# TABLE OF CONTENTS

Welcome From the Chair ......................................................................................... 4
About the Department .............................................................................................. 6
  Overview of our Programs .................................................................................... 6
  Industrial Advisory Board .................................................................................... 8
  Co-operative Education ....................................................................................... 9
  News ..................................................................................................................... 10
Areas of Study .......................................................................................................... 16
  Data Sciences ....................................................................................................... 17
  Artificial Intelligence ............................................................................................ 18
  Languages & Tools .............................................................................................. 19
  Security ................................................................................................................. 20
  Computer Graphics .............................................................................................. 21
  Distributed Systems ............................................................................................. 22
  Theory .................................................................................................................. 23
Undergraduate Studies ............................................................................................ 24
  First Year Computer Science ............................................................................... 24
  Undergraduate Research ....................................................................................... 25
  Study Abroad ....................................................................................................... 26
  Honors & Awards ................................................................................................. 27
  Class of 2019 (BS) .............................................................................................. 29
Graduate Studies ...................................................................................................... 31
  Graduate Research ............................................................................................... 31
  Honors & Awards ................................................................................................. 33
  Class of 2019 (MS) .............................................................................................. 34
  PhD Program ........................................................................................................ 36
Alumni ....................................................................................................................... 39
Faculty and Staff ...................................................................................................... 44
  Research Areas .................................................................................................... 49
  New Faculty .......................................................................................................... 52
Research and Scholarship ....................................................................................... 53
  Publications ......................................................................................................... 53
  Funding ................................................................................................................. 62
WELCOME FROM THE CHAIR

It is my pleasure and privilege to write this message on behalf of the faculty, staff, students, and alumni of the department of Computer Science at RIT (CS@RIT). The department of computer science offers an ABET accredited 5-year BS degree in Computer Science (CS) that includes one year of mandatory co-op while the MS program in Computer Science is the largest graduate program at RIT. CS@RIT’s BS and MS programs are highly sought after by students across the US and the world, with more than 12% of all RIT applicants seeking Computer Science programs. Furthermore, CS@RIT attracts highly talented students despite the stiff competition from hundreds of computer science departments across the nation, including several in the Northeast region. The department also offers popular combined BS/MS programs, in collaboration with several other programs at RIT, and a graduate certificate course in Big Data Analytics. Starting in 2020-21, we will be offering a graduate certificate course in Artificial Intelligence for Computer Science. Our PhD program is administered within the Golisano College of Computing and Information Sciences (GCCIS). RIT’s experiential programs provide opportunities for research, professional experience, study abroad, and entrepreneurship. At any given time, the department is home to nearly 1300 students. During the last five years, BS and MS programs at CS@RIT have experienced significant increase in enrollment, persistence and graduations. Typically, a total of 275-300 students graduate from CS programs each year.

Our faculty, comprising 29 tenured/tenure-track and 14 lecturers, are committed to excellence in teaching and research. 9 tenure-track faculty and 9 lecturers have joined our department in the last 5 years to boost our research profile and to provide a robust offering of courses across the discipline.

In recent years, at CS@RIT we have significantly enhanced our research presence while maintaining our commitment to excellence in teaching. Many of our faculty, established and new, are actively involved in seeking funding, publishing in quality venues, and supervising BS, MS, and PhD students. In 2019, one junior faculty member received the prestigious NSF Career Award while two other junior faculty members have received NSF’s CISE Research Initiation Initiative grant (CRII). Faculty coauthored more than 120 peer-reviewed journal and conference articles in
2019. Faculty are engaged in ongoing research activities in computing education, data science, distributed systems, graphics and visualization, artificial intelligence and pattern recognition, networking, pervasive and mobile computing, programming languages, security, and theory. The department is proud to have 4 winners of the Eisenhart Award for Outstanding Teaching and one winner of the Outstanding Teaching Award for non-tenure track faculty.

Computer Science staff, including academic advisors contribute significantly to student success. The CS Alumni network is expansive and engaged, providing the department with invaluable feedback, and support on many fronts. The department’s Advisory Board comprises members from Amazon, Apple, Cisco, Google, IBM, Intel, Microsoft, and other leading companies.

Employment rate of our BS and MS graduates exceeds 98% while our PhD graduates have made meaningful contributions in their respective areas, and secured positions in industry and academia. As computer science continues to be the most attractive field of study to major and minor in, growth in enrollments poses challenges and opportunities.

We are proud of our achievements and excited by new opportunities as we aspire to be among the top computer science departments in the U.S. At CS@RIT, our vision is to make dreams come true. We endeavor to provide the right environment for students, staff and faculty to flourish.

Mohan Kumar
Professor and Chair
Computer Science Department
Rochester Institute of Technology
ABOUT THE DEPARTMENT

Overview of our Programs

BS in Computer Science

RIT established one of the first undergraduate schools of Computer Science and technology in the nation in 1972. The program was initiated while the department was in the Institute College (later changed to the College of Applied Science and Technology). The program has been ABET (https://www.abet.org) accredited since 1989. Currently, the BS in Computer Science is the largest undergraduate program at RIT. This program receives over 2750 applications each year; more than 12% of all applications to the undergraduate programs at RIT. The BS is a 5-year comprehensive and rigorous program that includes one year of mandatory co-op. The employment rate of our graduates is more than 98%.

<table>
<thead>
<tr>
<th>Fall 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS Students</td>
</tr>
<tr>
<td>Fulltime Equivalent</td>
</tr>
<tr>
<td>Credit Hours</td>
</tr>
</tbody>
</table>

BS Student Outcomes

To allow our BS graduates to meet our long-term program educational objectives, the department has developed seven student outcomes, which describe what our students are expected to know and be able to do by graduation. Students graduating from our BS program are able to:

1. Apply the theory and principles of computer science;
2. Demonstrate fluency in high-level programming languages, environments, and tools for computing;
3. Demonstrate knowledge of the principles of computer organization, operating systems, and networks;
4. Apply computing skills and work effectively in teams in industry or research;
5. Demonstrate advanced knowledge of a selected area within the computer science discipline;
6. Prepare technical documents and make effective oral presentations; and
7. Comprehend and analyze both legal and ethical issues involving the use of computing in society.
**MS in Computer Science**

The MS in Computer Science is by far the most successful graduate program at RIT, attracting 800-1000 applications each year - this is nearly 18% of all applications to graduate programs at RIT. The MS graduation rate is more than 98% with 150-200 graduations each year. The MS program is preceded by a set of bridge courses, and includes an optional co-op of up to 1 year.

<table>
<thead>
<tr>
<th></th>
<th>Fall 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Students</td>
<td>375</td>
</tr>
<tr>
<td>Fulltime Equivalent</td>
<td>314</td>
</tr>
<tr>
<td>Credit Hours</td>
<td>3018</td>
</tr>
</tbody>
</table>

**BS/MS in Computer Science**

Students have the ability to complete a joint BS/MS degree in computer science. The degree program, including 1-year mandatory co-op, can be completed in 6 to 6.5 years. We also offer joint BS/MS programs with Computer Security, Software Engineering, and Computer Engineering Technology.

**Program Educational Objectives**

Our program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation. Our graduates will be able to:

1. Pursue advanced study in computing or participate in modern software development;
2. Collaborate successfully with colleagues and clients;
3. Work as ethical and responsible members of the computing profession and society.
Industrial Advisory Board

The Computer Science Industrial Advisory Board (IAB) consists of leaders from industry and government sectors who help the department ensure that "real-world" concerns are incorporated into our programs. One of the primary goals of the board is to help the department to create curricula that continue to meet the changing needs of industry. The IAB convenes annually with department members to share information about Computer Science curricula and the skills and training needed to advance the computing industries.

CS Industrial Advisory Board Members

<table>
<thead>
<tr>
<th>Bridget Beamon - Robertson</th>
<th>Sal Ceravolo</th>
<th>David Cok</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Professional Engineer</td>
<td>Strategic Planning and Research Manage</td>
<td>Senior Principal Consultant</td>
</tr>
<tr>
<td>The Johns Hopkins University</td>
<td>REDCOM Laboratories</td>
<td></td>
</tr>
<tr>
<td>Applied Physics Laboratory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>David Doerman</th>
<th>Erik Haddad</th>
<th>Tad Hunt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor</td>
<td>UX Engineer</td>
<td>Product Manager</td>
</tr>
<tr>
<td>University at Buffalo</td>
<td>Google</td>
<td>Google</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>James Janicki</th>
<th>Sean Janis</th>
<th>Michael Kirby</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Unit Director</td>
<td>Engineering Manager, Mobile Shopping</td>
<td>Vice President, Embedded Hardware/Software for Controller Product Development</td>
</tr>
<tr>
<td>Sparton Corporation</td>
<td>Amazon</td>
<td>Xerox</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Juli Klie</th>
<th>John Marshall</th>
<th>Paul Monette</th>
</tr>
</thead>
<tbody>
<tr>
<td>President</td>
<td>Distinguished Engineer</td>
<td>Director of Quality Engineering</td>
</tr>
<tr>
<td>Veritor</td>
<td>Cisco Systems</td>
<td>CloudCheckr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Craig Paton</th>
<th>Aaron Rallo</th>
<th>Laura Weime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Head of Investments Technology</td>
<td>CEO</td>
<td>Game Developer Relations Engineer</td>
</tr>
<tr>
<td>Citibank</td>
<td>TSO Logic</td>
<td>Intel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aaron Robinson</th>
<th>Anoop Thomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Software Engineer</td>
<td>Senior Graphics Programmer</td>
</tr>
<tr>
<td>Microsoft</td>
<td>Rockstar Games</td>
</tr>
</tbody>
</table>
Co-operative Education

A co-op is a full-time paid work experience directly related to a student’s course of study and career interests. The goals of cooperative education for Computer Science students include the application of theory to real-world situations and the opportunity to work with others in a professional environment. The co-op program prepares students for software development and provides background in communication skills, professional responsibilities, and ethical behavior mandated by today's team-oriented work environment.

BS students are required to complete a minimum of three co-op work assignments. One assignment occurs during summer and two assignments take place during semesters. MS degree students optionally complete up to 12 months of co-op work assignments.

The employment outcomes for Computer Science students and graduates remain bright. RIT sponsors and supports university-wide career fairs where employers and students connect. The Winter and Spring career fairs each draw around 250 employers and approximately 4000 students, leading to an average of 1500 interviews on the following day.


