

GEORGIA INSTITUTE OF TECHNOLOGY

# INDUSTRIAL AND SYSTEMS ENGINEERING

SPRING 2023

THE H. MILTON STEWART SCHOOL ALUMNI MAGAZINE



## *Engineering for* HUMAN NEEDS

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IMPROVING TRANSIT ACCESS • CONCUSSION DIAGNOSIS • RETROFITTING HOMES  
BUILDING A BETTER GEORGIA • ENERGY EFFICIENCY IN RWANDA

On behalf of all of us at the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), I am honored to share the latest issue of the ISyE alumni magazine with you.

Our ISyE students have truly taken this year by storm and are enthusiastic about engineering and exploring new horizons. Many of our students are establishing their own path within industrial engineering (IE), and you'll be able to read about some of those stories that touch on housing insecurities, mental health, and problem-solving — all active obstacles in IE.

Today, ISyE remains the top industrial engineering program in the nation, which is highly recognized due to the advanced research and commitment our students and faculty have toward the industry and human needs. IE is such a multi-faceted field with researchers expanding on the optimization and use of technologies to improve productivity, minimize waste, and increase organizational effectiveness. In this year's magazine, you'll read about the development of our continued efforts with growing the Center for Academics, Success, and Equity (CASE), specifically how they've connected the ISyE community through the MentIEs mentorship program.

Last summer, ISyE strengthened its outreach efforts with K-12 initiatives by dedicating more than half the spots to underrepresented minorities for Mission Possible. In addition to that, ISyE has also devoted itself to including students in Seth Bonder Summer Camp (SBC) which actively diversifies the field by increasing the number of women interested in pursuing industrial engineering.

The level of determination and resourcefulness that our faculty members exemplify has contributed to pushing ISyE to the top of the rankings in industrial engineering. Our faculty have launched training programs in coordination with AI4OPT, developed research to bring more energy-sustaining cookstoves



to Rwandan schools, as well as award recognition from some of the most distinguished organizations in engineering.

As for our alumni, their engagement with the ISyE community highlights the value of staying connected and involved with your colleagues and mentors. From volunteering their time to supporting our students at sporting events and even popular game shows, our alumni show up and engage with our community. This issue showcases many of the successes built within ISyE by our very own students, faculty, staff, and alumni. We are privileged to share these stories with you and hope they continue to inspire you to follow our industrial engineering journey.

Take care and be well.

*Edwin*

**H. Edwin Romeijn, Ph.D.**

H. Milton and Carolyn J. Stewart School Chair and Professor  
H. Milton Stewart School of Industrial and Systems Engineering

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# ISyE by the numbers

## Rankings

ISyE is the No. 1 program of its kind, as ranked by *U.S. News & World Report*.



**32** Number of consecutive years the ISyE graduate program has been ranked No. 1

**28** Number of consecutive years the ISyE undergraduate program has been ranked No. 1

## Degrees Offered

### 1 B.S. in IE Degree

WITH 7 CONCENTRATIONS IN:

- Advanced Studies in Operations Research and Statistics
- Analytics and Data Science
- Economic and Financial Systems
- General Industrial Engineering
- Operations Research
- Quality and Statistics
- Supply Chain Engineering

### 9 Master's Degrees

SPECIALTY MASTER'S DEGREES:

- Master of Science in Analytics
- Master of Science in Health Systems
- Master of Science in Quantitative and Computational Finance
- Master of Science in Supply Chain Engineering
- Master of Science in Urban Analytics

GENERAL MASTER'S DEGREES:

- Master of Science in Computational Science and Engineering
- Master of Science in Industrial Engineering
- Master of Science in Operations Research
- Master of Science in Statistics

ONLINE MASTER'S DEGREE:

- Online Master of Science in Analytics\*

*\*Same degree as on-campus program*

### 6 Doctoral Degrees

- Industrial Engineering with specializations in:
  - Economic Decision Analysis
  - Statistics
  - Supply Chain Engineering
  - System Informatics and Control
- Algorithms, Combinatorics, and Optimization
- Bioinformatics
- Computational Science and Engineering
- Machine Learning
- Operations Research

