

A photograph of two men, one Black and one Asian, both wearing glasses, looking intently at a laptop screen. The man on the left is pointing at the screen. The background is dark, suggesting a late evening or night setting in a computer lab or office.

**SIGNIFICANT**

# Bits

Newsletter Spring 2020

**COMPUTING** *for the* **COMMON GOOD™**

UMass**Amherst**

College of Information  
& Computer Sciences

# SignificantBits

Spring 2020

Significant Bits is published by the College of Information and Computer Sciences at the University of Massachusetts Amherst.

Email your news, suggestions, comments, and contributions to [bits@cics.umass.edu](mailto:bits@cics.umass.edu).

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## On the Cover

Tajour Cohen-Henry (BS '19), left, works with a fellow student during the college's annual Halloween LED Workshop led by Associate Professor Rui Wang.

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# Letter from the Dean



When I joined the UMass Amherst College of Information and Computer Sciences (CICS) after 36 years at IBM, I was excited about tackling the challenges facing computer science programs today. I was also drawn by the warm and close-knit community, underlined by the values that I saw faculty, students, and staff putting into practice every day.

After a year of brainstorming with faculty and staff, we have created a vision for the college: “Computing for the Common Good.” At CICS, we express this mission through research, education, and service to society.

We perform innovative research that creates robust, reliable, and humanistic technology that serves and protects us, and embodies our values. We apply that research towards good causes. Our world-class faculty are working to ensure that information in the 2020 Census is kept private, aiding bird conservation efforts by using machine learning to analyze migration patterns, and providing workers with recommendations for upskilling and lifelong learning.

The education we provide gives students not only technical knowledge, but also the ethical foundation and critical thinking to apply their skills for good in a challenging, rapidly changing world. Our high-achieving students—with an average 4.2 GPA among new first-years—are building tutoring systems for incarcerated youth and software for local non-profits. They’re founding and running new organizations, like UMass Amherst’s first-ever hackathon for women and non-binary students, HackHer413.

But there’s still a long way to go, and we’re committed to centering our college around inclusion, fairness, and ethical behavior.

We hired two directors of diversity last year, Emma Anderson and Erika Dawson-Head, who are creating outreach and mentoring programs to attract and retain people from historically marginalized populations in computer science.

We’ve also begun the considerable work of researching and teaching fairness and ethics in computing. Faculty members have formed a research initiative called EQUATE (Equity, Accountability, Trust, and Explainability), which fosters faculty work related to creating algorithms and systems that embody those values. One group of faculty is working on “Ethics Simulation,” an online training where students role-play scenarios that help them see the ethical implications of their technical work, and empower them to say “no” or get help when something doesn’t seem right.

Computing for the Common Good is about integrating values into our work, research, and education. That’s the heart of it. I hope you’ll stay in touch with us and provide your own perspective on how we can best uplift our communities, our state, and our world. Drop me a line at [dean@cics.umass.edu](mailto:dean@cics.umass.edu) with your thoughts!

Sincerely,



Laura Haas, Dean

# Q&A

## with **Katie House**, Founder of **HackHer413**



*Significant Bits* sat down with Katie House, a computer science master's student and the founder of HackHer413, the first hackathon in Western Massachusetts for women and non-binary students. The inaugural HackHer413 was held in February 2019 and was attended by over 300 students.

For the 2020 hackathon, to be held February 8–9 at UMass Amherst, Katie has passed the leadership torch to a 16-person organizing team led by CICS undergraduate Disha Srivastava (BS '22).

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### **SigBits: Tell us about the inspiration behind HackHer413.**

**KH:** My first week as a master's student in computer science, I found it really hard to meet other women and non-binary students who shared the same passions that I do. And I realized that a hackathon would be an amazing opportunity to bring people together and to show [them] that they're not alone.

One of my most prized moments at HackHer413 was seeing all of the hackers in the auditorium during our opening ceremony. It was a humbling experience to look up and see all of the women and non-binary students at UMass Amherst—and beyond—come together and encourage each other to keep going and pursue technology.

### **SigBits: What kind of impact do you feel like this event had on attendees?**

**KH:** I think it had an enormous impact. Over 50% of our hackers were beginners—it was their first hackathon. They didn't know what to expect. Some of them had never even written a line of code, and they wanted to go outside of their comfort zones and try something new.

I've had multiple students come up to me after the event and tell me, "Now that I've gone to HackHer413, I'm going to start learning Python." Having those kinds of impacts—and really opening the doors for more students to attend an event like this—was our main mission, and I think we achieved it.

### **SigBits: What do you love most about computer science?**

**KH:** I love how computer science is essentially limitless. Every day can be different. It's up to your imagination and what you want to build—you can solve any real-world problem that you can think of.



Watch a short video feature from this interview at [bit.ly/CICS-KHvid](https://bit.ly/CICS-KHvid)

## CICS Welcomes Directors of Diversity

Emma Anderson and Erika Dawson-Head have just wrapped up a full year as the first directors of diversity for CICS, establishing a rich set of programming that demonstrates the college's commitment to diversity and inclusion.

Anderson works on equity and inclusivity in classroom education and research, with a focus on mentorship and student retention. Dawson-Head works with the overall CICS community, with a special focus on student leadership and external relations.

"As a college, we embrace and encourage diversity in many forms and we are committed to inclusivity among our community members, including all students, staff, and faculty," says Laura Haas, dean of CICS. "Emma and Erika are providing tremendous leadership in making our college even more welcoming than it is today, both to those



Emma Anderson



Erika Dawson-Head

already part of the community, and those we hope will join us in the future."

Prior to joining the college, Anderson was a high school computer science teacher in Seattle, WA, where she created one of the first programs in data science for high school students in Washington state. Dawson-Head was previously the diversity and employee engagement coordinator for the University of Saint Joseph in West Hartford, CT, where she was instrumental in establishing the Office of Diversity and Inclusion.

## NCWIT Grant to Support End-to-End Review of PhD Program

CICS has been selected to be the first institution to participate in the National Center for Women in Technology's Extension Services (NCWIT-ES) Grad program. A partnership with Google, the program helps doctoral computing programs increase gender diversity while advocating for systemic change.

NCWIT is providing CICS with consultants and extensive research on the recruitment and retention of women in computing fields, along with a \$10K seed grant for the college to help implement new initiatives.

"We're thrilled to be the first institution chosen for this program," says Emma Anderson, CICS director of diversity. "NCWIT's consultants have already helped pinpoint our recruitment and retention challenges. They've provided recommendations for improvements to the entire PhD student experience—from application to graduation—that will make CICS a more diverse institution."