For more information, see https://www.rit.edu/emcs/oce/student/intro-to-co-op.
RIT research helps artificial intelligence be more accurate, fair and inclusive

Rochester Institute of Technology has received a grant from the National Science Foundation to help make artificial intelligence smarter and more inclusive.

The three-year, $359,927 grant creates the Research Experiences for Undergraduates (REU) Site in Computational Sensing for Human-centered AI. It will allow a total of 30 undergraduate students from across the country - mostly from computing disciplines - to spend 10 weeks at RIT. The first cohort of 10 students will arrive later this month and will stay on campus through the beginning of August, when they will present at the RIT Undergraduate Research Symposium.

Cecilia Ovesdotter Alm, principal investigator and an associate professor in the College of Liberal Arts, said it is important to broaden participation of underrepresented groups in scientific research. At least half of the students in the program will be women and recruiting efforts will also focus on underrepresented minorities, including Native American and Latino/a American students.

The research will attend to fairness and critical thinking in data collection and development of AI so that systems are more accurate.

“The program aims to ensure that the next generation of researchers are mindful of the importance of inclusion and that all voices are represented in computational artificial intelligence research,” Alm said.

Research projects this summer will include measuring engagement with eye tracking in mixed reality applications, developing accessible captioning techniques for deaf and hard-of-hearing individuals, and improving automatic screen magnification for individuals with low vision.

“We consider human sensing in a variety of contexts,” said Reynold Bailey, co-principal investigator and professor in the Department of Computer Science.

“Human activity generates data - your speech, facial expressions, eye movements, pulse, skin conductance, emotional reactions - it’s all data,” Alm said. “The projects will advance computational approaches to sense and model this data.”

Two additional students from Malmö University in Sweden will join the research on campus. Their visit is sponsored by Malmö University and RIT Global.
“We’re thankful for how this partnership exposes all students to global issues and provides mutual intercultural exchange,” Bailey said.

Five additional faculty members - Ammina Kothari from RIT’s College of Liberal Arts; Ray Ptucha from Kate Gleason College of Engineering; and Joe Geigel, Kristin Shinohara and Matt Huenerfauth from B. Thomas Golisano College of Computing and Information Sciences - will also mentor the students during their stay in Rochester.

“It’s really important to make it a team experience,” Bailey said. “The mentors will continue to support the students and guide them as they disseminate their team’s work in research publications or apply to graduate school.”

RIT student develops tool to visualize molecular dynamics of proteins in virtual reality

A Rochester Institute of Technology student developed a tool that can help scientists visualize molecular motion and dynamics of proteins using virtual reality headsets.

Kyle Diller, a fifth-year computer science student from East Windsor, N.J., developed a plug-in application for the molecular visualization program UCSF ChimeraX. The application is currently under development at the University of California at San Francisco, where they are developing new visual capabilities in more life-like multidirectional shadowing and virtual reality. Diller’s plug-in allows users to display an atomic structure as if it were a movie so they can manipulate how the view looks and see how the protein or structure changes.

“Molecular dynamics is becoming a big field within bioinformatics and this can help you see how physics plays out at the atomic level,” said Diller. “Chimera X is a fairly new visualizer but it previously didn’t have this capability. I hope that this helps people with their molecular dynamics simulations.”

Diller created the tool in the spring semester as a project for his bioinformatics languages class taught by Gregory Babbitt, an associate professor in the Thomas H. Gosnell School of Life Sciences.

“With Kyle’s project, we wanted to incorporate these features into our current software for visualizing comparative protein motions,” said Babbitt. “He did such a nice job extending ChimeraX that I suggested that he offer his viewer as a plug-in for their user community. I think it is a perfect example of how a student can take an open-ended class project and develop it into something that can help the broader scientific community.”

The plug-in Diller developed, MolecularDynamicsViewer, is available to download from the UCSF ChimeraX toolshed or GitHub.
RIT faculty earns NSF CAREER award to study human behavior using machine learning

A Rochester Institute of Technology professor has earned a prestigious National Science Foundation award to use computers to better understand human behavior and social interaction.

Ifeoma Nwogu, an assistant professor of computer science, received an NSF Faculty Early Career Development (CAREER) award and grant for her five-year project.

She aims to study human behavior in a new way, by using machine learning techniques to analyze and find patterns in the many signals that individuals display during social interactions. Her work will specifically look at groups working in science, technology, engineering and math (STEM), with the aim of supporting underrepresented groups in STEM.

“In a conversation, people are constantly displaying and processing different non-verbal signals, such as how fast someone is talking or the facial expressions they are making,” said Nwogu. “I wanted to use computers to analyze all of these signals in new ways and help us gain a better understanding of social intelligence and our emotions.”

Working with a team of student researchers, Nwogu will observe and collect data generated in small face-to-face group meetings. Some of the non-verbal communication data she will collect include galvanic skin response information, facial expressions, gestures, self-observed data and speech prosody—which includes intonation, tone, stress and rhythm of speech.

The sequence of data is essentially time series signals, and the real challenge is extracting meaningful statistics and analyzing patterns in that data, Nwogu explained. Using Bayesian trained neural networks, she plans to develop a computational framework for analyzing individuals’ behavior and interactions.

“Deep learning is good at analyzing large data sets and finding hidden patterns, layers or clusters, but it can’t tell you why there are patterns,” Nwogu said. “We can then create probabilistic models to help gain a better understanding of collective behaviors in a group, such as why people with a certain perceived-personality type might speak at a specific volume or pace.”

For example, Nwogu could use the models to predict if people in a group have rapport or not. Speech volume or certain facial expressions could be indicators used for making that prediction.

For the project, Nwogu is partnering with RIT’s Center for Advancing STEM Teaching, Learning and Evaluation (CASTLE), which is a network of faculty, projects and programs engaged in scholarship surrounding STEM education.

Nwogu will observe and collect signal data from student and faculty mentoring or peer-to-peer groups that the center offers. She hopes to better understand everything that happens, to find ways to improve teaching in STEM. For example, the study may observe what happens when a
student becomes flustered by a difficult topic or when an instructor becomes frustrated teaching a specific concept.

“Ifeoma’s work has the potential to truly revolutionize how we study student learning,” said Scott Franklin, director of CASTLE and a professor of physics. “Social and group interactions are critical to learning, which is why activity-based classrooms are so successful, but research on human dynamics, which are incredibly subtle, has always been extremely labor-intensive. Machine-learning can automate procedures that reliably identify complicated group dynamics, exponentially increasing our ability to acquire and analyze important data on how students work together to construct knowledge and learn content.”

As part of outreach for her research, Nwogu recently taught a computer vision course at the African Institute of Mathematical Sciences (AIMS) in Rwanda.

As part of outreach for the study, Nwogu has partnered with RIT’s African Center for Excellence in Teaching and Learning Mathematics and Science to teach a course at the African Institute of Mathematical Sciences (AIMS) in Rwanda. She also plans to bring research students to Rwanda and continue the NSF project, observing if social interaction patterns change across different cultures.

The CAREER program is an NSF-wide activity that offers awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations.

“Congratulations to Ifeoma on this tremendous achievement,” said Anne Haake, dean of RIT’s Golisano College of Computing and Information Sciences. “NSF CAREER awards like this are a testament to the increasing strength of computing research by our faculty at RIT.”

RIT hosts elite universities for regional International Collegiate Programming Contest

RIT is hosted the Northeast North American Regional Final of the International Collegiate Programming Contest (ICPC), Nov. 9 in the Golisano College of Computing and Information Sciences. The top regional team advanced to the World Finals in Moscow.

In the contest, each team of three students attempted to solve a set of 10 complex, real-world problems. More than 50,000 students from 3,000 universities around the world compete in the annual programming contest.

RIT’s Department of Computer Science has organized the regional contest for almost two decades. This year’s sponsor is M&T Bank. For the contest, RIT faculty get to design the algorithmic problem sets and create the corresponding implementation and data sets. As a chief judge, RIT Professor Zack Butler also sets up the judging software to go along with the problems.

“Needless to say, organizing the contest involves an extraordinary amount of work, which is all done via volunteers,” said Ivona Bezakova, professor of computer science and director of the
regional contest. “As a reward, we get to interact with the best students in the region (and the world) and show them what a great place RIT is.”

Student teams from RIT and 19 other colleges and universities took part in the 2019 regional competition, including Brandeis University, Brown University, University at Buffalo, Concordia University, Harvard University, Massachusetts Institute of Technology, McGill University, Mount Allison University, Northeastern University and University of Rochester.

RIT’s team included Ayana Adylova, a fifth-year computer science student from Almaty, Kazakhstan; Steven Landau, a fifth-year computer science student from Rye Brook, N.Y.; and Andrew Searns, a BS/MS computer science student from East Amherst, N.Y.

“I like to participate in programming contests because I am a pretty competitive person and therefore find the ICPC environment very helpful in preparing for coding interviews, rather than just solving problems on my own without any real time pressure,” said Adylova.

A possible problem in the event could look at airline schedules. For example, students must find an optimal route from place A to place B, within given constraints, such as a desired layover time. Teams need to design and implement an algorithm that will produce the desired output for any possible input.

When they are done with implementation, they submit it to a judging software that runs their implementation against a set of hidden test cases and gives them a good or bad response. Teams are scored by the number of problems solved.

“However, the catch is that they are not given the test case — so they need to do extensive testing by creating their own test cases,” said Bezakova. “This is a very useful skill for students to have when they graduate, whether they choose to work in industry or do research.”

**Three Theory Lab Student Abstracts accepted to AAAI-20**

Three papers written by students involved with the Theory lab located in the Golisano College of Computing and Information Sciences were recently accepted to the Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-20) Student Abstract and Poster Program.

David E. Narváez’s paper “A QSAT Benchmark Based on Vertex-Folkman Problems”

Andrew Searns’s paper "Fairness Does Not Imply Satisfaction".

Wenbo Sun’s paper "Sampling Random Chordal Graphs by MCMC".

Link to conference: [https://aaai.org/Conferences/AAAI-20/](https://aaai.org/Conferences/AAAI-20/)
International Collegiate Programming Contest

Several teams from the Department of Computer Science have spent the past month participating in the International Collegiate Programming Competition. The first stage in this journey was a qualifying competition at RIT among seven teams. The top four teams moved on to the regional qualifying competition at Hamilton College on October 26th. RIT took positions one, two, four, and nine with the top team solving all problems with more than an hour to spare!