## Fall 2022

## Enrollment

Undergraduates: **1,184\***Master's: **432** on campus  
**5,301** online/videoDoctoral: **187***\*Includes co-op and study abroad students*

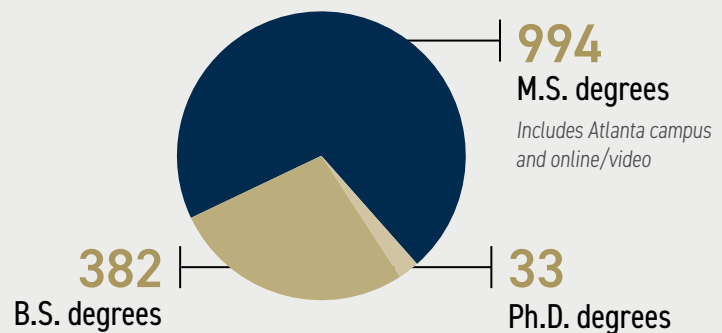
## Faculty

**62** tenured/tenure-track faculty**25** NFS Career Awardees**18** chairs: professorships**8** INFORMS Members**4** lecturers

## Academic Year 2021-22

**1,409**

ISyE Degrees Awarded



## For undergraduates:

- **91.6%** of job seekers had an offer before graduating in May
- **47%** participated in a co-op or interned at the company they accepted a job offer with
- **40%** of our graduates are employed through consulting industry

## Of the 382 B.S. IE degree recipients in 2021-22:

- **82%** graduated with honors
- **10%** graduated with a co-op designation
- **49%** were female
- **\$82,000** was the median starting salary



# Jing Li and Turgay Ayer Named Virginia C. and Joseph C. Mello Chairs in ISyE

Georgia Tech's H. Milton Stewart School of Industrial and Systems Engineering announced two new appointments to the Virginia C. and Joseph C. Mello Chair. Professor Jing Li and Associate Professor Turgay Ayer both earned the designation, which recognizes faculty leaders in the field of health care delivery operations.

Li, also core faculty in the Center for Machine Learning at Georgia Tech, currently focuses on the developments of machine learning algorithms for precision medicine specifically with regards to the brain. She leverages collaborations with radiologists and neurologists to investigate brain diseases like cancer, Alzheimer's, and post-traumatic headache after brain injury.

Today, technology advances have produced more data than ever before — imaging, genomics, mobile health data, etc. — which allow researchers to develop more personalized algorithms for diagnosis and prognosis.

“What disease do they have? How severe is it? How will the disease change in the future? Are they on the track of recovery, or are they going to get worse?” Li said.

Using the available datasets from imaging, genomics, clinical records, and mobile apps & wearables, they are building personalized models for diagnosis and treatment in each of these areas that can lead to early detection and more effective outcomes.

Ayer, who also holds an appointment from Emory University School of Medicine and serves as a senior advisor to CDC, focuses on health care analytics and socially responsible business analytics with an emphasis on practice-focused research. In recent work, he has attempted to build up more robust and effective virtual trials for medical screening, diagnosis, and treatment using large-scale mathematical models.

If you look at the gold standard in medicine and clinical science — randomized control trials — it generally utilizes A/B testing strategies. But what if there are thousands of strategies to compare, not just Strategy A and Strategy B?

“In a recent study, we looked at multi-modality cancer screening strategies for cancer detection in gene mutation carriers,” Ayer said. “You ask questions like: Should you use ultrasound screening or MRI screening? How about mammog-

raphy screening? Or maybe mammography plus ultrasound screening? At what age should you start — 25 to 30? Or 35?

“At what age should you transfer from a less intensive screening to another? Is that cost effective? And what if we are solving this problem for the United States versus sub-Saharan Africa where resources are more limited? There are millions and billions of scenarios, and you can't design a randomized control trial that would effectively compare those.”

Ayer's work has spanned long-term chronic disease, both communicable and non-communicable — diseases like Covid-19 for the former and different cancers for the latter.

Both Li and Ayer said the chair appointment would assist in their work.

“It's a great honor and recognition,” Li said. “I think going forward this will help me to pursue bigger efforts and initiatives, engaging people with a variety of expertise. This research needs collaboration across different descriptions.”

