures. I'll continue to stay involved with the technical community but not as a regular employee.

Michele Denber (MS '80)

I joined a project last year started by the original developers of Interlisp-D at PARC to modernize the language. You can now run it on a variety of computers, including Suns, IBM PCs, and Macs. Interlisp-D was and remains an unbeatable tool for rapid prototyping. I'm also getting the original Interlisp 10 running again on a PDP-10 emulator on my Sun. For more information see <https://interlisp.org/>. I'm also restoring a 1958 BRAINIAC, the first personal computer toy ever made (<https://en.wikipedia.org/wiki/Geniac>). Technically, it's more a state machine than an entire computer as it lacks any RAM, clock, or automatic switching ability, but with hand-wired circuits, six rotary switch discs for manual input, and 10 flashlight bulbs for output, it can do combinatorial logic. It became fairly popular in the 1950s and was the first introduction to computers for many kids, even making it to the pages of Superman by 1964.

Pictured above, right, is my BRAINIAC, the oldest computer in my collection, long before the Alto or the PDP-10. Three of the discs have been removed to show the concentric rows of contact points. Wipers on the discs make circuit connections when the discs are rotated, causing various bulbs to illuminate according to the problem defined by the wiring in back.

Jay and Susan (Hollbach) Weber (PhD '89)

We now have one grandchild and another on the way! We also have recently moved from Palo Alto, California, to Cape Cod, Massachusetts.

Alice Kyburg (PhD '94)

I live on Martha's Vineyard with my husband, Brad Abbott, and twins Henry and Amelia, who are now high school juniors. My husband is a partner at Gannon & Benjamin Marine Railway, Inc., where they build and restore wooden sailboats. We live aboard our recently restored schooner Calabash during our summers. Please drop by and say hello! I retired from the University of Wisconsin Oshkosh Department of Philosophy two years ago, and I now run a tutoring center. I am also participating in an online collaborative degree program through the University of Wisconsin that offers a master's in data science. I teach the

Ethics of Big Data. I'm enjoying following the development of CS research into ethical algorithms. If you have any relevant material or experiences, please be in touch! I'm also in the final phase of establishing the **Henry Kyburg Fund**, honoring my father, Henry Kyburg Jr., which will be funding interdisciplinary research and programs at the UR, with preference given to data science, cognitive science, computer science, philosophy, and neuroscience. Please consider a contribution to help us reach that required minimum we are so very close to. You can contact me or Jenna Hiller (jenna.hiller@rochester.edu) at the UR Alumni office or donate directly through the UR alumni website (www.rochester.edu/alumni/); specify "Henry Kyburg Fund."

Jim Muller (MS '94)

After 15 years at Google, I left last year to found Didero. We use controllable AI to make recommendations in areas where personal preferences are a big deal, starting with books and TV shows. Didero also focuses on helping people find something to read or watch for a group, whether it's a show for the family to watch together, an audio book to listen to together in the car, or a book for a book club. Didero is fully remote, which was an opportunity for my wife and me



Poesio

to move to the Olympic Peninsula, where we now live on Discovery Bay.

Massimo Poesio (PhD '94)

This past year hasn't been great for international travel. It is the first time since I left Italy in 1987 that I didn't go back to see my family after the ski trip in Val d'Aosta (illustrated in the photo), but I've been to Germany a couple of times, and we've been traveling within the UK (Scotland, the Lake District, etc.). My son Joshua (picture left) is now in the second year of secondary school and enjoying it, mostly. I have published a bunch of papers, as usual, and finished a new book with Morgan Claypool that will come out later this year. Nothing too unusual, except perhaps a lot more cooking than I normally would do.

Galen Hunt (PhD '98)

My 18-year-old son, Weston, and I took up flying during the COVID-19 lockdown. He got his license before me, but the old man scored higher on the written exam.

Amit Singhal (PhD '01)

Last year brought some significant changes. I completed my JD degree, passed the bar exam, and became a partner at Rossi, Kimms & McDowell LLP. My primary practice is in intellectual property law. Here is a graduation photo!

April Mitchell (MS '02)

I have recently joined a cloud data security start-up, Dasera, as head of engineering.



Hunt

Rahul Bhotika (PhD '03)

I was promoted in October 2020 to "Director, Computer Vision" at Amazon.