This team, consisting of RIT students Ayana Adylova, Steven Landau, Andrew Searns, and coached by professors Michael Mior and Alexander G. Ororbia II, continued to the Northeast North America regional contest hosted at RIT on November 9th. The team achieved an impressive seventh place behind teams from MIT, Harvard, and other top schools. Unfortunately the team will not be moving on the next round of the competition, but these students should be congratulated for their impressive performance!

4th Annual Frameless Symposium 2019

The 4th Annual Frameless Symposium, an exciting 2 days of virtual, augmented, and mixed reality, was held November 21-22 at the Magic Spell Studios

Highlights included:

- Interactive workshops on Virtual Sculpting, Media Literacy, Spark AR, and Snapchat Lens Studio on Thursday (pre-registration recommended)
- Keynote presentation by Luis Cataldi, Global Education Evangelist at Epic Games
- A full day of talks on a variety of XR topics including VR/AR in Advertising, Digital Storytelling, XR in Education, Imaging and Optics, Creating XR Experiences, and Wellbeing and Awareness on Friday
- Interactive Demo session and Reception (RSVP on Web site for complementary beverage ticket)
- Encore performance of Fragile Corridors performed by BIODANCE with visuals by W. Michele Harris, first seen at the 2019 Rochester Fringe Festival.

All events were free and open to the public.

Full schedule can be found at [http://framelesslabs.rit.edu/symposium-2019/](http://framelesslabs.rit.edu/symposium-2019/)
Where is your degree from (and in what)?
I have an MS in Computer Science from the University of Kansas. My MS thesis was entitled "Static Evaluation Functions and the Game of Othello".

Where did you grow up?
I was born in Indianapolis, Indiana, but moved to Topeka, Kansas at age 7 and grew up there. Between those places we also lived in Glenview, Illinois and Kirkwood, Missouri for a few years.

What did you do before RIT?
I was a student at KU. While there, I worked at the Kansas Geological Survey as a programmer for several years as an undergraduate, and did some software development for the Menninger Foundation in Topeka, KS. I began teaching during the last semester of my senior year, and taught throughout graduate school, including teaching both undergraduate and graduate classes.

I did spend a Summer working in industry in 1979, writing COBOL compiler test programs (!) for NCR Corporation in Wichita, KS. That was enough to convince me that I really was much more interested in teaching than in programming as a nine-to-five activity.

What are your professional interests?
My primary interest has always been in computer architecture and organization, along with operating systems and system software in general. I have also had a long-time interest in programming language design and features; my interest in computer graphics dates back to the late 1990s.

Tell us about a high point thus far in your career.
Receiving the Eisenhart Outstanding Teaching award in 1993 was a "high point." I was the first person in CS to receive it; at the time, CS was in CAST, and I was only the second person in CAST to receive it.

A few years after I received it, Margaret Reek received it, followed by Ken Reek, then Edith Hemaspaandra, then Ivona Bezakova, and Zack Butler. Being a member of that group is absolutely something I’m proud of.

What are your personal interests?
I have always been a "reader," primarily of science fiction, mystery, and detective fiction. I also enjoy choral singing, and in recent years have taken up music composition and arranging.

Describe a particularly rewarding RIT-related experience (i.e., student interaction, classroom)?
One of the most rewarding things about this job is the feedback I receive from former students who have gone on to successful careers after graduation. Many of them tell me that it was a particular course (or even just a topic within a course) they took from me that caught their interest and eventually led to the work they are involved in.

The idea that something I might say in class could have a profound influence on someone else's future is at the same time astonishing, frightening, and profoundly satisfying. It sounds pretty sentimental (almost schmaltzy), but this is what has kept me in this profession over the years - the idea that my interest in passing on what I've learned might help inspire someone else and spur them on to bigger and better things.

AREAS OF STUDY
Students are required to complete a set of core classes covering programming and CS theory. After those courses are completed, students select a specialization area or cluster for their remaining courses. Master’s students must complete a project or thesis in their cluster. The combination of coursework and research found in our program provides students with the skills to both engineer and advance modern computing systems.
The Data Sciences Cluster studies the foundational data management and knowledge discovery challenges prevalent in design, analysis and organization of data. The courses cover general database issues, including database design, database theory, data management and data mining.

Courses of Study
- Principles of Data Mining
- Intro to Big Data
- Database Systems Implementation
- Data Security and Privacy
- Big Data Analytics
- Data Cleaning and Preparation

Opportunities
- Analytics Manager
- Database Administrator
- Data Scientist

What students are saying
- All about data storing, querying, processing and application both in theory and practical implementation. - Zizhun Guo
- There is enough diversity in the courses. It helps to know where my interest lies and what courses align with that interest. - Sapan Singh
- Very well-designed coursework if you are looking to dig deeper into data analytics and databases. - Aniket Giriyalkar
Artificial Intelligence encompasses the study of algorithms and architectures that enable effective decision making in complex environments. Artificial Intelligence aims to create technology that allows computers and machines to function in an intelligent manner. The ability of your computer to make decisions about how to solve problems without insight from users makes this discipline one of the most in demand for both research and careers-oriented students.

Courses of Study
- Intro to Computer Vision
- Intelligent Security Measurement
- Foundations of Intelligent Systems
- Mobile Robot Programming
- Image Understanding
- Neural Networks and Machine Learning
- Pattern Recognition

Opportunities
- AI Developer
- AI Engineer
- Azure/AWS Scientist
- Data Scientist
- ML Data Developer

What students are saying
- Provides mathematical foundations for the higher-level AI concepts that everyone talks about. Now, you're one of the people who can actually work with it, not just talk about it. - Dylan P. Jackson

- The Artificial Intelligence cluster has helped me demystify machine learning. This cluster exposes you to cool concepts and projects that you can easily apply to real world problems. - Yancarlos Diaz

- Artificial Intelligence has great scope in almost all the possible fields(Finance, Space, Health, etc) you can think of and also a lot of potential for research as it is continuously growing. - Karan Manghi
## Courses of Study
- Aspect Oriented Programming
- Design Patterns & C#/.Net
- Functional Programming
- Efficient Design in Modern C++
- Software Development Tools
- Compiler Construction

## Opportunities
- Apple
- Microsoft
- Oracle
- Facebook
- Google

## What students are saying
- It is a fantastic way to learn about languages. - Robert Svetlichniy

The Languages and Tools cluster focuses on language design and implementation. Students will learn how languages are specialized to solve particular problems as well as how those languages and the software written in them is architected. Students will gain a broader understanding of compiler construction, language parsing and tools used in a language. Students specializing in this cluster gain a broad understanding of theoretical and applied knowledge.
The Security area spans topics from networking to cryptography to secure databases. By choosing different domains in which to study security students can gain a broad understanding of both theoretical and applied knowledge.

Courses of Study
- Data Comm & Networks
- Data Security & Privacy
- Machine Learning
- Secure Coding

Opportunities
- NSA
- Google
- L3 Harris
- Northrup Grumman
- Lockheed Martin

What students are saying
- It helps you understand the implications of seemingly simple decisions when designing systems. - Nathaniel Heitsch
The Graphics and Visualization Cluster provides the technical foundations for studies in Computer Graphics and Image Understanding. Areas for further study include Graphics Programming, Rendering and Image Synthesis, Computer Animation and Virtual Reality, Image Processing and Analysis, and Data Visualization. Areas for further study include graphics programming, rendering and image synthesis, computer animation and virtual reality, image processing and analysis, and data visualization.

Courses of Study
- Intro to Computer Graphics
- Foundations of Computer Graphics
- Global Illumination
- Computer Animation
- Scientific Visualization
- Computational Geometry

Opportunities
- Disney
- Pixar
- Dreamworks
- Electronic Arts
- Apple

What students are saying
- This cluster deals with computer graphics and how modern day game engines, computer animations and various other computer graphics related things work - Manan Joshi
- Lots of fun with using math and physics to make images and animation! - Caleb Adrian
- It's awesome. Being able to create images and renderings is exciting. - Boyuan Li
This area studies systems formed from multiple cooperating computers. This includes the analysis, design, and implementation of distributed systems, distributed middleware, and computer networking protocols, including security.

Courses of Study
- Data Comm & Networks
- Distributed Systems
- Parallel Computing
- Cryptography
- Cloud Computing
- Network Security

Opportunities
- General Dynamics
- PayPal
- Cloudflare
- Dropbox
- Raytheon

What students are saying
- Distributed nature of things has always fascinated me to a point of becoming an addiction and RIT has provided me with an ideal platform to nurture my passion for distributed systems. - Moiz Arif
- RIT's High-Performance Distributed Systems Laboratory has been instrumental in fostering my passion for bridging the gap between high performance computing and Big Data analytics. - Avinash Maurya
- Distributed systems allow me to understand life better. It is the interpretation of how every domain has evolved in the World, and my daily interactions with such systems provide valuable insights on how to improve efficiency. - Kevin Assogba
The Theory area studies the fundamentals of computation. These fundamentals include complexity theory to determine the inherent limits of computation and communication and cryptography and the design and analysis of algorithms to obtain optimal solutions within those limits.

<table>
<thead>
<tr>
<th>Courses of Study</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• XTreme Theory</td>
<td>• Security</td>
</tr>
<tr>
<td>• Cryptography</td>
<td>• Cryptography</td>
</tr>
<tr>
<td>• Computational Geometry</td>
<td>• Internet Algorithms</td>
</tr>
<tr>
<td>• Programming Language</td>
<td>• Algorithmic Game Theory</td>
</tr>
<tr>
<td>Theory</td>
<td>• Geometric Algorithms</td>
</tr>
</tbody>
</table>
UNDERGRADUATE STUDIES

First Year Computer Science

The undergraduate first year curriculum at RIT is a challenging yet rewarding experience. Students learn Python, Java, object-oriented programming, data structures, algorithms, and other core topics of Computer Science through a unique problem-solving approach to teaching.

Each week begins with a new problem to solve, and the pedagogical goals of the course are introduced as potential solutions. This approach encourages students to thoughtfully consider which algorithms and data structures they should use, as opposed to simply translating notes on a board into source code.