The college previously received an NCWIT-ES Undergraduate Program grant in 2018, which was used to support the creation of a near-peer mentorship program for first-year Black, Latinx, and/or female CICS students.



# Hello, world!

CICS showed up in force on May 4 for the 2019 Northampton Pride Parade, held annually since 1982. The event celebrates the spirit and strength of the LGBTQIA+ community in Western Massachusetts.

# EQUATE

Equity, Accountability, Trust, and Explainability

## CICS Faculty Are Making Algorithms More Equitable

A new initiative, EQUATE, brings together faculty across specialties to address issues around equity and fairness.

When you apply for a credit card or a mortgage, it's increasingly likely that a software algorithm will decide whether you are approved. But will that algorithm make a fair decision, or will it penalize you based on your zip code or other data-driven decisions that factor into systemic bias?

These issues of equitable algorithms and systems are being tackled by CICS faculty in an initiative, chartered by Professor Gerome Miklau, called EQUATE (Equity, Accountability, Trust, and Explainability). "We formed EQUATE to bring together the broad set of CICS faculty already doing research in equity-related computer science, including algorithmic fairness and transparency, safe and explainable AI, and privacy," says Miklau. "The group has since expanded to engage in related educational initiatives as well as to welcome faculty from across campus."

Miklau's own research focuses on balancing fairness and privacy. In a recent paper titled "Fair Decision Making Using Privacy-Protected Data," Miklau and collaborators from Duke and Colgate investigated whether the "noise" added to data to protect individual privacy impacts the accuracy of the data in a biased way. US Census data, for example, has a privacy mechanism applied to it, so that no individual can be identified through the data.

Miklau and his collaborators showed that this type of "noise" added to county-level data could cause a county to be incorrectly identified as not having a sufficient Hispanic population, thus depriving voters in that county from receiving the dual-language election material mandated in the Voting Rights Act. Ultimately, the Census Bureau has to decide how to balance two social goods: personal privacy and accurate statistics about the population. "There is an inherent tension between those two things and, as a society, we simply cannot have as much as we want of both of them," Miklau explains.

Among other education activities, EQUATE is sponsoring COMPSCI 692E: Equitable Algorithms and Systems, a one-credit seminar that gives students the opportunity to learn more about EQUATE research across specialties.

From computer vision to public policy to data diversity and more, CICS faculty are making strides in improving the equity of algorithmic systems.



To learn more, visit the EQUATE initiative website: [groups.cs.umass.edu/equate](https://groups.cs.umass.edu/equate)

# NSF Selects Three Faculty for Early Career Grants



Brendan O'Connor, Subhransu Maji, and Daniel Sheldon were awarded CAREER Program grants by the National Science Foundation (NSF) in 2018–2019.

**Brendan O'Connor** was granted a five-year, \$545,963 award to develop fairer and uncertainty-aware text analysis methods for measuring relevant factors across bodies of text. As researchers use algorithms to track sentiments from social media or medical trends, O'Connor intends to make them more accurate and more alert to possible mistakes. "Algorithms make mistakes all the time," he explains.

An algorithm meets his definition of "self-aware" when it knows that it might be wrong or unable to select the right answer, and should alert researchers by statistically indicating greater uncertainty. "This is important to apply particularly when doing social signal detection in text," O'Connor says, providing an example of a text aggregate of online opinions expressed by thousands of people.

Improving algorithm fairness means that when measuring sentiment in an online data set, an algorithm will be able to identify and account equally for many different types of people, such as older and younger users or those who communicate using African-American English. "You do not want a higher error rate for one group," he notes. "That means their voices are not being properly conveyed."

**Subhransu Maji** was awarded a five-year, \$545,586 grant to support his work in computer vision and artificial intelligence. "My main research aims are to teach machines to reason, learn, take intelligent decisions and make sense of the tremendous amount of information we can gather from visual data," says Maji. "It's a hard problem but an incredibly useful one if you can master it. I believe it is tremendously important for robots to have a way of understanding the visual world."

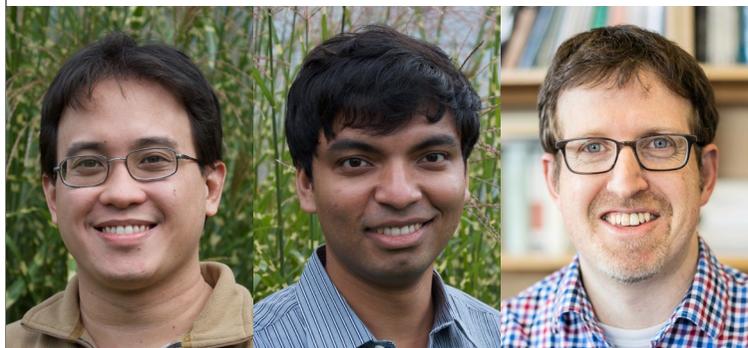
His larger project integrates research, teaching, and outreach to address challenges such as computer vision system deployment in areas like social media, healthcare, robotics, and ecology, among others. He plans to develop computer architectures that are "substantially more accurate and capable of extracting detailed information from perceptual data across different modalities," he notes, with an emphasis on computer vision systems that can reason about data in ways interpretable by humans.

Maji also collaborated with **Daniel Sheldon** and CICS doctoral student Tsung-Yu Lin, among others, to extract biological information from weather radar using machine learning, which they demonstrate can be used to track bird migration patterns.

This project among others formed the basis of Sheldon's five-year, \$550,000 grant to design and test new mathematical approaches and algorithms that can help ecologists and other scientists better use large data sets generated by citizen science projects, animal tracking devices, and earth observation instruments.

As Sheldon explains, these new data sources hold "exceptional promise" for monitoring biodiversity, advancing scientific discovery and guiding decisions to conserve natural systems. But their full potential has not yet been realized, in part because the information they provide is so diverse and varies over space and time. "These qualities really challenge existing computational and statistical tools," he says.

Another thread of Sheldon's investigation will focus on causal reasoning about citizen scientist data, which encodes information about animal populations but may also have systematic bias. For example, observers have different skill levels and make their own decisions about when and where to observe animals. The causal reasoning will learn to recognize and correct systematic errors that come from the observation process and will improve overall data quality.



Brendan O'Connor

Subhransu Maji

Daniel Sheldon

# Dean Laura Haas Receives IEEE Computer Society's Computer Pioneer Award

CICS Dean Laura Haas was chosen to receive the IEEE Computer Society's Computer Pioneer Award in 2019 "for significant contributions to early concepts and developments in the electronic computer field that have clearly advanced the state of the art in computing."