Myroslava Dzikovska (PhD '04)

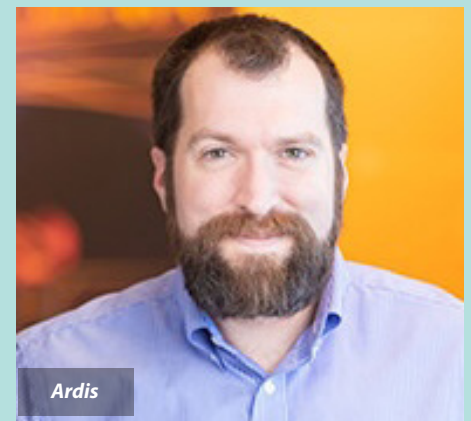
I am still working for Google Health. My biggest piece of impact is that the app that I worked on, Streams, ended up being used by doctors caring for acutely ill patients in a couple of London hospitals during the pandemic. Now I am working on Care Studio (<https://health.google/for-clinicians/care-studio/>), a new application to bring Google search capabilities to improve health care in the US hospitals. I have recently moved cities, as I really did not enjoy living in London during the pandemic. So, in July 2020, I moved back to Edinburgh, where I had lived for 11 years before joining Google. This made my life much better because I can meet with friends for (socially distanced) walks outside without relying on public transport and have multiple beautiful parks to visit within walking distance. I like the quality of life so much better that now I'm looking for options to make my Edinburgh stay permanent.

Nate Blaylock (PhD '05)

In February, I started a new position as CTO of Canary Speech, a startup that uses speech as a digital biomarker to diagnose a variety of diseases as well as cognitive and mood conditions.



Singhal



Ardis

Paul Ardis (PhD '10)

I was recently promoted to technology manager-machine learning, so I'm now leading ML research activities for GE.

Benjamin Van Durme (PhD '10)

In the last couple of years, I was granted tenure at Johns Hopkins University (JHU), moved my family immediately before pandemic lockdown, and began a 50/50 hybrid role as a researcher at Microsoft Semantic Machines. My family is well, with two young boys healthy and loving school.

Undergraduate Alumni Notes



Steven Lewis '00

was ordained a priest of Jesus Christ for the Catholic Diocese of Rochester. He began his priestly ministry in Tioga County, New York (Owego and the surrounding area) at the end of June.

Brendan Heavey '02

manages the value-based reimbursement team within the actuarial department at Independent Health in Buffalo. Their mission is to identify ways of increasing the value of insurance plans by identifying and reducing variation across different episodes of care. Brendan uses his URCS education on a daily basis.

Luke Bakken '98

continues to backpack, rock climb, and mountaineer in his spare time. Last year he summited Mt. Adams, and this year he plans to climb Mt. Olympus and Glacier Peak in Washington State.

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Recent PhD Graduates

Tianlang Chen

Joint Visual-Textual Modeling for Multimodal Content Classification, Retrieval and Generation

Amazon, Applied Scientist
Faculty Advisor: Jiebo Luo

Shupeng Gui

Neural Embedding: Compact, Robust, and Non-euclidean Solutions

Facebook, Research Scientist
Faculty Advisor: Ji Liu

Zahra Razavi

Dialogue Management and Turn-Taking Automation in a Speech-Based Conversational Agent

Faculty Advisor: Len Schubert

Parker Riley

Text Rewriting with Missing Supervision

Google, Software Engineer
Faculty Advisor: Dan Gildea

Samiha Samrose

Modeling and Mediating Conversational Norm Violations

Read AI, Data Scientist
Faculty Advisor: Ehsan Hoque

Taylan Sen

Interpersonal Communication Analysis with Facial Expression Encoding and Interactional Modeling

Faculty Advisor: Ehsan Hoque

Hanlin Tang

Communication Efficient Machine Learning

Tencent, Research Scientist
Faculty Advisor: Ji Liu

Zhengyuan Yang

Visual Grounding: Building Cross-Modal Visual-Text Alignment

Microsoft, Researcher
Faculty Advisor: Jiebo Luo

Anis Zaman

Combining Traditional and Non-traditional Data Stream for Understanding Mental Health

eBay, Research Scientist
Faculty Advisor: Henry Kautz

Undergraduate Student Groups

Women and Minorities in Computing (WIC-MIC)

In Spring 2021, WIC-MIC successfully introduced a new model for general meetings. These virtual, biweekly sessions allowed members to connect and catch up while also providing opportunities for academic and professional development. Some meetings were more relaxed, discussing topics like course planning in a peer-to-peer environment. Others were more focused on professional development; for example, a visiting Postman API representative provided an informative, fun training module for students. WIC-MIC also hosted speed-friending and speed-networking events, which proved especially successful in getting members talking among themselves and with guests. In the coming year, they hope to expand and improve on the program, with a special focus on creating a fun, active, and rewarding space for underrepresented students in computing.