Imagine being given a set of railcars encircling a board. The goal is to make the rail lines as long as possible to the center of the board or to a power station on the edge of the board. The player with the total of the longest route wins. This is the type of problem that students will solve in the introduction sequence at RIT.

Students develop solutions by working in small teams of three to four people, with pen and paper before taking the solutions to a computer. This problem-solving approach teaches students how to adapt their knowledge to a variety of applications and domains. Students, by the end of their program, will have the ability to continue to learn and adapt to new situations by applying the problem-solving skills learned in their first year. Lab time is also provided for students to implement weekly labs with the assistance of their instructor and student assistants. TAs provide weekly recitations so that students can get additional reinforcement of the material after the two-hour lecture. In addition to the time spent in the classroom, the department provides a tutoring center where students can get additional assistance for topics they may be struggling with.

Each of the introductory courses culminates in a project that utilizes many of the concepts they have learned throughout the semester. Some projects have included a competition with other students in a rousing game of Cable Car, where students compete against each other to form the longest path possible without intersecting their opponents’ paths; while other projects have involved data analytics, network programming, text processing and significant aspects of program design.
Undergraduate Research

Reynold Bailey, Professor of Computer Science and Associate Undergraduate Program Coordinator, recently completed a 3-year National Science Foundation Research Experience for Undergraduates (REU) Site award, “Computational Sensing,” on which he served as co-PI, alongside PI Cecilia Ovesdotter Alm, Associate Professor of in the College of Liberal Arts. The goal of this REU Site project is to give students experience with fundamental research in acquisition and fusion of multisource sensing data related to human beings. Students are challenged to make sense of human behaviors and cognitive processes with hardware, software, and complex thinking, exploring the nexus of computational science, scientific practice, and the human experience. Traditionally, sensors have been understood narrowly, often as physiological measurements. This project envisions sensing in broader, new ways, as time-evolving measurable data directly linked to individuals and, by extension, to their communities. With this understanding, sensing data may involve language, social network and environment signals, or emotional-creative reactions.

“REU Site: Extremal Graph Theory and Dynamical Systems" is a competitive NSF award to create research experiences for undergraduates hosted by RIT during summers. Professor Narayan from the School of Mathematical Sciences (SMS) is the PI of this project, and Professor Radziszowski from CS is a co-PI, as the only member on the project’s team not from the School of Mathematical Sciences. The current award of $287,556 is funding 10 students (selected from about 150 applicants from across the US) for each of three summers to work with mentors on research projects during an 8-week residence workshop on the RIT campus. The students working with Professor Radziszowski focus on the computational aspects of Ramsey theory. This project award has been renewed three times, and has been running at RIT since 2007. The typical outcomes of each summer are student presentations at the annual Young Mathematicians Conference and at the Joint AMS Meetings, and papers published in conference proceedings and specialized journals.
Study Abroad

The Computer Science Department has created multiple opportunities for students to continue their studies while experiencing the world from a different perspective. Although there are many study abroad options available to students at RIT, the CS Department programs are unique in that all participating students take computer-science-based coursework while abroad. We encourage undergraduate students to explore the options that the department offers, and encourage all students to check out additional study abroad opportunities offered by RIT.

Osnabrück, Germany

We offer a semester study abroad program in Osnabrück, Germany (in affiliation with SUNY Oswego). Students attend the University of Osnabrück and carry a minimum of 12 credit hours per semester in the Cognitive Science Program and focus on artificial intelligence, functional programming, neural networks, and German language and culture. This program kicks off in the beginning of April and runs through mid-July every year. This program is open to all computing students.

Student Spotlight

Andrew Searns

I’ve always known that I have a deep love for math and logical thinking. In high school, I took nearly every computer science and engineering course that was offered. The decision was very close, but ultimately, I decided on Computer Science because it mixes the logic of mathematics with the power of modern technology. As a CS major here at RIT, I’ve had a lot of opportunities to develop and give back, from personal projects to tutoring.

Within CS, I’m very involved with the theory group. I’ve attended Theory Canal talks since my freshman year, and I even presented three of my own talks. I’ve worked on independent research now with both Dr. Bezakova and Dr. Hosseini. I presented my research on Planar Graph Data Structures with Dr. Bezakova at ISAAC 2018 in Taiwan last December, and my student abstract regarding Fair Division with Dr. Hosseini was recently accepted into AAAI 2020.

There were many people who inspired me to go into Computer Science, but the person who first inspired me towards theoretical Computer Science was Professor Mongan at Drexel University. During a high school summer camp, Professor Mongan introduced me to Markov Chain methods for text prediction, and I’ve been hooked with Computer Science ever since.

Outside of CS, I am the treasurer of RIT’s Tango Club and the Social Media Director of RIT’s Juggling Club. My dream is to push the boundaries of scientific knowledge, so I’d like to continue in research either in academia or in industry.
Honors & Awards

ECI Systems & Engineering Scholarship
- Paula Register
- Cody Burrows
- Daniel Osváth Londoño

Established in November of 1997 by Dr. Richard T. Cheng, current President of ECI Systems & Engineering, and former Chair of Computer Science at RIT from 1973-1976. Applicants must be majoring in Computer Science, be in at least their second year of study, demonstrate academic achievement (at least a 3.0 overall GPA and a 3.2 GPA in Computer Science courses), and financial need.

Kenneth and Margaret Reek Scholarship
- Chinonso Akujuobi

Established in 1999 by Ken and Margaret Reek, both alumni of RIT's Computer Science Program and former faculty members in the Department. The scholarship was established to assist students who might not otherwise be able to attend RIT. Applicants must be majoring in Computer Science, demonstrate academic achievement (at least a 3.0 overall GPA and 3.2 GPA in Computer Science courses), and financial need.

Carl Reynolds Computer Science Scholarship
- Fatima Umar

Established in 2008 in memory of Carl Reynolds, who was a member of the faculty of RIT's Computer Science Department from the fall of 2004 until his death in the spring of 2008. Applicants must be majoring in Computer Science and in their first year of study. The award recognizes students who demonstrates academic achievement (at least a 3.0 GPA overall and a 3.2 GPA in Computer Science courses) and who combines academic accomplishments with a willingness to help and mentor fellow students.

Outstanding First Year Student Scholarship
- Sri Kamal Chillarage

The outstanding first year student scholarship recognizes a first year Computer Science major who maintains high academic standards while also contributing positively to the culture within the Department. The award is given annually to an undergraduate student majoring in Computer Science in their first year who has earned an overall GPA 3.5 or better.
Outstanding Fifth Year Student Award

- Qadir Haqq

The outstanding fifth year student award recognizes a fifth year Computer Science student for maintaining high academic standards during his or her studies at RIT and has made significant contributions to the department. The award is given annually to a student who has maintained a 3.0 GPA or better average during his or her five years of study.

Alumni Scholarship

- Emily Wesson

The Alumni Scholarship recognizes a Computer Science BS student for maintaining high academic standards (at least a 3.5 overall GPA) during their studies at RIT and who have made significant contributions to the Department. The award is made possible by generous donations from Computer Science alumni.

Where is your degree from (and in what)?
SUNY Alfred State - Network Administration, BS.

Where did you grow up?
Bosnia/Turkey/Rochester NY

What did you do before RIT?
I worked as Sr Security Analyst at Frontier (Business Analyst, Exchange Admin, AD Admin and various other roles).

What are your professional interests?
Network security.

What are your personal interests?
Running, knitting.

Describe a particularly rewarding RIT-related experience (i.e., student interaction, classroom)?
There have been plenty of weird and strange problems to figure out, but I think my most rewarding experience was working with the CS main office staff and figuring out all the little things they do and touch to make a student successful within Computer Science. This was quite the challenge during my initial discovery phase but I can say that my appreciation only grew stronger.

Describe a particularly challenging RIT-related experience?
Working with other individuals from different departments, with each department having their own set of goals is quite the challenge. It is key to understand where each puzzle piece fits.

Is there anything else you would like to say?
I think RIT is a wonderful place for students, faculty and staff. I have felt accepted and part of, what I like to call, extended family. I enjoy the challenges presented to us as it keeps things very new and exciting.
Class of 2019 (BS)

Ahmad, Saad
Aleksic, Stefan
Barandiaran, Thomas
Beagley, Starbuck
Belisle, Melissa
Bertonica, Andrew
Bicking, Josh
Bodzas, Austin
Bohde, Tommy
Both, Corie
Brown, Rebecca
Campbell, Kemoy
Carmosino, Robert
Cassata, Nathan
Cerbone, Stephen
Cheung, Ka
Chowdhury, Tousif
Clay, Casper
Clow, Corey
Coval, Connor
Crespo, Aaron
Crisanti, Giovanni
Davis, Quinn
Deichmann, Josh
DeSain, Jeffrey
DeVizia, Josiah
Dimoff, Dara
Dodds, Raymond
Dudley, Eric
Durek, Jason
Farrell, Nathan
Ferris, James
Flinchum, Jonathan
Forcier, James
Gibson, Matthew
Glasser, Abraham
Glynn, George
Goh, Gregory
Graham, Matthew
Haller, James
Hartz, Jacob
Hedges, Alex
Henry, Samuel
Herzig, Daniel
Hobson, Samuel
James, Brandon
Javaid, Zahir
Johnson, Christopher
Karthigeyan, Ganesh
Katcher, Christopher
Kelly, Eero
Kilgus, Samuel
Kim, Stephen
Kliot, Elijah
Kopinski, Brandon
Kroll, Juliana
Ku, Matthew
Kushalnagar, Kesavan
Lemelin, Christopher
Lentner, Christopher
Lewis, Kevin
Liao, Hmwe
Ling, Christian
Link, Coleman
Lista, Jacob
Lucas, Elizabeth
Lydic, Christopher
Lynaugh, Benjamin
Mainali, Bikash
Maloney, Matthew
Martinez, Connor
Masley, Steven
McMullen, Maximillian
Miller, Charissa
Mirabito, Steven
Mitchell, Benjamin
Miu, Jodie
Moreyn, Joseph
Muller, Liam
Ni, Lisa
Olivera, Stuart
Perweiler, Laurel
Pitt, Gavin
Porillo, Nicholas
Prescott, Emma
Promokhov, Gleb
From the early years, I was excited about how Internet technologies can connect me to people from different parts of the world. For example, when I was a kid, I had a website and enjoyed studying its statistics on a daily basis. Later, I became curious about how computer networking works on lower layers, specifically, IP and transport layers. This led me to choosing computer networking as my primary field of study.