“It helps to bring more visibility to the work,” Ayer echoed. “This will also help us scale up the resources that we have within our communities and reach out to more collaborators.” • DAVID MITCHELL

The Mello Chair designation recognizes faculty leaders in the field of health care delivery operations.



Ayer



Li

# K-12 Educational Outreach

In ISyE, our faculty and staff are committed to increasing exposure to industrial engineering (IE) for K-12 students, educators, and the community through an assortment of outreach opportunities and activities

## Seth Bonder Summer Camps

High school education is probably the most critical and challenging component of the proposed educational pathways. The difficulties faced by high school educators, especially for underrepresented groups, are described as getting them interested in the field and then getting them to stay interested.

The AI4OPT high school initiative addresses these two challenges. It leverages the significant expertise built when developing the in-person and online Seth Bonder Summer Camp (SBC) in Computational and Data Science for Engineering. Since 2018, the camp has been recruiting students who do not have exposure to computer or data science in their middle and high schools. This resulted in a truly diverse set of participants, heavily weighted toward minority students and young women. The high school initiatives represent a step change in the impact of the SBC, moving from training hundreds of students to the longitudinal education of thousands, possibly tens of thousands, of high school students through multiple long-term partnerships and flipped classes.

**Mentors:** AI4OPT is also pioneering a mentorship program for its longitudinal camps. Students who complete a camp will be eligible to mentor the camp for subsequent years. Each mentor will receive a stipend and benefit both financially and academically because they will acquire a deeper understanding of the material. The mentorship program is a critical element to retain students and keep them interested. 23 mentors are already accepted to the team.

### Teacher Professional

**Development:** AI4OPT is constructing teacher professional development programs (“teaching the teachers”) for each summer camp. The goal is to train high school teachers and non-profit organizations to run the camps themselves (either as summer camps or after-school programs) or integrate them into their curricula. This activity is critical for the scalability and replicability of the initiative. The first camp in the Teacher Professional Development program was offered in June 2022. A total of 12 high school teachers were trained during the data science summer camp and teacher professional development program in Fall 2022. Among those teachers, four of them introduced the exciting field of data science and artificial intelligence to their students with specific activities through the support of the AI4OPT education team. Also, three faculty members and a couple of undergraduate students outside of the AI4OPT team supported efforts to diversify the AI field through their visit to underserved high schools. Around 550 students attended those activities and speaker series.

**Partners:** In 2022, AI4OPT offered a dedicated SBC for Banneker High School (approximately 1,449 students with 94.1% Black and 4.1% Hispanic population), Drew Charter High School (approximately 997 students with 60.6% Black students) and Westlake High School (approximately 2,148 students with 95.3% Black and 2.5% Hispanic students). Kids Teach Tech, a nonprofit organization in California, is also offering camps based on the SBC material. • TUBA KETENCI



## Outreach Highlights

### Summer Camps

- Data Science: 100 students (AI4OPT Center)
- Mission Possible: 30 students

### ISyE Visits to High Schools

- Gwinnett STEM high school: 100 students
- Innovation Academy: 95 students

### High School Visits to ISyE

- The Center for Academics, Success, and Equity (CASE) hosted 3 visits: 100 students
- Hispanic Society student organization hosted 30 first-generation students

### Virtual Visits to El Salvador Schools

- 4 schools visited with student organization STEMpower

### New ATL Science Festival

- Volunteers from Black student organizations, who are CASE-affiliated

### High School Interns

- 6+ student interns

### Professional Development for Teachers

- Teacher Fellowship Program (Mathieu Dahan, Brandy Blake, Damon Williams)





Mission Possible participants visited the Coca-Cola Supply Chain Department (top) and spent time on Georgia Tech's campus.

## Mission Possible: Exploring Coca-Cola Supply Chain

Mission Possible was developed to introduce high school students to the dynamic field of industrial engineering (IE). The week-long summer camp is filled with various activities, speakers, and world-known faculty to demonstrate the sub-areas of IE. One of the key highlights from the camp was having the students visit the Coca-Cola Supply Chain Department, where they were able to see the operations facilities and explore how Coca-Cola ends up on dinner tables across the globe.