In particular, she was recognized for "pioneering innovations in the architecture of federated databases and in the integration of data from multiple, heterogeneous sources."

Alexandra Meliou, an assistant professor at CICS who focuses on database systems management, explains the importance of Dean Haas' early work: "Laura Haas' early research produced one of the first federated database systems, called Garlic, which pioneered a faster, more efficient way to integrate data. We have her groundbreaking work to thank when using systems like electronic medical records that allow us to use one interface to quickly search for different types of data from varied data sources."

As one of the first federated database systems—which map several database systems together—Garlic provided a solution where data was integrated only as needed. At the time, this approach was in sharp contrast to existing integration engines that built carefully planned warehouses where data were collected and grouped together ahead of time. The flexibility of this new "data-less database" allowed



users to investigate questions requiring information from many and varied data sources. For example, pharmaceutical companies were able to use Garlic to combine information from chemical stores with data from biological assays to identify potential new drugs.

Haas followed this advance with new and creative tools that made it significantly easier to tell integration systems what data to integrate and how to do it, launching an entire subfield of database theory.

Haas says of the recognition, "I am honored and very grateful to receive this year's IEEE Computing Pioneer Award. Previous awardees are the stars of computer science, so this feels very special. I'm proud that the information integration technologies I helped to develop at IBM were given life in IBM products, and I am thrilled to now be guiding the College of Information and Computer Sciences as it grows in the broader field of data science."

Haas came to UMass Amherst as Dean of CICS in 2017 after 36 years at IBM, where she received several awards and honors, including IBM Fellow. During her tenure at IBM, she served as director of the Accelerated Discovery Lab, and also ran IBM Research's global exploratory science program.

**Andrew McCallum: *Distinguished Professor***

Andrew McCallum, director of CICS's Center for Data Science, was appointed Distinguished Professor in 2018. In their letter of nomination, Chancellor Kumble Subbaswamy and Provost John McCarthy wrote, "Professor McCallum is a world-renowned data scientist, specializing in machine learning, natural language processing, information extraction, and knowledge-base construction ... 90 of his publications have been cited 90 or more times, placing him among the leading scholars in his field worldwide. Since joining UMass Amherst, he has attracted an impressive \$60M in funding from government, industry, and philanthropy."



**Ramesh Sitaraman: *Achievements in Internet Content Delivery***

The IEEE Computer Society elevated Professor Ramesh Sitaraman to Fellow in 2018, citing his "contributions to content delivery, internet performance, and distributed systems." Sitaraman and colleagues also received the inaugural ACM SIGCOMM Networking Systems Award on behalf of the team of scientists and engineers who pioneered internet content delivery while building the Akamai content delivery network. Additionally, Sitaraman and doctoral student Kevin Spiteri received the Excellence in DASH award from the DASH Industry Forum for their paper, "From Theory to Practice: Improving Bitrate Adaptation in the DASH Reference Player."



**William Verts: *UMass Amherst Distinguished Teaching Award 2018***

William Verts, senior teaching faculty, was awarded the 2018 UMass Amherst Distinguished Teaching Award, becoming the first computer science faculty member to receive the university's most prestigious and competitive teaching award. Verts, who has been at UMass since 1990, teaches computer and information science courses for non-majors. In letters gathered by the award committee, Verts' students called him a "brilliant, model professor" who "instilled passion" in them. Teaching assistants who worked with him called him "a great mentor" and "a sincere teacher with an all-consuming love for his students."



**Charles Weems: *UMass Amherst Distinguished Teaching Award 2019***

Associate Professor Charles ("Chip") Weems was awarded the 2019 UMass Amherst Distinguished Teaching Award. Weems teaches courses centered around computer architecture within the college, and has co-authored 28 introductory computer science texts used by more than a million students. Students who nominated Weems for the award described him as having "superhuman knowledge" and the ability to "effortlessly weave together information he has gathered over his entire life into a cohesive whole."



**Shlomo Zilberstein: *Leadership in Artificial Intelligence***

Shlomo Zilberstein, professor and associate dean of research and engagement, presented, "AI Will Change Everything, But Not So Fast," as part of the UMass Amherst Distinguished Faculty Lecture Series. Following the talk, he was presented with the Chancellor's Medal by Chancellor Kumble Subbaswamy—the highest recognition bestowed on faculty by the university. Zilberstein also received the 2019 Distinguished Service Award from the Association for the Advancement of Artificial Intelligence (AAAI) for his "sustained and conscientious service and leadership, both to AAAI as a councilor and conference committee chair, and to the broader AI community, as the president of ICAPS."



# Beyond

## BATTERIES



**Sunghoon Ivan Lee's breakthrough health monitoring research aims to invent devices that operate without batteries.**

CICS Assistant Professor and Institute of Applied Life Sciences researcher Sunghoon Ivan Lee is leading a cross-disciplinary team working to invent devices that operate without batteries or wires, transferring power using a far more efficient, if surprising, conductor—human skin.

“There’s been a lot of work with wireless power transfer,” explains Lee, “but we’re the first to look at utilizing a person’s skin. We’re the first out with this type of research.”

This advancement lays the framework for all sorts of applications, with the potential to revolutionize personalized health monitoring. Due to being self-powered, their sensors are able to be ultra-miniaturized and ergonomically designed for placement on small areas of the body, like a finger, an ear, or even a tooth.

“Because you don’t have to change batteries, there’s a variety of ways in which wearable sensors can be improved and expanded,” says Lee. “There are safety requirements for different parts of the body. We’ve learned we can collect, store, and transfer data in a small computer chip. Size is a limitation at this point, but we hope to scale up.”

Their next application may be an in-ear or an in-tooth sensor, a potential the team has been discussing with Tufts Dental School. “Imagine inserting a battery-less sensor that’s like a crown or implant,” Lee muses. “When elderly people lose their teeth, it’s important to measure the pressure or moisture level.”

In-ear sensors present further possibilities, as well. “We could measure EEG, EOG, muscle signals, and brain activities,” says Lee, “and even monitor eye movements from inside the ear, using something the size of an earplug that’s equipped with sensors.”

Their research received an early boost last March when Lee and Yeon Sik Noh, assistant professor of nursing and electrical and computer engineering, won UMass Amherst’s Armstrong Fund for Science grant fund competition.

There’s been a lot of work with wireless power transfer, but we’re the first to look at utilizing a person’s skin.