I have a Master's Degree in computer science. Currently, I am a Phd. candidate. My research interests focus on different areas of computer networking, specifically, routing scalability in the context of IP and BGP protocols, verification of forwarding correctness of a router and in a private network, programmability of routers' control and data planes for designing more dynamic, application-driven networks, and remote direct access memory data transfer for minimizing the CPU overhead when processing network packets at end-hosts. Throughout the years of graduate studies, I have co-authored six full conference papers at venues such as IEEE INFOCOM, ICC, and NCA, ACM ANCS, 2 US Patents and 4 poster papers at IEEE ICNP and ACM ANCS.

My typical weekday starts with doing exercises at the Weidman fitness center of RIT. I also enjoy playing badminton and other sports. In addition, I am an amateur musician. I played two mini-shows at the Rochester Fringe Festival, and I am a member of a music band that occasionally plays at different open mic shows.

I am glad for several accomplishments I have had so far, however, I would like to be proud of something more than that. Within the computer science field, those accomplishments were positive feedback from students of classes where I had been an instructor or a teaching assistant, and papers accepted at top conferences like IEEE INFOCOM and ACM ANCS.

I am inspired by people who make a positive change in the lives of others, and those people are not necessarily from the computer science field. They can be musicians, entrepreneurs, social activists or software engineers. As for myself, I find that the studies in computer science advance me towards the goal of having a positive impact on society.

My dream job is a job that has a positive impact on society. It can be a computer science professor's job, to educate younger generations. It might be a software engineer job, to develop products that will make the Internet faster, safer, reachable and accessible.
GRADUATE STUDIES

Graduate Research

Students in the RIT Computer Science Master’s Program are required to finish a master’s project or thesis to complete their degree. Faculty in the department carry out research in a wide variety of Computer Science areas (see the Research Areas section near the back of the report).

**MS projects** may be implementation-based, or a narrowly-focused research effort. Project students are required to take the Master’s Project Colloquium (CSCI-788), in which students study technical writing, presentation skills, strategies for research programming, experimental design, and analysis of results. Projects culminate with a poster presentation session and final report submitted to their advisor.

A **master’s thesis** is a research-based undertaking, normally requiring 2-3 semesters to complete. A thesis culminates with an oral presentation and defense of the thesis document to a committee of three faculty members. Successfully defended theses are archived by RIT. Often, thesis students also complete an independent study with their advisor, to obtain sufficient time for studying background literature and identifying a research problem of interest. Master’s students wishing to pursue a PhD or research-related positions in academia or industry are well-served by the additional time and technical depth that a thesis requires. A list of master’s theses completed in 2018 may be found in the *Publications* section.

A number of our MS project and theses students have published research papers, provided tools for research, and contributed to educational activities and exhibitions.
Master’s Project Best Poster and Report Awards (2019)

Each semester at the Master’s Project Poster Session, up to three posters are selected for the Best Poster Award. In addition, one report was selected for the Best Report Award in Spring 2018. All award recipients traditionally receive a gift card and book by Prof. Bischof, the master’s program coordinator.

Spring 2019

Best MS Project Poster Award
Advisor: Dr. Leon Reznik

Summer 2019

Best MS Project Poster Award
1st Place Poster: Coleman Link: Integrating Kubernetes and RDMA
Advisor: Dr. Minseok Kwon

Fall 2019

Best MS Project Poster Award
1st Place Poster: Xuan Huang: A Mechanized Formalization of the WebAssembly Specification in Coq
Advisor: Dr. Matthew Fluet

2nd Place Poster: Sudhish Surendran Thazhakasseril: Road Pothole Classification and Reporting with Data Quality Estimates
Advisor: Dr. Leon Reznik

3rd Place Poster: Bharath Suresh Modhipalli: Detecting Phishing using CT Logs and Website similarity
Advisor: Dr. Taejoong Chung
Honors & Awards

Outstanding Graduate Student Award

- **Bharath Suresh Modhipalli**

The outstanding graduate student award recognizes a Computer Science graduate student for maintaining high academic standards (at least a 3.5 overall GPA) and for making significant contributions to the Department and the Computer Science Graduate Program.

TSO Logic - An Amazon Web Services Company Scholarship

- **Srinath Obla**
- **Leilei Sun**
- **Puneeth Kukkadapu**
- **Jainey Elsa James**
- **Mansha Malik**

Selection for this scholarship was based on the recipient's matriculation in a degree-granting program in RIT's B. Thomas Golisano College of Computing and Information Sciences. Preference is given to second-year graduate students enrolled in computer science. Recipients should demonstrate an area of interest in edge computing and/or big data analytics as evidenced by coursework and research topics and be in good academic standing.

I grew up in Poland and since I remember I loved mathematics. I earned a doctoral degree with honors in Mathematics from the University of Maria Curie Skłodowska in Lublin, Poland, in 2016. My dissertation was in algebraic graph theory, cryptography and coding Theory titled "On the applications of Algebraic Graph Theory to Coding" under excellent supervision of Prof. Vasyl Ustimenko. My main research interests are in extremal graph theory, algebra, cryptography and coding theory. I embraced in a transition from Mathematics to Computer Science even as a student. Now my focus is in applications of Mathematics in Computer Science. I worked as assistant professor at the University of Information Science and Technology “St Paul the Apostle” in Ohrid, North Macedonia, 2017, where I taught cryptography and modeling and simulations. Being a faculty member was my dream job since the first semester as a student. I think it is very important to do work that you love because it is the only way to be really good.

I have been a lecturer at RIT since Fall 2018. I really enjoy teaching and seeing my students engaged during my lectures. At RIT I teach Introduction to Computer Science, Introduction to Computer Science Theory and Introduction to Cryptography. The latter is my favorite course in great part because I can teach students what I do for my research.

I am involved in Women in Computing (WiC) at RIT. I was excited when the Director of WiC asked me to prepare a curriculum for the Python Coding Camp for Girls organized by WiC and funded by a grant from AT&T. Summer Camp 2019 was very successful and we received great feedback from students. I would like to see more and more female students in my classroom. In the Fall semester I led special office hours targeting mainly freshmen female students. In 2019 I received funds from the STARTS Ignite Program to take a group of female students to the ACM Richard Tapia Celebration of Diversity in Computing where they presented a poster "Just press Run Girl". I was awarded a Grace Hopper Celebration 2019 Faculty Scholarship and I served as a judge for undergraduate student’s poster competition during the celebration.

Personally, I love summer time, sea, good coffee, and traveling. During summer I visit Poland and Albania to spend time with family and friends. I really enjoy great food and beautiful nature there.
Class of 2019 (MS)

Abraham, Japheth Adhavan
Agarwal, Sanket
Ajmera, Tappan
Ao, Xiang
Belisle, Melissa
Bhavsar, Komal
Bhide, Saylee
Bhuta, Bhavin
Binu, Thomas
Bongale, Pratik Sanjay
Bostian, Dylan
Both, Corie
Caceci, Caroline
Carcano, Damian
Ceesay, Isza
Chaudhary, Sandeep Shivbhagwan
Chen, Jietong
Chheda, Anuj
Crisanti, Giovanni
Dabholkar, Shardul
Dixit, Utsav
Dodeja, Rashmi
Dodoo, Emmanuel
Dolas, Kashmira
Dourado, Renzil Anthony
Francis, Michael
Frey, William
Fulwariya, Jitesh
Furman, Scott
Gambogi, Matt
Gaydhani, Prajakta
Gevaria, Harnisha
Gevaria, Kushal
Govindarajan Chandraketu, Gokul
Gupta, Atit
Guthinabail, Prajwal
Harjani, Sunny
Hedges, Alex
Hedin, Samuel
Hingu, Dharmendra Pravin
Hounyo, Wilfried
Huang, Tongtong
Immel, Poppy
Indukuri, Srivardhana Reddy
Iyer, Ravi Sreelalan
Iyer, Tushar Mahesh
Jaisinghani, Amit Shyam
Jariwala, Karan Kishorkumar
Jheeta, Maninder Singh
Jin, Guangze
Job, Joe Tom
Jones, Michael
Joshi, Ketan
Joshi, Harsh
Kalbhor, Akshay Balvant
Kamalaskar, Manali
Kanase, Chirag
Kaur, Manpreet
Kavathe, Darshan
Kayarat Jayasankar, Savitha
Khasbag, Sourabh
Khatwani, Sanjay
Kole, Vishal Vijay
Kothari, Naman
Kukkadapu, Puneeth
Kuppusamy, Aravindh
Lewis, Mica
Li, Qiaoran
Link, Coleman
Logan, Thomas
Lucas, Elizabeth
Lunn, Susan
Made, Prajakta
Magar, Amit
Malhotra, Trisha
Mali, Parag Shrikrishna
Maller, Amit
Mantri, Varun Rajiv
McGlynn, Kyle
Meher, Pranit Sudhakar
Miller, Charissa
Mishra, Antara Aniles Kumar
Mudaliar, Rohit Anbalagan
Munson, Richard
Murali, Sandhya
Murthy, Sahana
Nagda, Vaibhav
Nair, Parvathi
Pachori, Bhaarat
Pandey, Mayank
Parekh, Saurabh
Parekh, Virtee
Parmar, Viral
Pawar, Sameer
Perez, Michael
Pinto, Darryl Cyprian
Poon, Mitchell
Prabhakar, Shashank
Pudage, Akshank
Raman, Vishwanath
Ramesh, Chandini
Randolph, Joshua
Rao, Venkata Chinna Sai Praneeth
Raut, Tanvi
Rewaskar, Saurabh
Rinos, Michael
Robbins, Joshua
Rodriguez Sosa, Ana
Rudraraju, Sanjay Varma
Saha, Anindo Ashim
Sajan, Richie
Saran, Jesse
Sasuri, Ruzan
Sathish, Meghana
Schenk, Jonathan
Seshadri, Sanchitha
Shah, Eshaan
Shah, Hiteshi
Shah, Jinesh
Shah, Bhavin Navin
Shah, Jinal Sunil
Shakwala, Abhishek
Sharma, Tushar
Sharma, Akshay Chandramouli
Sharma, Deepak
Shaw, Aziel
Sheth, Sanket
Sheth, Mitul
Singh, Alankar Dingsh
Singh, Ashwini Rajesh
Singh, Chinmaya
Sodergren, Erikson
Soni, Yashowardhan
Srivastava, Paridhi
St George, Jason
Su, Hao
Thote, Gitanjali Shitalnath
Tippur Gururaj, Krishna
Upadhyay, Jay
Upadhyay, Neha
Vaghela, Maitri
VanScoy, Jake
Venkatachalam, Akash
Vora, Arpit
Warner, Adam
Wilkins, Nicholas
Wilson, Erik
Xhagolli, Orens
Xu, Ruiyang
Yadav, Shristika
Yadav, Sheshans
Yin, Haonan
Young, Alexander
Zerner, Ariel
Zhao, Junan
**PhD Program**

The [Golisano Computing College PhD program](#) began in Fall 2006. Since that time, the program has grown from a handful of students to over 100. Our PhD students carry out research in both fundamental and applied Computer Science.