Top, from left: Haochen Zeng, Jiahao (Jerry) Lu, Samuel Frank; bottom, from left: Tasheem Brown, Anh (Jessie) Nguyen, Aman Shrestha, Minghui (Emily) Zheng; not pictured: Alex Martin, Duong Phan

WIC-MIC welcomes all forms of collaboration, especially within the department and its alumni community.

For more information, please visit <https://ccc.rochester.edu/wicmic/home/> or send an email to uofrwic@gmail.com.

Computer Science Undergraduate Council (CSUG)

CSUG's executive board has worked hard to bring more programs, events, and resources to undergraduate students. The executive board recently expanded to include two new positions: First Year Representative and RocLabs Chair. The First Year Representative connects incoming first-year students to CSUG activities, academic resources, and other forms of support, while the RocLabs Chair oversees a committee facilitating student collaboration on technical projects.

CSUG introduced exciting new events this past year, including the 2020 Summer Challenge Series. The series included two competitions, one on CSS (cascading style sheets, a web formatting language) development and the other on coding interview questions. The goal of each challenge was to encourage students to learn and develop new skills during the quarantine period. Additionally, CSUG conducted a weekly series of coding workshops; these were student-led sessions



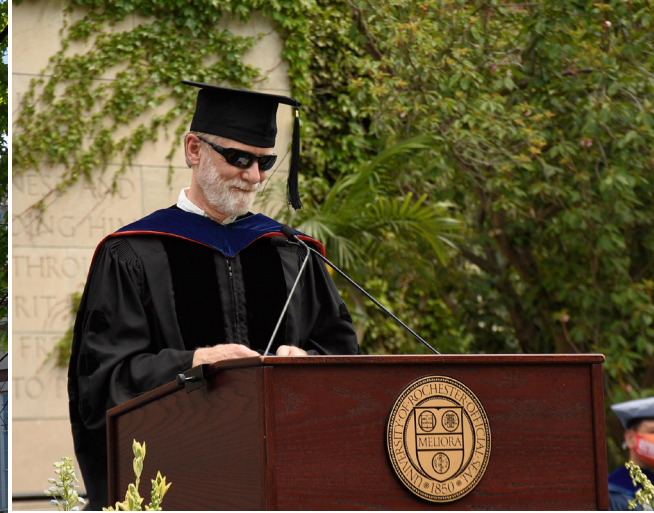
focused on solving technical questions typically presented in internship and job interviews. CSUG also started an open-source initiative on its (brand new!) official website, ur-csug.org. Students are encouraged to contribute to CSUG's open-source projects, to learn new technologies, and to become familiar with GitHub.

Last year, CSUG received two awards for its leadership and community impact. The first award was the University Student Life Award, also known as a Rocky, for Excellence in Programming. CSUG received a Rocky in recognition of its successful organization and expansion of the DandyHacks hackathon on a virtual platform as well as its expansion: participation increased from 173 students in 2019 to 250 students in 2020, with a total of 38 projects submitted.

Secondly, the Alice DeSimone Award was presented to the president of CSUG, Aman Shrestha, as a part of 2020 Student Leadership Appreciation season. Shrestha was recognized for his dedication, enthusiasm, and collaborative skills; he has truly made CSUG an ever-better organization!



Aman Shrestha receives the 2020 Alice DeSimone Award.





Congratulations Class of 2021!



Shreif K.e.h. Abdallah
 Abdelrahman Mohamed
 Ali Abdelkader
 Constanza Aceves
 Rodriguez
 Abhisesh Acharya
 Jeffron Addy
 Saad Ahmad
 Ziyi Ai
 Ehab Ajmal
 Mustafa Ali
 Victor Nikhil Antony
 Marlie Cassidy Augustin
 Amit Bhattarai
 Daniel Busaba
 Emma Campbell
 Nicholas Caraballo
 Xinyi Chen
 Zhengdong Chen
 Prinaya Choubey
 Joshua A Cohen
 Hengguang Cui
 Kaile Ding
 Sydney J Dlhopsky
 Yuqiu Dong
 Dominique Cecile Dorvil
 Thabani Dube
 Alexandra Ferrante