# Data Science Graduate Students Solve Problems That Matter

**From helping at-risk students succeed in college to protecting wildlife from vehicle collisions, the Data Science for the Common Good (DS4CG) summer program is answering the question, “How can computer science help?”**

The DS4CG summer term program, administered by the CICS Center for Data Science, matches computer science graduate students with local nonprofits or government agencies to use their data science skills on mission-driven projects. This summer’s cohort of DS4CG fellows worked in small teams on projects with The Nature Conservancy in Massachusetts, Springfield Public Schools, the Charles River Watershed Association, the Greater Holyoke YMCA, the Metropolitan Area Planning Council, and the Massachusetts Department of Public Health.

The Nature Conservancy (TNC) in Massachusetts wanted to reduce animal-vehicle collisions by analyzing data on animal behavior near roadways. The four students on the DS4CG team were asked to develop a computer vision system able to analyze images captured from motion-triggered cameras placed in forests and along trails. Of the thousands of images captured, only a few hundred contain an animal, making it difficult for human analysts to find relevant images. The students used machine learning to develop algorithms that can automatically detect whether an image contains an animal or not, which will save TNC time and resources as they work on mitigation strategies for animal-vehicle collisions. CICS Professors Dan Sheldon and Subhransu Maji provided input and guidance during the project, advising students on datasets that would help them train computers to recognize images of animals.

Vaishnavi Kommaraju, a master’s student on the TNC team, was first interested in this project because of the use of computer vision, as well as the opportunity to work on a project that would help people and animals. She also appreciated the real-world experience she got from participating. “In addition to the technical skills I developed, one of the things I enjoyed the most about being part of Data Science for the Common Good was the opportunity to improve and gain confidence in my public speaking and presentation skills.”

Another master’s student, Nicholas Perello, worked on the Springfield Public Schools (SPS) team. He felt fortunate to have guidance from mentors Tom Walsh of Kronos and Andy Reagan of MassMutual, as well as the opportunity to interact with SPS data analysts. This project focused on analyzing SPS student data in combination with college-enrollment data from a national clearinghouse, to address issues such as why some students succeed in college while others don’t, and what can be done early on to identify and help those at risk for dropping out of college. The team sought to identify factors that contribute to post-secondary school success, and create predictive models that identify at-risk students so that interventions can be applied.

Tom Walsh, the senior director of artificial intelligence and data science at Kronos, served as the volunteer mentor for the SPS team. “I was really impressed with the level of engagement from the partner organization ... as well as the commitment of the students. Every week the students were churning out new insights. It was a joy to see the creative things they did with the data.” Walsh provided guidance and mentorship to the students on his own time because he believes that “we have a responsibility to use the tools we have and the knowledge we have to make progress in society, especially in areas where these tools may not have been applied previously.”

The Data Science for the Common Good program will be seeking a new cohort of fellows, and new partnerships with nonprofits and government agencies, for the Summer 2020 term.



To learn more, visit the CDS website:  
[ds.cs.umass.edu](https://ds.cs.umass.edu)



# New Makerspace Helps Students Explore Physical Computing

The college's new facility, located in 2,970 square feet on the first floor of the Lederle Graduate Research Center, will provide aspiring makers with the materials and machinery they need to create physical projects.

The space includes a large classroom, a conference area, a lounge area, an electronics fabrication room, a parts room, storage lockers, a woodworking room, and a finishing room. It is expected to be outfitted with equipment such as 3-D printers, laser cutters, circuit assembly machines, sewing machines, and woodshop machines.

Students, faculty, and former colleagues gathered at the unveiling to dedicate the makerspace to Professor Emeritus Robin John Popplestone (1938–2004), an early pioneer in robotics and computer programming languages.

With this dedication, we wish to honor Robin's impact on our department and the field of computer science. We hope that Robin's playfulness and joy in creating extends to all of the students who use this new makerspace.

**Dean Laura Haas**

Popplestone, who was born and raised in the United Kingdom, became known for his research work in the mid-1970s on the "Freddy II" hand-eye robotic device at the University of Edinburgh. He joined the University of Massachusetts Amherst as a professor of computer science and director of the laboratory for perceptual robotics in 1985, staying until his retirement in 2001.



Professor Emeritus  
Robin J. Popplestone  
(1938–2004)

# Looking at the World Through a Computational Lens

**Our new BS in informatics develops leaders set to revolutionize science, business, and the arts.**

Increasingly, organizations across a range of industries—including health care, financial services, and biotech—are improving their products, processes, and decision-making using computing. At CICS, the new BS in informatics degree program prepares students to help transform these industries, providing them with the skills needed to combine their interest in computing with their passion for another field.

The new program, approved by the Massachusetts Board of Higher Education in 2019, is designed to give students the opportunity to develop a series of unique, in-demand strengths for the information economy. Computing is everywhere, with application areas in fields as diverse as economics, health, advertising, communication, biology, finance, and agriculture. Informatics applies a “computational lens” to these fields to help predict the spread of diseases, discover new treatments, understand social phenomena, analyze business trends, and more.

The major combines a strong grounding in computing with a program of study in another field, and a special focus on human factors and the societal aspects of computing. It also provides the option to choose a concentration in data science, where students will learn how to analyze, visualize, and reason about enormous quantities of information. More concentration options are expected to be added as the program expands.

Professor Ramesh Sitaraman has been spearheading the informatics effort since its inception seven years ago, as part of the Bachelor’s Degree with Individual Concentration program, to this year, when it was approved as a full major.

Sitaraman compares the role of computing in informatics to mathematics, which formed an intellectual core for disciplines like physics and chemistry in the 20th century. “In this century, computing can play a similar role where it contributes techniques and intellectual tools that can be applied elsewhere. In many cases the computational thinking is revolutionizing those other fields.”

While the informatics program has graduated only a small number of students so far, it’s clear that there is a strong demand from employers. One hundred percent of CICS informatics graduates have gone on to graduate school or taken jobs in companies like MassMutual, Arrowstreet Capital, and Liberty Mutual.

What I’ve learned in my informatics classes has applied itself to all my other classes. I really like the idea of being able to apply computer science to biochemistry.

**Arianna Kazemi (’20)**



# Welcoming

## *Six New Faculty Members in 2019-2020*

### Ivon Arroyo *Associate Professor*

Ivon Arroyo specializes in learning sciences, computer science, and educational/cognitive psychology, with a focus on mathematics learning and assessment for K-12 students. Previously, Arroyo was an associate professor of social science and policy studies at Worcester Polytechnic Institute. She holds a BS in computer science from Universidad Blas Pascal in Argentina, and an MS in computer science and an EdD in math and science education from UMass Amherst.