Our program is research-focused. Admitted PhD students have chosen their advisor prior to admission. During the first year of the program, in addition to coursework students complete their research potential assessment, which requires writing, presenting, and defending a mock conference paper to the PhD faculty from across the Golisano Computing College. This requires our students to engage directly in research when they enter the program. To complete the program, they must also write and defend a thesis proposal and their final dissertation.

The Computing and Information Sciences PhD graduates advised by CS faculty have gone on to successful careers in industry and academia, including faculty positions at the Stevens Institute of Technology and The College of the Holy Cross, postdoctoral positions (e.g., at University at Buffalo), and senior positions at corporations including Google and Appnexus.

**PhD Students Advised by CS Faculty**

- Asma Alnemari
  *Cybersecurity and Privacy*
  Advisors: Rajendra Raj and Carol Romanowski

- Asma Aloufi
  *Information Security and Applied Cryptography*
  Advisor: Peizhao Hu

- Moiz Arif
  *Next-Generation Data Centers for Emerging Distributed and Parallel Workloads*
  Advisor: M. Mustafa Rafique

- Angelina Brilliantova
  *Multi-agent Systems*
  Advisor: Hadi Hosseini
Maheen Contractor
Ted
Advisor: Matthew Fluet

Garegin Grigoryan
Computer Networking, Routing Scalability and Programmable Data Planes
Advisor: Minseok Kwon

Sahil Gupta
Securing the Internet of Things Networks
Advisor: Minseok Kwon

Igor Khokhlov
Data Quality and Security, Artificial Intelligence, Android OS
Advisor: Leon Reznik

Eduardo Lima
Statistical Learning of Service Features
Advisor: Xumin Liu

Tong Liu
Crowdsourcing and Human Computation, Natural Language Processing and Machine Learning
Advisor: Christopher M. Homan

Mahshad Madhavi
(Imaging Science)
Recognizing Handwritten and Typeset Math Formulas
Advisor: Richard Zanibbi

Behrooz Mansouri
Information Retrieval, Machine Learning
Advisor: Richard Zanibbi

Avinash Maurya
Exploiting Multikernels to Accelerate High-Performance Data Analytics Platforms
Advisor: M. Mustafa Rafique

Hannah Miller
Ted
Advisors: Edith Hemaspaandra, Ivona Bezákůvá

Justin Namba
Ted
Advisor: Michael Mior

David E. Narváez
Constraint Satisfaction Techniques for Combinatorial Problems
Advisors: E. Hemaspaandra and S. Radziszewski
Nibesh Shrestha  
Byzantine Fault Tolerant Protocols  
Advisor: Mohan Kumar

Wenbo Sun  
Sampling Graph Structures Related to Chordal Graphs  
Advisor: Ivona Bezáková

Tharindu Cyril Weerasooriya  
TBD  
Advisor: Christopher M. Homan

Sawyer Welden  
Multi-agent Systems, Algorithmic Economics  
Advisor: Hadi Hosseini

Zhizhuo Yang  
Data-driven Framework for Realistic Self-Organized Virtual Humans  
Advisors: Reynold Bailey, Alexander Orobia

Timothy Zee  
Interpretability of Neural Models  
Advisors: Ifeoma Nwogu, Alexander Orobia

Wei Zhong  
Structural and Semantic Similarity Search for Documents Containing Math Formulas  
Advisor: Richard Zanibbi
When did you graduate? What degree(s) did you earn?
I graduated in 2013 with an M.Sc. in Computer Science, and in 2017 I received my Ph.D. in Computer and Information Sciences. Prior to RIT, I received my B.Sc. in Computing Systems Engineering in 2009 from Universidad Tecnologica Centroamericana (Tegucigalpa, Honduras).

What do you currently do for a living?
I am working on research as a Post-Doctoral Associate at University at Buffalo.

What are your professional interests?
Despite being difficult and frustrating at times, I love working on scientific research. I want to keep working on difficult problems where solutions can be used for practical applications that would benefit many. In particular, I love the potential that AI has in education, especially in helping to connect those who want to learn something new with the resources they need. In the long term, I see myself following a career in academia, where I can share my findings with the community through many more academic publications.

What are your personal interests?
My personal interests often overlap my professional ones. For example, I really love programming. I have always loved video games, earlier I loved making them, and now I still enjoy playing them. I also like visiting new places, and academic conferences are a perfect excuse for traveling around the world. Rock concerts are also another good excuse for me to travel around the country.

Describe a particularly rewarding RIT-related experience (i.e., student interaction, classroom)?
I am from a country where innovative ideas are quite often dismissed as absurd, crazy, or just impractical. One of my bosses told me once that developing our own handwriting recognition system was basically an impossible task. When I came to RIT, I took Pattern Recognition taught by Dr. Zanibbi, which led to my first publication; a system for recognizing handwritten mathematical symbols. Four years later, a paper based on my dissertation at RIT received the “best paper award” at the same leading conference in handwriting recognition (ICFHR). This proved to me that sometimes the boundaries of what is possible is just in our minds.
Is there any one thing you wished you had known as a student that you could share with current students? If so what?
Hard work can help you succeed in many things, but smart work makes you more effective. Often, spending more time thinking and learning about a task will help you to get it done faster and with less effort. I wish I had known how to work smarter during my earlier years as a student.

Is there anything else you would like to say?
I am really thankful for everything I learned during my time as a student at RIT.

After completing my Undergraduate Degree in Information Technology, I worked in TCS, India for 2 years. My hunger for knowledge brought me to the USA. I completed my Master of Science in Computer Science in December 2017. I also earned the Big Data Analytics Advanced Certificate during my time at RIT. Along with my studies I completed two summer internships at Skyscape Medpresso Inc in Boston and PayPal in San Jose. My second internship at PayPal earned me a full time offer, where I then worked for fifteen months. Currently, I work as a Full Stack Engineer at Intuit, San Jose.

I personally take interest in learning new technologies and keeping myself up to date with emerging trends. Apart from my technical interest, I enjoy traveling, hiking and exploring new places.

There were many challenges when I began working, as everything was new including a diverse culture, technology, attending remote meetings, etc. However, I applied technical skills that I learned at RIT and it helped me grow into a confident and independent individual. I try to understand our customer’s problems, and incorporate new features for the products we develop. Customer satisfaction is an utmost priority, and I have received a spotlight award for the work I have done within this area.

It was a very difficult decision to study in a different country because of my hearing disability. After many hours researching, I decided to study at RIT because of the amazing support services, such as captioning and speech therapy, which helped me understand what professors were teaching in the classroom. I would like to thank RIT for making it easier for me to study and for providing me with a strong foundation in computer science. I am also thankful to all the RIT professors for being
accessible at all times, and for ensuring students are understanding the material taught in the classroom through their assignments. Lastly, I would like to say, "Never be afraid of challenges, as they make you grow stronger".

Laurel Perwieler

When did you graduate?
May 2019

What degree(s) did you earn?
Bachelor of Science in Computer Science

What do you currently do for a living?
I am a full-time graduate student in the Higher Education program at the University of Denver. I work 30 hours a week as a Graduate Assistant in the Office of Student Engagement where I plan all social, professional, and wellness events for 8000 graduate students.

What are your professional interests?
Student affairs, and incorporating technology into this work to better support students (If you've heard of CampusGroups at RIT, I was part of the team that started that project and I am working on implementing this tool at my grad institution!)

What are your personal interests?
Aerial arts, traveling to see the Jonas Brothers, and hanging with my cat while watching Disney+

Describe a particularly rewarding RIT-related experience (i.e., student interaction, classroom)?
Honestly, my entire RIT experience was incredibly rewarding. However, without my time as a Computer Science Ambassador and working for New Student Orientation, I would not have been able to see how engagement outside-of-the-classroom helped me grow both professionally and personally. (Plus seeing students, I gave tours to as a CS Ambassador actually enroll was really awesome!)

Is there any one thing you wished you had known as a student that you could share with current students? If so what?
Please, please, please do not be afraid to approach the faculty and staff around you - whether that is within the department or another resource around campus. I do not think I would have gotten
through the program without all of the support I got from professional staff members. They are there to listen to you and more than likely will be willing to work with you!

**Is there anything else you would like to say?**
I will forever be grateful for the entire Computer Science Department. Everyone I interacted with over the course of five years wanted the best for me and helped me get there. Despite not working directly in the field, I know everything that I learned will guide me in whatever position I do hold after graduation pt. 2!

**Mike Kirby**

**When did you graduate?**
I graduated in 1991 and 1994

**What degree(s) did you earn?**
Bachelor of Science in Computer Science and a Bachelor of Science in Software Development and Management

**What do you currently do for a living?**
Vice President, Office Engineering for Xerox

**What are your professional interests?**
I enjoy new technology and understanding how it impacts how people interact with technology. Machine intelligence, user experience, and real-time embedded systems for “Internet of Things” applications.

**What are your personal interests?**
Hiking, skiing and baseball

**Describe a particularly rewarding RIT-related experience (i.e., student interaction, classroom)?**
The ability to interact with really smart people in the context of new and innovative technology. When you leave RIT and go into industry, you find a mix of skills and capabilities. Only at RIT will you be among the best of the best for so long.

**Is there any one thing you wished you had known as a student that you could share with current students? If so what?**
First year GPA! So many kids slack off in the 1st year, and then can never recover when their GPA goes south.

Is there anything else you would like to say?
RIT is a sea of opportunity, but no one makes you take advantage of it. If there is an opportunity in front of you, seize it!