Kenda Flores-Garcia
 Bowen Fu
 Yicheng Gao
 Liam G Geffen
 Thomas Winter Geiger
 Aaron J Gindi
 Kainoa G Giomi
 Leah Goodwin
 Adam D Green
 Duncan Grubbs
 Junkang Gu
 Dominick Alexander
 Harasimiuk
 Marcus Anthony Hill
 Thu Hoang Phan Ha
 Wanyin Hu
 Jamie L Huber
 Muhammad Usama Ijaz
 Anesi David Ikhianosime
 Andrew A Jarvis
 Bartlomiej Radoslaw
 Jezierski
 Dane Ryan Johnson
 Kevin Kao
 Jason Zeldin Katzner
 Nikita Kim
 Benjamin Kuehnert

Andrew Alexander
 Lavryshyn
 Dung Tuan Le
 Matthew J Lee
 Jialin Li
 Tianyi Li
 Rebecca Liu
 Sihao Liu
 Tianyi Liu
 Ermiyas Liyeh
 Jiahao Lu
 Qingjie Lu
 Yilin Luo
 Claire MacCormick
 Lamine Male
 Kevin Martinez
 Scott McKinney
 Jayda Medina
 Muskaan Mendiratta
 Olivia G Morton
 Emanuela Natali
 Hieu Dang Nguyen
 Oliver Orion Otcasek
 Hong Jun Park
 Michael Pawlicki
 Anh Quoc Pham
 Patrick Andrew Phillips
 Jeffrey Pinsker-Smith

Kevin J Pottackal
 Sarmishtha Prathivadhi-
 Bhayankaram
 Liza Miriam Pressman
 Alexander Curtis
 Rabideau
 Joshua Ethan Radin
 Nurfajri Rafiuddin
 Nathan H Reed
 Emely Rosa-Ortiz
 Riordan Helen Ryan
 Akira Sah
 Nicholas Salem
 Avi J Saven
 Huzeyfe Mehmet Sel
 Mingyuan Shan
 Aman Shrestha
 Joshua Ziffer Sobel
 Ashton Sopher
 John Sosa
 Jiangqi Su
 Yiyang Su
 Mingqing Sun
 Matthew W Sundberg
 Advait Suresh
 Ariel Tello
 Ashely Tenesaca
 Brandon J Toops

Sirui Wang
 Xiwei Wang
 Yuanzhuo Wang
 Ziyi Wang
 Melissa Welsh
 Bowen Wu
 Yihang Xu
 Zhengyuan Xu
 Jiajiang Yang
 Qiaoyu Yang
 Tongyu Yang
 Yanwei Yang
 Yifei Yang
 Kecheng Ye
 Montel Yu
 Boyu Zhang
 Dan Zhang
 Haoqi Zhang
 Shuran Zhang
 Yipeng Zhang
 Yixin Zhang
 Grace Zheng
 Yuqiao Zhu
 Anna E Zimmerman
 Canruo Zou

Inclusive Computing Program to Improve Representation in CS

The number of computer science PhD students from underrepresented groups has seen a steady decline in the US, while the number of students from historically privileged groups has remained largely the same (2019 Taulbee Survey).

The gender ratio of assistant professors in computer science is so imbalanced that, with sustained effort, it would take 50 more years to obtain gender equality (S. Way, D. Larremore, and A. Cluset, 2016).

So, what can we do today?

The Department of Computer Science launched an Inclusive Computing Program in the 2020–21 academic year, supported by a Google exploreCSR award that aims to engage a diverse body of University of Rochester undergraduate students in computing research, especially female, LGBTQ+, BIPOC, and first-generation college students, as well as students with accessibility needs.

Led by Professors Ehsan Hoque and Zhen Bai, the program provided rich research experiences in order to help increase students' competence in computing and collaborative skills to solve real-world problems. It also sought to boost each individual's sense of belonging in the world of computing and their interest and confidence in pursuing graduate study.

Participation: The program attracted 85 applicants from a diverse range of academic backgrounds, such as computer science, data science, applied mathematics, electrical and computer engineering, biomedical engineering, neuroscience, psychology, economics, and linguistics. Thirty students from diverse backgrounds (55 percent female, 43 percent BIPOC, 40 percent LGBTQ+, 33 percent first-generation college, 7 percent students with accessibility needs) were selected to join the first cohort of the Inclusive Computing Program.

Activities: Students engaged in several research activities throughout the academic year. To start, they participated in a two-hour orientation workshop that showcased various computing research topics and a roundtable discussion with researchers from marginalized communities. Activities also included 40 hours of paid, hands-on research advised

Duong Phan, CS '23, writes, “[the workshop] gave me more insights into researching and helps me to confirm the future career path I want to follow. I was able to make great progress, thanks to constant feedback and guidance from my supervisor and research partners—I would definitely take the program again if I have a chance.”