### Jaime Dávila *Senior Teaching Faculty*

Jaime Dávila's research focuses on neural networks performing human-like tasks. He is currently studying human morpho-semantic processing theories. Before joining CICS, Dávila was an associate professor of computer science at Hampshire College. He holds a BS in computer engineering from the University of Puerto Rico-Mayaguez and a PhD in computer science from The City University of New York.



### Cameron Musco *Assistant Professor*

Cameron Musco studies algorithm design, with a focus on applications in data science and machine learning. He was previously a postdoctoral researcher at Microsoft Research New England. He completed his PhD in computer science at MIT, where he was a member of the Theoretical Computer Science and Theory of Distributed Systems groups, and received a BS in computer science and applied mathematics from Yale.



### Matthew Rattigan *Teaching Faculty & Director of Research Programs at the Center for Data Science*

Matthew Rattigan's current research focuses on applying data science techniques to workforce data. Before joining CICS, Rattigan co-founded Edgeflip, a data-intensive social media startup serving social good organizations. In 2012, Rattigan led Obama For America's targeted social media efforts. He received a BA from Wesleyan University, and an MA and PhD in computer science from UMass Amherst.



### Ali Sarvghad *Research Assistant Professor*

Ali Sarvghad's research investigates novel visualization and interaction techniques for supporting exploratory data analysis and sense-making. Previously, Sarvghad was a postdoctoral fellow at UC San Diego. He holds a PhD in computer science from the University of Victoria, Canada, a master's of software engineering from University of Malaya in Malaysia, and a bachelor's in computer science from University of Science, Malaysia.



### Yair Zick *Assistant Professor*

Yair Zick is working on various problems at the intersection of game theory, machine learning, transparency, and privacy. In particular, he is interested in the interplay between differential privacy and model explainability. Zick is currently an assistant professor at the National University of Singapore's School of Computing. He will join CICS in September 2020.



# Giving

Thanks for your generous commitment to give back to the community. This act inspires me to aim high in order to, one day, be able to give back to the community as well.

Matteo Brucato, PhD Candidate  
Krithi Ramamritham Computer Science  
Scholarship Recipient

## Donor Report

The following alumni and friends have made gifts to the College of Information and Computer Sciences from July 1, 2017 through June 30, 2019. Philanthropy is vitally important to the college and helps maintain a world-class instructional and research program. Contributions from alumni and friends help fund scholarships and important special activities that are not supported through the state budget.

**We thank you for your philanthropic support.**

## Our Giving Community

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### HackHer413

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 Dr. Trevor D. Strohman ('05) and  
 Ms. Anne-Marie K. Strohman ('14)  
 Ms. Julie Stubbs and Mr. Petr Jirovsky  
 Ms. Barbara A. Sutherland  
 Dr. Howard R. Turtle ('91)  
 Ms. Ellen Voorhees  
 Dr. Jinxi Xu ('97)  
 Dr. Hamed Zamani ('19)  
 Dr. Chengxiang Zhai  
 Yongfeng Zhang

\* Current Student

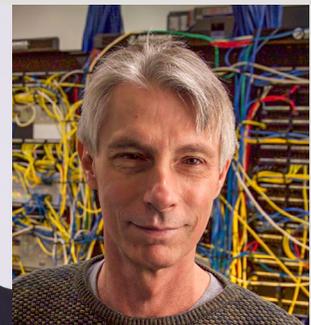
# New Endowed Scholarships Honor Croft, Towsley

Dr. Trevor Strohman (MS '05, PhD '08) and his wife, Dr. Anne-Marie Strohman (PhD '14, English) have endowed the W. Bruce Croft Graduate Scholarship in Computer Science. The Croft Scholarship will be awarded to a PhD student in computer science with research interests in information retrieval or natural language processing. The new endowment honors the impact of Distinguished Professor W. Bruce Croft, who joined the Department of Computer Science in 1979 and served as Dean of the College of Information and Computer Sciences from 2015 until 2017.

The new scholarship recognizes Croft for his impact on the information retrieval sub-discipline of computer science, as well as in the lives of his students. Trevor remarked, "In the Center for Intelligent Information Retrieval, which he founded, Dr. Croft's research accomplishments gave students a model to follow, his advising helped their research improve, and his leadership in the laboratory and the department ensured that even the students he didn't advise would have a place to learn and grow."



W. Bruce Croft



Donald F. Towsley

Dr. Jayanta Dey (MS '93, PhD '98) and Ms. Amita Vasudeva have endowed the Donald F. Towsley Graduate Scholarship in Computer Science. The scholarship will be awarded in 2020 to a student in the PhD program in computer science whose research interests are in networking and measurement science. Towsley, a Distinguished Professor, is an influential researcher in areas such as the design, analysis, and control of classical and quantum networks.

Dey shared, "This is a small way to celebrate the enormous influence Don has had on a very large progeny of very successful graduate students who have had the fortune of his tutelage, in addition to the tremendous impact he has have made to many areas of computer science systems and performance."

# It's a Match:

## *Liberty Mutual Finds Talented Interns via Industry Affiliates Program*

CICS students have the skills employers want, driving participation in the college's Industry Affiliates Program (IAP). Through IAP, corporate members work in coordination with CICS Careers to recruit highly-qualified students through employer-specific events on campus and opportunities targeted at students.

One example is Liberty Mutual Insurance, which has worked closely with CICS Careers to gain significant increases in student recruitment for the past two years, and ensure that their programs are a success for both the company and the students.

In Liberty Mutual's "TechStart" program, interns attend a 10-12 week summer opportunity where they are integrated into working software development teams in an agile environment. The insurance firm also runs a one-year entry-level program for students with experience in object-oriented programming, which acts as a pipeline into employment at Liberty Mutual.



**UMassAmherst**  
College of Information  
& Computer Sciences

It's a match that's been working for both CICS students and the employer. As of the spring of 2019, seven UMass Amherst students had been hired for the company's full-time program, and 27 students had been hired for the internship program—nearly double from two years ago. In fact, UMass Amherst is currently Liberty Mutual's top hiring school for IT.

"[CICS students] do their research and come prepared to the career events—that makes them stand out. CICS students have strong technical skills across the board," says Liberty Mutual campus recruiter MacKenzie Bachry. "UMass Amherst does a great job preparing students for the workforce and aligning their curriculum with the needs of employers."