I have always been intrigued by how computers interface with every life aspect. While I was in high school, I was given the opportunity to take an introductory course in creating basic programs. Upon taking this class, I became very excited about learning the basic computer language. I began writing small programs on my computer. My best program was writing a library management software for my undergraduate college.

The ability to create tools that make day to day processes simple amazes me. Choosing computer science as a major gave me a path to realize the vision of simplifying people’s lives. Moreover, an undergraduate degree in computer science built my problem solving and analytical skills, and prepared me to pursue this major for master’s as well. I had worked in insurance domain in India where I worked with outdated technologies. While working in London I came across some AI and ML projects which motivated me to learn new technologies. Computer science major was the best way to enhance skill sets.

My CS Major experience at RIT has been amazing. CS at RIT not only built a strong foundation for me but also guided me to get a job in the career path of my choice. The bridge courses were a great revision for all programming languages, data structures, and algorithms. On top of that, the challenging homework assignments and projects shaped me well to handle complex problems effectively. The co-op program is also commendable. Moreover, the career fair is one of the best among all technology schools in the states. Getting a chance to interact with top-tier organizations was made easier through this. To sum up, I feel studying CS in RIT is one of the best decisions I have taken and I am extremely thankful to the amazing faculty, advisors and HOD.

I have been a graduate teaching assistant and tutor as a part of which I help undergrad CS students with assignments and projects. I am a part of WiC and have participated in WiC hackathons during my time here at RIT. Currently, I am a grader for both big data analytics courses and a lab assistant as well. Moreover, I have attended talks from various accomplished professors. For example, recently I attended a talk and was part of lunch with Prof. Vincent Poor.

Since I was trying to finish my masters as soon as possible. I was not able to participate in group activities outside CS. However, I enjoyed occasional folk dance practice at RIT Bhangra group. I judge my accomplishments by how I am doing on the goals I have set for myself. I feel there is this series of events which lead to a feeling of accomplishment. Coming from an organization which was working on outdated technologies, the first semester was very challenging and gave me the most learning. I have always maintained an A grade which gave me a chance to interview for the Graduate teaching assistantship. When I got the position, it was an amazing experience for me both in sense of learning and getting help with tuition fees by gaining 75% scholarship. My short-term goals included getting summer internships in the field of interest. I interned in Blue cross blue shield and ZS associates. Now as I am in the last semester I have 4 job offers with me in data science in EY, ZS Associates, Blue Cross Blue Shield and Cognizant.

As I am the first girl to get out of my hometown, away from family to work towards the career of my choice, everyone back home now looks up to me and feels motivated. My parents are proud and this journey has been a great accomplishment. I am the first person/generation from my extended family to have a career in computer science. It was my interest that drove me towards this. However, I would like to mention that listening to my achievements and journey motivated other kids in the family. I have three cousins who are studying computer science.

My dream job is to be a partner/CTO in one of the top 3 tech consulting firms such as McKinsey, BCG etc. Once I achieve that I plan to retire as a professor to sculpt new minds and give back to the society by opening a women’s education foundation which will help underprivileged kids and women to acquire knowledge in the area of their interest.
CS FACULTY AND STAFF

Faculty

Dr. Reynold Bailey
Professor and Associate Undergraduate Program Coordinator

Dr. Ivona Bezáková
Professor

Dr. Hans-Peter Bischof
Professor and Graduate Program Director

T.J. Borrelli
Senior Lecturer

Jeremy Brown
Lecturer

Dr. Zack Butler
Associate Chair, Professor and Associate Graduate Coordinator

Ting Cao
Lecturer

Warren R. Carithers
Associate Professor

Maria Jose Cepeda Garcia
Lecturer

Dr. Taejoong "Tijay" Chung
Assistant Professor

Dr. Aaron Deever
Senior Lecturer and Undergraduate Program Coordinator

Razieh Fathi
Visiting Lecturer
Dr. Matthew Fluet
Associate Professor

Timothy Fossum
Lecturer

Dr. Joe Geigel
Professor

Susan Haller
Lecturer

Dr. James Heliotis
Professor

Dr. Edith Hemaspaandra
Professor

Dr. Hossein Hojjat
Assistant Professor

Dr. Chris Homan
Associate Professor

Dr. Hadi Hosseini
Assistant Professor

Dr. Peizhao Hu
Assistant Professor

Scott Johnson
Lecturer

Dr. Thomas Kinsman
Lecturer
Dr. Leon Reznik
Professor

Dr. Carlos Rivero
Assistant Professor

Dr. Carol Romanowski
Professor

Niyazi Sorkunlu
Visiting Lecturer

Ben K. Steele
Senior Lecturer

Sean Strout
Principal Lecturer

Paul Tymann
Professor

Phil White
Senior Lecturer

Dr. Richard Zanibbi
Professor
Adjunct Professors

Jake Brandt            William Childs            Sam Fryer
Matthew Hosking        Mike Kirby               Michael Kurdziel
Laura Reznikov

Research Areas

Below is an alphabetical list of research areas that our faculty engage in, along with the specific faculty that teach and supervise student projects in each area.

Artificial Intelligence

Artificial Intelligence encompasses the study of algorithms and architectures that enable effective decision making in complex environments. Faculty and students work on projects in computer vision, robotics, sensor networks, data mining, document recognition, information retrieval, and the theoretical foundations of decision-making.

- Zack Butler
- T.J. Borrelli
- Edith Hemaspaandra
- Hadi Hosseini
- Chris Homan
- Thomas Kinsman
- Ifeoma Nwogu
- Alex Ororbia
- Leon Reznik
- Linwei Wang
- Richard Zanibbi
Computer Graphics and Visualization


- Joe Geigel
- Reynold Bailey
- Hans-Peter Bischof
- Warren Carithers
- Ifeoma Nwogu
- Sean Strout

Computer Science Education

Computer Science Education explores the pedagogy of Computer Science focusing on new methods and paradigms for the teaching of the CS curriculum.

- Ivona Bezáková
- T.J. Borrelli
- Jeremy Brown
- Zack Butler
- Joe Geigel
- James Heliotis
- Hadi Hosseini
- Scott Johnson
- Xumin Liu
- Arthur Nunes-Harwitt
- Rajendra Raj
- Ben Steele
- Sean Strout
- Paul Tymann

Data Sciences

Data Sciences studies the foundational data management and knowledge discovery challenges prevalent in design, analysis and organization of data. This area can be applied in a variety of domains including data management in resource constrained environments, enterprise and multimedia databases, active and secure databases, and knowledge discovery algorithms.

- Xumin Liu
- Jeremy Brown
- Scott Johnson
- Thomas Kinsman
- Michael Mior
- M. Mustafa Rafique
- Rajendra Raj
- Prof Carlos Rivero
- Carol Romanowski
- Leon Reznik
Distributed Systems

Distributed Systems studies systems formed from multiple cooperating computers. This includes the analysis, design, and implementation of distributed systems, distributed middleware, and computer networking protocols, including security.

- Hans-Peter Bischof
- Jeremy Brown
- James Heliotis
- Peizhao Hu
- Mohan Kumar
- Minseok Kwon
- Michael Mior
- M. Mustafa Rafique
- Leon Reznik

Languages and Tools

Languages and Tools studies language design and implementation together with architecture and use of software development tools.

- Hans-Peter Bischof
- Jeremy Brown
- Matthew Fluet
- James E. Heliotis
- Hossein Hojjat
- Scott Johnson
- Fereydoun Kazemian
- Arthur Nunes-Harwitt
- Rajendra K. Raj

Security

Security spans topics from networking to cryptography to secure databases. By choosing different domains in which to study security, students can gain a broad understanding of both theoretical and applied knowledge.

- Hans-Peter Bischof
- T.J. Borrelli
- Warren R. Carithers
- Taejoong Chung
- Chris Homan
- Peizhou Hu
- Alan Kaminsky
- James Minseok Kwon
- Monika Polak
- Stanisław P. Radziszowski
- Rajendra K. Raj
- Leon Reznik

Theory

Theory studies the fundamentals of computation which include complexity theory to determine the inherent limits of computation and communication, the design and analysis of algorithms to obtain optimal solutions within those limits, and theoretical foundations of cryptography.

- Edith Hemaspaandra
- Ivona Bezáková
- T.J. Borrelli
- Aaron Deever
- Chris Homan
- Hadi Hosseini
- Stanislaw P. Radziszowski
New Faculty

**Ting Cao**

Ting Cao joined the Computer Science department of RIT as a lecturer this January. Before joining, she was a lecturer in Computer Science at Xi’an Jiaotong-Liverpool University (PRC) and University of Liverpool (UK). Before that, she worked for Oracle as Applications Engineer, for The GenieLab (UK) as Web Developer, and for the University of Aberdeen (UK) as Teaching Fellow and Software Developer. She did her MSc in Computer Science at the University of Edinburgh (UK). She has expertise in a plethora of modern software development skills. She has taught a variety of computer science courses around software development in UK and China to both undergraduate and postgraduate level.

**Maria Jose Cepeda Garcia**

Maria Cepeda joined the Computer Science department of RIT as a lecturer in August. She received her master’s degree in Computer Science at the Rochester Institute of Technology in 2017. After finishing her master’s, she worked at Cognivue Co. as a software engineer. Before that, she worked as a research assistant for the computer science department at the University of Idaho, and for the largest electricity company in Spain as a software developer. Her interests include programming languages, databases, and computer graphics.
RESEARCH AND SCHOLARSHIP

Publications

Below is a list of publications by faculty and students from the Department of Computer Science that appeared in 2019. In computer science, many of the most prestigious publication venues are conferences rather than journals due to the rapid development in new technologies. For the same reason, technical reports are cited frequently, particularly those appearing in the arXiv.org collection maintained at Cornell University.

Master’s Theses


Journal Papers


Mior, Michael J. and Alexander G. Ororbia II. Column2vec: *Structural understanding via

Müller, Moritz, Taejoong Chung, Alan Mislove, and Roland van Rijswijk-Deij. Rolling with confidence: Managing the complexity of dnssec operations. IEEE Transactions on Network and Service Management.


Conference Papers


Bhide, Saylee, Elizabeth Goins, and Joe Geigel. Experimental analysis of spatial sound for storytelling in virtual reality. In Rogelio E. Cardona-Rivera, Anne Sullivan, and R. Michael Young,


Bort, Heather, David Bunde, Zack Butler, Christopher Lynnly Hovey, and Cynthia Taylor. **Propagating educational innovations.** In *SIGCSE Special Session*. ACM, 2019.