A snapshot of the kickoff event with some of the participants and faculty mentors

by faculty members with joint research interests; a roundtable discussion with six UR alumni from Google on career path, graduate education, and professional development; and other various research and professional development opportunities.

Outcome highlights: Students in the program took part in a variety of research areas spanning AI/ML, human computer interaction, system, and computational cognition.

An analysis of the pre- and post- self-reported survey responses indicated that there was an increase in students' “self-efficacy,” “research skills,” and “sense of belonging” and a decrease in “imposter syndrome.”

Faculty engagement: The workshop was supported by several URCS faculty members who took on the role of mentor, including

AI: Dan Gildea, Jiebo Luo, Lenhart Schubert, and Robert Jacobs

HCI: Zhen Bai and Ehsan Hoque

Systems: Sandhya Dwarkadas, Fatemeh Nargesian, Sreepathi Pai, Michael Scott, and Yuhao Zhu.

Professor Len Schubert, who supervised three students, writes, “The students learned about symbolic processing, representing the meaning of language, and using these representations in story processing, inference, and learning; and they were able to make significant contributions to our research projects in these areas during the Spring semester.”

Alumni engagement: We were fortunate to engage with some of our distinguished alumni who participated in a roundtable discussion with the workshop participants. The panelists included **Iftekhar Naim, PhD '16**, software engineer (advised by Daniel Gildea) **Melissa Dominguez, PhD '03**, engineering manager (advised by Robbie Jacobs) **Chetan Bhole, PhD '14**, software engineer (advised by Henry Kautz) **Bo Hu, PhD '05**, software engineer (advised by Chris Brown)

Peter Battaglia, BS '02, research scientist at Deepmind (advised by Robbie Jacobs) **BiJun He, MS '04**, product manager (advised by Michael Scott)

Acknowledgments: We also appreciate the generous support from the David T. Kearns Center for Leadership and Diversity in Arts, Sciences & Engineering, the Gwen M. Greene Center for Career Education and Connections, and the Office of Minority Student Affairs, as well as the various UR communities, such as

the Women and Minorities in Computing (WIC-MIC), the Society of Hispanic Professional Engineers (SHPE), the Society of Women Engineers (SWE), the National Society of Black Engineers, Pride Network, and the Womanist Club.

More details about the workshop are available at <https://inclusive-computing.roc-hci.com/>.

Let's Welcome:



Narváez

We Welcome Our New Postdoctoral Member

URCS is delighted to welcome Dr. David E. Narváez to the department; he joined us in January 2021 for a two-year postdoctoral appointment. Narváez has

been working with Professor Lane A. Hemaspaandra on the connections that structural complexity theory has to SAT solvers and computational social choice, especially regarding issues of search versus decision. Hemaspaandra notes that "David is an outstanding, versatile, creative researcher. It is a real treat having him here, and he is already collaborating with us on multiple projects." Narváez's stay at URCS is supported by a prestigious award from the highly competitive CRA/NSF CIFellows 2020 program.

Narváez's interests are broad, encompassing complexity, computational social choice, constraint satisfaction, CS education, and extremal combinatorics. He has published on all these topics, and his more recent paper with Brakensiek,

Heule, and Mackey, which shows that a tiling claim (Keller's Conjecture) holds in seven-dimensional space, won the Best Paper Award at the 2020 International Joint Conference on Automated Reasoning.

Narváez's thesis for his PhD in computer science from Rochester Institute of Technology, defended in December 2020, was titled "Constraint Satisfaction Techniques for Combinatorial Problems" and was advised by Professor Edith Hemaspaandra and Professor Stanisław Radziszowski. Narváez's CS MS degree is also from RIT and his BS in Systems Engineering and Computing is from Universidad Tecnológica de Panamá. His career goal is to become a professor of computer science.

We Welcome Our New Babies

The department is delighted to welcome so many new additions this past year, including three faculty babies!



Keith, Professor Zhen Bai's son, born March 2021



Ameila, Dr. Eustrat Zhupa's daughter, born May 2020



Andrew, Professor Chenliang Xu's son, born November 2020



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 Lane A. Hemaspaandra, Ehsan Hoque, Kaave Hosseini, Johanna Lester,
 David E. Narváez, Jim Roche, Michael Scott, Yuhao Zhu*

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