Read an interview with MacKenzie Bachry at [bit.ly/CICS-LMQA](https://bit.ly/CICS-LMQA)

## College's First Planned Gift Committed to Popplestone Fellowship

Dr. Kristin Morrison of Glasgow, Scotland, who established the first endowed fund in computer science in 2006, has made a generous provision to CICS in her estate—the college's first planned gift. With her generous bequest, the Robin Popplestone Fellowship in Robotics & Artificial Intelligence will one day fully support a graduate student in CICS. This fellowship is a lasting legacy to Dr. Morrison's husband, computer science professor Robin Popplestone (1938–2004), and an investment in the talent of current and future graduate students. As a professor emerita at Boston College, Morrison has devoted her life to scholarship and education, and is delighted to learn about each year's Fellowship recipients.

The Popplestone Fellowship has provided support to 11 students in the PhD program in computer science. Emily Pruc, co-recipient of the 2019 fellowship award,

remarked, "I was thrilled to learn of my selection for this honor and I am incredibly appreciative of the support. The fellowship has lightened my financial burden, which allows me to redouble my focus on my research in long term autonomy." Pruc hopes to push the state of the art forward in both long term autonomy and soft robotics in an effort to craft robotic systems capable of traveling further into space, the bottom of the oceans, and into the Earth.

Robin Popplestone  
August 1969  
Photo credit: Murfas

# Industry Mentorship Program Gives Graduate Students Experience with Real-World Issues

CICS's Center for Data Science Industry Mentorship Program gives master's students experience with real-world problems while providing partner companies the opportunity to make cost-effective progress on business issues.

The program matches small teams of students in data science with a partner-proposed project. Over the course of an academic semester, each team works under the guidance of a company mentor to create industry-usable solutions that are typically open-sourced and released to the public.

The 2019 cohort of students worked on projects for Amazon, American Institute for Research, Bloomberg, Chan-Zuckerberg Initiative, Google, IBM, Lexalytics, Microsoft, Oracle, Quantiphi, and Scripps Research. Student teams met with industry mentors once a week via conference call, gave three presentations, and wrote three reports.

Shanu Vashishtha, a first-year master's student, worked on the Microsoft Azure project. The Microsoft Azure team challenged the students to show that data scientists can achieve better solutions with Azure than with other platforms. "We couldn't have asked for more from them," said Vashishtha. "They were always available to answer questions, sometimes late at night." To his fellow master's students, he says, "Just go for it. The experience is unparalleled. No course can match this amount of learning. You not only gain technical skills, but also other important skills such as communication, managing time, and working as part of a team for a client who expects results."

Pallavi Patil, now a data mining engineer at Yelp, was a second-year master's student when she participated. Patil worked on a project predicting roll-call votes of politicians using universal schema knowledge bases for Bloomberg.



"Being involved in the ideation phase definitely resulted in us being more invested in the outcome," Patil said. Her advice to companies interested in participating is to be flexible. "Just having a general idea about which area you want to tackle, or which algorithm you want to explore should be enough; you can give your group the freedom to fill in the blanks and come up with their own ideas."

Trapit Bansal, the doctoral student supervising this year's cohort, thinks these are great opportunities for students and sponsoring businesses. "This would be a good fit for a research-oriented project that a company doesn't have the bandwidth for right now," Bansal explains. "In exchange for some of their time mentoring students, they would get a very diverse group of talented students working on the project throughout the semester."



Learn more about the program at  
[bit.ly/CDS-IMP](https://bit.ly/CDS-IMP)



# Outstanding *Alumni Honored*

On April 5, 2019, CICS faculty, students, and alumni gathered at the beautiful Old Chapel on campus for our **11th Annual Outstanding Achievement and Advocacy Awards Banquet**, honoring the achievements of UMass Amherst computer science alumni.

**Panos K. Chrysanthis**  
(MS '86, PhD '91)  
*Outstanding Achievement in Education*

Chrysanthis was cited for excellence in classroom teaching and the mentorship of students, and significant contributions to the field of data management. He is a professor of computer science and a founder of the Advanced Data Management Technologies Laboratory at the University of Pittsburgh.

**Quentin Clark (BS '94)**  
*Outstanding Achievement in Management*

Clark, then the chief technology officer at Dropbox, was honored for his outstanding vision, strategy, and execution in the leadership of large-scale data products. Previously, Clark has worked as the chief business officer at SAP SE, where he built SAP's growth strategy and drove the direction of future technologies.

**Arvind Nithrakashyap (MS '97)**  
*Outstanding Achievement in Entrepreneurship*

Nithrakashyap was cited for outstanding innovation and leadership in the creation of database and cloud data management platforms. He is currently co-founder and CTO of Rubrik, a market-leading cloud data management company based in Palo Alto, CA.

**Matthew B. Dwyer (PhD '95)**  
*Outstanding Achievement in Research*

Dwyer, a John C. Knight faculty fellow and computer science professor at the University of Virginia, was recognized for outstanding achievement and contributions in research, with a focus on the application of formal reasoning frameworks. Dwyer previously served as a professor of computer science at the University of Nebraska-Lincoln.

**Paul Scorza (BS '81)**  
*Outstanding Achievement in Management*

Scorza was honored for sustained excellence in information technology management, with a focus on scalable solution systems. He is the executive vice president of information technology and chief information officer for Retail Business Services, the services company of Ahold Delhaize USA.

**Helen Gigley (MS '69, PhD '82)**  
*Computing for the Common Good™ Award*

Gigley, the first recipient of the Computing for the Common Good Award, had a groundbreaking career dedicated to education and public service spanning over 50 years. She served as a university professor, as deputy division director at the National Science Foundation, and as a civilian employee for the US Navy.

**Jay M. Wong (BS '14, MS '16)**  
*Outstanding Achievement by a Young Alum*

Wong was recognized for extraordinary contributions at an early stage of his career to the fields of robotics and artificial intelligence. Wong co-founded Southie Autonomy in 2017, where he now leads the engineering effort in building a "no-code" robotics automation system.

# Alumni News

**Philip Johnson** (MS '85, PhD '90), a professor in the Department of Information and Computer Sciences at the University of Hawaii at Manoa, is the recipient of a 2019 University of Hawaii Board of Regents Medal for Excellence in Teaching.

**Satinder Singh Baveja** (MS '92, PhD '94) was named the inaugural Toyota Professor of Artificial Intelligence in the University of Michigan, Ann Arbor's College of Engineering. Baveja, whose research focuses on reinforcement learning, also serves as a distinguished research scientist at Google's DeepMind.

**Toumas Sandholm** (MS '94, PhD '96) received the 2019 Marvin Minsky Medal from the International Joint Conference in Artificial Intelligence for his work, with co-recipient Noam Brown, on Libratus, the first computer program to beat top no-limit poker pros.