Foster, Michael, Marcin Łukowiak, and Stanisław Radziszowski. **Flexible HLS-based implementation of the Karatsuba multiplier targeting homomorphic encryption schemes.** In *Proceedings of MIXDES’2019*, Rzeszów, Poland, June 2019.


Heliotis, James and Leo Ureel. **Towards an ability to direct college students to an appropriately paced introductory computer science course.** In *2019 ACM Conference on Innovation and Technology in Computer Science Education*. ACM, 2019.


Khokhlov, Igor, Qiaoran Li, and Leon Reznik. **D.i.f.e.n.s.e.: Distributed intelligent framework for expendable android security evaluation.** In *The 14th Annual Symposium on Information Assurance (ASIA ’19)*, page 18-27, 2019.


Khokhlov, Igor, Akshay Pudage, and Leon Reznik. **Sensor selection optimization with genetic


Mansouri, Behrooz, Richard Zanibbi, and Douglas W. Oard. **Characterizing searches for mathematical concepts.** In Maria Bonn, Dan Wu, J. Stephen Downie, and Alain Martaus, editors, *19th ACM/IEEE Joint Conference on Digital Libraries, JCDL 2019, Champaign, IL, USA, June 2-


**Posters and Presentations**


## Funding

Research and academic grants that were active or newly awarded in 2019 to Computer Science faculty are listed below. The total amount of funds exceeds $11 million, with the majority of funding coming from external grants.

<table>
<thead>
<tr>
<th>Investigators</th>
<th>Sponsor</th>
<th>Project Title</th>
<th>Duration</th>
<th>Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alm, Cecilia, and Reynold Bailey</td>
<td>NSF</td>
<td>Computational Sensing for Human-Centered AI. Research Experiences for Undergraduates (REU)</td>
<td>4/2019 - 5/2022</td>
<td>$359,926</td>
</tr>
<tr>
<td>Alm, Cecilia, and Reynold Bailey</td>
<td>NSF</td>
<td>Supplemental Funding Request to Enhance 2020 and 2021 REU Student Stipends. Research Experiences for Undergraduates (REU)</td>
<td>4/2019 - 5/2022</td>
<td>$20,000</td>
</tr>
<tr>
<td>Bezáková, Ivona</td>
<td>GCCIS</td>
<td>Sampling and Counting Independent Sets in Low Average Degree Graphs</td>
<td>1/2018 - 12/2019</td>
<td>$10,000</td>
</tr>
<tr>
<td>Chung, Taejoong</td>
<td>NSF</td>
<td>Measuring and Improving the Management of Resource Public Key Infrastructure</td>
<td>10/2019 - 9/2021</td>
<td>$166,561</td>
</tr>
<tr>
<td>Chung, Taejoong, Dave Levin, Alan Mislove, Bryan Parno, Chisto Wilson and Bruce Maggs</td>
<td>NSF</td>
<td>Large: Collaborative Research: Towards an Evolvable Public Key Infrastructure</td>
<td>6/1/2019 - 5/2022</td>
<td>$300,000</td>
</tr>
<tr>
<td>Coüasnon, Bertrand, Yann Ricquebourg, and Richard Zanibbi</td>
<td>FMHE</td>
<td>Interactive Combination of Deep Learning and Syntactical Methods for Contextual Segmentation and Structure Learning in Document Recognition</td>
<td>9/2016 - 8/2019</td>
<td>€90,000</td>
</tr>
<tr>
<td>Frank, Mark G. and Ifeoma Nwogu</td>
<td>NSF</td>
<td>Deceit and Interactional Synchrony In Different Social Constellations</td>
<td>5/2017 - 4/2020</td>
<td>$318,526</td>
</tr>
<tr>
<td>Investigators</td>
<td>Sponsor</td>
<td>Project Title</td>
<td>Duration</td>
<td>Funds</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Fluet, Matthew</td>
<td>NSF</td>
<td>Positioning MLton for Next-Generation Programming Languages Research</td>
<td>8/2014 - 7/2019</td>
<td>$224,329</td>
</tr>
<tr>
<td>Hartpence, Bruce, and Minseok Kwon</td>
<td>RIT</td>
<td>Applying Active Learning to New Courses on Software Based Networking</td>
<td>1/2018 - 8/2019</td>
<td>$5,000</td>
</tr>
<tr>
<td>Hemaspaandra, Edith</td>
<td>GCCIS</td>
<td>Constraint Satisfaction Problems in Noninterference</td>
<td>1/2018 - 12/2019</td>
<td>$22,500</td>
</tr>
<tr>
<td>Homan, Christopher M. and Cecilia Alm</td>
<td>RIT</td>
<td>Label Distribution Learning for Qualitative Coding</td>
<td>9/2019 - 8/2020</td>
<td>$10,000</td>
</tr>
<tr>
<td>Hosseini, Hadi</td>
<td>RIT</td>
<td>An Interactive Online Platform for Artificial Intelligence Education</td>
<td>5/2018 - 8/2019</td>
<td>$4,864</td>
</tr>
<tr>
<td>Hosseini, Hadi</td>
<td>RIT</td>
<td>Modeling Malicious Agents in Cyber Systems</td>
<td>1/2019 - 1/2020</td>
<td>$75,000</td>
</tr>
<tr>
<td>Hu, Peizhao</td>
<td>Microsoft</td>
<td>Private AI/Homomorphic Encryption Research Collaboration</td>
<td>8/2019</td>
<td>$55,000</td>
</tr>
<tr>
<td>Hu, Peizhao</td>
<td>The L Foundation</td>
<td>Smart and Secure Wearable Device</td>
<td>1/2019 - 12/2021</td>
<td>$60,000</td>
</tr>
<tr>
<td>Joshua Faber, Hans-Peter Bischof, Richard O'Shaughnessy</td>
<td>NSF</td>
<td>NSF REU Grant for a Site on Multi Messenger Astrophysics</td>
<td>9/2016 - 8/2019</td>
<td>$384,866</td>
</tr>
<tr>
<td>Investigators</td>
<td>Sponsor</td>
<td>Project Title</td>
<td>Duration</td>
<td>Funds</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Kwon, Minseok, and Warren Carithers</td>
<td>Cisco</td>
<td>End-to-End Traffic Control with Virtual Switches for Containerized Applications</td>
<td>1/2019 - 12/2019</td>
<td>$57,541</td>
</tr>
<tr>
<td>Kwon, Minseok, Hossein Hojjat, and</td>
<td>RIT</td>
<td>Real-Time Validation of BGP Route Updates in Programmable Control Planes</td>
<td>1/2018 - 8/2019</td>
<td>$12,960</td>
</tr>
<tr>
<td>Matthew Wright</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Łukowiak, Marcin, Peter Bajorski,</td>
<td>L3 Harris</td>
<td>Bit Stream Obfuscation for Securing IP on FPGAs</td>
<td>1/2019 - 12/2020</td>
<td>$49,411</td>
</tr>
<tr>
<td>and Stanisław Radziszowski</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Łukowiak, Marcin, Peter Bajorski,</td>
<td>Harris RF</td>
<td>A Prototype Cross Domain Solution Using Functional Cryptography</td>
<td>11/2018 - 6/2019</td>
<td>$36,000</td>
</tr>
<tr>
<td>Alan Kaminsky, and Stanisław Radziszowski</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mior, Michael</td>
<td>RIT</td>
<td>Benchmarking Integration of Relational and Non-Relational Data Systems</td>
<td>5/2019 - 8/2020</td>
<td>$4,960</td>
</tr>
<tr>
<td>Mior, Michael</td>
<td>RIT</td>
<td>An Interactive Exploration of Relational Database Query Processing</td>
<td>6/2019 - 6/2020</td>
<td>$4,960</td>
</tr>
<tr>
<td>Mior, Michael and and M. Mustafa Rafique</td>
<td>Harris</td>
<td>EVA and Device Management Database</td>
<td>9/2019 - 12/2020</td>
<td>$20,000</td>
</tr>
<tr>
<td>Narayan, Darren, Elizabeth Cherry,</td>
<td>NSF</td>
<td>Extremal Graph Theory and Dynamical Systems. REU Mathematics Program</td>
<td>1/2017 - 12/2020</td>
<td>$287,556</td>
</tr>
<tr>
<td>Jobby Jacob, Laura Muñoz, Stanisław</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radziszowski, and Paul Wenger</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ororbia, Alexander</td>
<td>RIT</td>
<td>Neurocognitively-Motivated Conversational Assistants Based on Distributed Representations</td>
<td>5/2019 - 8/2020</td>
<td>$4,960</td>
</tr>
<tr>
<td>Name</td>
<td>Organization</td>
<td>Description</td>
<td>Start Date - End Date</td>
<td>Amount</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Rivero, Carlos</td>
<td>GCCIS</td>
<td>Clustering Student Solutions to Programming Assignments Using Program Dependence Graphs</td>
<td>12/2018 - 12/2019</td>
<td>$10,000</td>
</tr>
<tr>
<td>Rivero, Carlos</td>
<td>RIT</td>
<td>GRAV: A visual tool for helping students understand graph algorithms</td>
<td>2/2019 - 12/2020</td>
<td>$4,800</td>
</tr>
<tr>
<td>Rivero, Carlos</td>
<td>RIT</td>
<td>Why Am I Getting This? Helping Students Understand Unexpected Results in Big Data Databases</td>
<td>2/2018 - 12/2019</td>
<td>$4,800</td>
</tr>
<tr>
<td>Yuan, Bo, Andrew Meneely, and Rajendra K. Raj</td>
<td>NSF</td>
<td>Cybersecurity as a Diverse Discipline</td>
<td>8/2019 - 7/2024</td>
<td>$5,515,422</td>
</tr>
</tbody>
</table>

**FMHE** - The French Ministry of Higher Education; **NSF** - National Science Foundation; **NSA** - National Security Agency; **NIH/UR** - National Institute of Health/University of Rochester Medical Centers; **GCCIS** - RIT Golisano College of Computing and Information Sciences
Editors
Jeremy Brown
Jennifer Burt
Christopher M. Homan
Rebecca O’Connor
M. Mustafa Rafique

Thank-you to all CS faculty, staff and students who contributed to this edition