**Thomas Wagner** (PhD '00) is CEO of Berkshire Grey, a new robotics start-up helping online retailers improve commercial operations in logistics and material handling. Wagner is the former chief technology officer at iRobot.

**Anita Raja** (MS '98, PhD '03) was named a Crain's 2019 Notable Woman in Tech. Raja, an artificial intelligence researcher, is currently a professor of computer science at Hunter College in New York.

*How to Code a Roller Coaster*, a book by children's book author and software engineer **Josh Funk** (BS '01) was published in September 2019 by Viking Books for Young Readers. This and his 2018 book, *How to Code a Sandcastle*, are part of a series published in collaboration with the computer science nonprofit Girls Who Code.

Former CICS faculty member **Kevin Fu** and alumni **Thomas Heydt-Benjamin** (MS '07), **Benjamin Ransford** (MS '10, PhD '13), **Shane Clark** (BS '07, MS '11, PhD '13), and **Benessa Defend** (MS '08, PhD '12) received the inaugural IEEE Security and Privacy Test of Time Award for their 2008 paper establishing the field of medical device security, "Pacemakers and Implantable Cardiac Defibrillators: Software Radio Attacks and Zero-Power Defenses."

**Kavya Krishna** (BS '17) co-founded the Society of Women Coders, a nonprofit that holds coding camps in developing nations with the goal of encouraging young girls to opt for careers in STEM. Over the past two years, the society has organized camps in Afghanistan, Belize, Brazil, Haiti, and Kenya.

## Major General Jody J. Daniels Awarded Honorary Degree

Alumna Major General Jody J. Daniels (MS '93, PhD '97) received an Honorary Doctorate of Public Service degree during the UMass Amherst Undergraduate Commencement ceremony on May 10, 2019.

Daniels is the commanding general of the US Army Reserve's 88th Readiness Division stationed at Fort McCoy, Wisconsin, and senior commander at Fort McCoy. She oversees the services and base operations support for more than 55,000 soldiers and civilians at 277 sites, spanning 19 states in the northwestern US.

While bestowing the honorary degree, Chancellor Kumble Subbaswamy cited Daniels' distinguished military and civilian careers in which she has earned numerous awards and decorations, including the

Distinguished Service Medal, Defense Superior Service Medal, Legion of Merit, and Bronze Star Medal. He said of Daniels, "The philosophy of the College of Information and Computer Sciences is 'Computing for the Common Good.' Your application of computer science principles in the service of our nation exemplifies that ethos."



# Faculty Notes

**Marc Liberatore**, a teaching faculty member and associate director of the Digital Forensics Lab, was selected to receive the CICS 2019 College Outstanding Teaching Award. As one undergraduate said in a letter nominating Liberatore, “His passion and dedication merits getting this prize yesterday. He is so nice, charismatic, and respectful and inclusive of students in his class. Get this man an award!” Since 2011, Liberatore has taught courses at UMass Amherst in cybersecurity, digital forensics, networking, and data structures.

Professor **Emery Berger** and collaborators, including former CICS faculty member Kathryn McKinley, won the Most Influential Paper Award at the 24th annual ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS) for their 2000 paper, “Hoard: A Scalable Memory Allocator for Multithreaded Applications.”

Alum **Daniel Bernstein** (PhD '05), Professor **Shlomo Zilberstein**, and Professor **Neil Immerman** were selected to receive the 2019 International Foundation for Autonomous Agents and Multiagent Systems Influential Paper Award for their two papers, both titled, “The Complexity of Decentralized Control of Markov Decision Processes.” The first version of the paper was presented in 2000 and the extended version, co-authored by Robert Givan of Perdue University, was published in 2002.

Fifteen CICS faculty were promoted, reappointed, or granted tenure in 2019: **Gordon Anderson** and **Marc Liberatore** to Senior Lecturer; **Neena Thota** and **Michelle Trim** to Senior Lecturer II; **Justin Domke** and **Sunghoon Ivan Lee** to tenure decision year; **Arjun Guha**, **Amir Houmansadr**, **Vangelis Kalogerakis**, **Arya Mazumdar**, **Alexandra Meliou**, **Barna Saha**, and **Dan Sheldon** to Associate Professor with tenure; and **Yanlei Diao** to Professor.

Professor and Chair of the Faculty **James Allan** was elected treasurer of the Computing Research Association Executive Committee. He is currently serving a two-year term that started on July 1. Allan also serves as co-PI on a new \$3 million NSF ADVANCE grant focusing on using collaboration as a tool for fostering equity for women

Professor Emeritus **Andrew Barto** was presented with the UMass Neurosciences Lifetime Achievement Award by Chancellor Kumble Subbaswamy for his foundational work in reinforcement learning and contributions to neuroscience. In a letter submitted in honor of the award, Richard Sutton (PhD '84)—one of Barto's doctoral advisees—wrote:

*“It is not too strong to say that Andy created the burgeoning field of modern reinforcement learning. He created it partly through his research and the research of his students, but a field's success is due to more than just its research results. As I have grown older I have gained a deeper appreciation of Andy's contribution in setting the tone of the field. That tone is an emphasis on scholarship, on humility, and on openness—on welcoming all fields and all people for whatever contributions they can make.”*

and faculty of color in science and engineering fields. Additionally, Allan and alum **Xing Yi** (PhD '11) received a 2019 European Conference on Information Retrieval Test of Time Award for their 2009 paper, “A Comparative Study of Utilizing Topic Models for Information Retrieval.”

Research Assistant Professor **Mohammad Hajiesmaili** was granted a Google Faculty Research Award to further his research on applying machine learning to the problems of data center energy procurement.

“Compressed Linear Algebra for Declarative Large-Scale Machine Learning,” co-authored by Professor **Peter Haas** was featured in the May 2019 issue of *Communications of the ACM*. Haas also received an ACM SIGMOD Research Highlight Award for his 2018 paper, “Temporally-Biased Sampling for Online Model Management.”

“Neuro-World,” a paper by Postdoctoral Research Fellow **Hee-Tae Jung** (PhD '19) and Assistant Professor **Sunghoon Ivan Lee** was chosen as the May 2019 cover article for the *IEEE Journal of Biomedical and Health Informatics*.

Professor **Gerome Miklau** and graduate students in the DREAM Lab received an ACM SIGMOD Research Highlight Award for their paper, “eKTELO: A Framework for Defining Differentially-Private Computations.”

A paper by doctoral candidate **Matteo Brucato**, Associate Professor **Alexandra Meliou**, et al., “Scalable Computation of High-Order Optimization Queries,” was selected as a *Communications of the ACM* Research Highlight for February 2019.

# Graduate Student Notes

“Energy and Policy Considerations for Deep Learning in ML,” a paper by **Emma Strubell** (PhD ‘19), research intern **Ananya Ganesh** (MS ‘19), and Distinguished Professor Andrew McCallum received widespread national media attention. The paper, presented at the Annual Conference for Computational Linguistics in July, finds that training common AI models can emit nearly five times the lifetime carbon emissions of the average car.

Four students were recognized for research and teaching excellence during the college’s annual Outstanding Achievement and Advocacy Awards Banquet held on April 27: **Su Lin Blodgett** (Synthesis Project Award), **Jarret Holtz** (Synthesis Project Award), **Rik Sengupta** (Teaching Assistant Award), and **Jared Yaeger** (Teaching Assistant Award).

Doctoral students **Su Lin Blodgett** and **Hamed Zamani** (PhD ‘19) were selected to receive the Accomplishments in Search & Artificial Intelligence Award, sponsored by Microsoft. The awards were presented at the Center for Data Science’s 2019 Data Science Research Symposium on April 24.

Recent doctoral graduates **Emma Strubell** and **Pat Verga** (PhD ‘19), advised by Distinguished Professor Andrew McCallum, were awarded Best Long Paper for their work “Linguistically-Informed Self-Attention for Semantic Role Labeling” at the 2018 Conference on Empirical Methods in Natural Language Processing (EMNLP).

Doctoral student **Rico Angell**, advised by Yuriy Brun, received a 2019 National Science Foundation Graduate Research Fellowship (GRF) in support of his work on testing for and mitigating bias in software. **Mikayla Timm**, **Akanksha Atrey**, and **Brandon Oubre** received GRF Honorable Mention awards.

## Three Recent Graduates Receive 2019 Outstanding Doctoral Dissertation Awards

The award recognizes exceptional work by the college’s computer science doctoral students and encourages the highest levels of scholarship and research.

### **Prateek Sharma (PhD ‘18)**

Title: “Transiency-driven Resource Management for Cloud Computing Platforms”

Advisor: Prashant Shenoy, Professor and Associate Dean

### **John Vilk (PhD ‘18)**

Title: “Righting Web Development”

Advisor: Emery Berger, Professor

### **Xiaolan Wang (PhD ‘18)**

Title: “Improving and Understanding Data Quality in Large-Scale Data Systems”

Advisor: Alexandra Meliou, Associate Professor

Doctoral student **Milad Nasr** was granted a Google PhD Fellowship in recognition of his promising research on circumventing internet censorship, advised by Assistant Professor Amir Houmansadr.

**Ryan McKenna**, a doctoral student advised by Professor Jerome Miklau, won first place and a \$25,000 prize in the National Institute of Standards and Technology’s 2019 Differential Privacy Synthetic Data Challenge. The competition tested participants’ ability to identify and develop practical methods for creating differentially private synthetic data sets. McKenna took third place in the 2018 challenge, the first time the competition was held.

**Huaizu Jiang** was selected to receive a 2019-2020 NVIDIA Graduate Fellowship and a 2019 Adobe Research Fellowship in support of his computer vision research with Professor Erik Learned-Miller. Jiang’s doctoral thesis is on large-scale visual learning from unlabeled data, particularly from unlabeled videos.

The Women for UMass Amherst alumni network granted the **CS Women** student group \$6,000 to fund their travel scholarship program. This is a continuation of a 2016 grant, which has helped graduate women at CICS participate in conferences and workshops in the field, engage with their research community, make professional contacts, and find collaborators for future projects.

# Undergraduate Student Notes

**Samuel Ginzburg, Alexander James Karle, Xin Liu, Samuel Holmes McGuire, Evan R. Moore, and Brittany Pine** were awarded CICS Outstanding Undergraduate Achievement Awards during the college's Senior Celebration on May 11, 2019. The highest honor for CICS undergraduates, these awards recognize students' commitment to serve their peers, the university, and the community.

**Caleb Carr ('20)**, a computer science and biochemistry/biology major, was one of four UMass Amherst students selected to receive a 2019 Barry Goldwater Scholarship. The Goldwater Scholarship is a highly competitive, nationally-recognized award for sophomore and junior students pursuing research careers in the STEM fields.

"Team iSpy"—**Anna Maria Miller** (microbiology and informatics), **Jeng-Yu Chou** (computer science), and **Hayley Green** (microbiology)—took home third place and \$7,500 in the Berthiaume Center for Entrepreneurship's Innovation Challenge Competition for their API designed to make the identification of bacteria faster and more accurate. The team previously won the Berthiaume Center's "Best Pitch" prize at the inaugural HackHer413 hackathon.

**Edwood Brice** (BDIC informatics, '19) won the Commonwealth Honors College's #MyHonors Thesis Video Contest and the UMass Amherst Libraries' Lenovo Mirage Solo Virtual Reality Competition for his work on "excer gaming," gamified exercising paired with virtual reality.

Four CICS computer science students received 2019 UMass Amherst Alumni Association Scholarships. The awards were distributed based on outstanding academic achievements, leadership, and community service. **Anjali Devakumar** ('19) received a Senior Leadership Award, and **Brian Dang** ('20), **Emily Earl** ('20), and **Cerek Moyon Hill** ('20) received William F. Field Alumni Scholar Awards.

## TED<sup>X</sup> Amherst

x = independently organized TED event

Thanks to **Ruby Ramsay** (computer science & mathematics, '21), TedX returned to Amherst on April 8, 2019 after a 4-year hiatus. Ramsay served as the executive director for the daylong community event, which featured speakers who presented topics around the theme "Solve for Wh(y)."

Informatics students **Arianna Kazemi** ('20) and **Yugal Subedi** ('19) were part of a team of UMass Amherst undergraduate students who won "Best Overall" in the American Statistical Association's Public Health Data Challenge. Contestants were asked to provide recommendations on how local officials should fight the national opioid epidemic after analyzing a CDC data set.

**Nila Abirami Sadeeshkumar** (computer science, '20) won first prize in the Undergraduate Research Competition held by the Consortium for Computing Sciences in Colleges–Northeast. Her winning entry, "CICS Assistant," was a chat bot created as part of an independent study to help students at CICS Advising.

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I **COMPUTING!**



Arianna Kazemi, a double major in informatics and biochemistry and molecular biology, and Elizabeth Voke, a chemical engineering major, help celebrate Computer Science Education Week 2018 in the UMass Amherst Campus Center. See the article about our new undergraduate program in informatics on pg. 11.

# SignificantBits

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