This program has a strong emphasis on improving education in STEM and is designed to encourage people from minority backgrounds to pursue careers in these fields. Within four years, ISyE has created more equitable access to Mission Possible, by reserving half of the spots to participants from underserved communities. This is a vital step towards tearing down the system barriers that have built disparities in access to economic opportunities, education, and other factors that add to the quality of our lives. • CAMILLE C. HENRIQUEZ





## Probability and Statistics HS Competition (STATpros)

High school students from around the state of Georgia were invited to participate in the inaugural Probability and Statistics High School Competition (STATpros). The H. Milton Stewart School of Industrial and Systems Engineering offered the competition as an outlet for young, driven students to engage in strategy, workshops, and networking. This type of competition was structured with virtual and in-person opportunities which allowed our high schoolers to gather with their peers and guest speakers for this unique experience.

Over 40 of the top finalists met on the Georgia Tech campus to embrace an entire day of quick-witted equations and questions. This initiative centers around the program providing advanced learning in probability and statistics for high schoolers who are currently or have taken an Advanced Placement (AP) course in the subject. Having high school students prepare for this extensive competition helps our incoming youth prepare for college-level statistics courses and will give them an engaged presence within the Georgia Tech community. • CAMILLE C. HENRIQUEZ

### STATpros By the Numbers

**120**

students competed

**5**

Ph.D. students

**44**

students qualified for the final round at Georgia Tech

**3**

undergrad students

**12**

faculty members, including the College of Engineering Dean

**2**

high school student volunteers



College of Engineering Dean and Southern Company Chair Raheem Beyah (front, center) with the finalists for the STATpros competition.

# Engineer and Pastor: It's All About Connections for New Associate Dean Damon P. Williams

Williams has been appointed the College of Engineering's first associate dean for inclusive excellence and chief diversity officer

**D**amon P. Williams is an engineer, a teacher, a man of faith, and a church leader. But really, he says, he's in the people business.

That's true as a senior lecturer and director of the Center for Academics, Success, and Equity (CASE) in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE). It's also true as senior pastor of Providence Missionary Baptist Church in southwest Atlanta.

"They end up being two sides of the same coin. Both jobs require a lot of teaching, sharing, and relationship building," Williams said. "It's my job to get to know people, to identify where their point of need is, and to see how I can support help them. I do that in both places."

On Sept. 1, Williams expanded the scope of where and how he helps students, faculty, and staff at Georgia Tech as the College of Engineering's first associate dean for inclusive excellence and chief diversity officer. The position was created this year to advance diversity and inclusion initiatives and support an inclusive climate of belonging across the College community.

"Diversity, equity, inclusion, and belonging (DEIB) are pillars of our College. They define what we are and will shape what we become," said Raheem Beyah, dean of the College of Engineering and Southern Company Chair. "Damon has exemplified these traits and inspired others to follow them throughout his career. As the College's first chief diversity officer and a member of our leadership team, Damon will lead and energize our students, faculty, and staff to ensure an inclusive climate and lead the DEIB discussion on a national stage."

Williams earned his bachelor's degree in industrial engineering at Georgia Tech in 2002 before pursuing a master's and Ph.D. in industrial and operations engineering at the University of Michi-

gan. He returned to the Stewart School as a part-time lecturer in 2010 and worked at the Center for Teaching and Learning as a postdoctoral fellow. Since 2015, he has been an ISyE lecturer, advisor, and now founding director of CASE.

Along the way, he went to seminary and became senior pastor of Providence Missionary Baptist Church. It's a full plate, but Williams said that's just how he likes it.

"I'm an engineer, so I see opportunities to improve everywhere. I see things to work on everywhere. I see need in people everywhere," Williams said. "It's hard for me to see need, know that I can help, and do nothing about it."

## Making Connections

The desire to help is why Williams started a program to improve the teaching skills of Ph.D. students in the Stewart School, built a mentoring program for alumni to work directly with ISyE students, and created a tutoring center to help undergraduates in upper-level courses. When he heard frustrations from staff members about a lack of career growth, he launched a program to help the School's staff think through their trajectories at Georgia Tech and find opportunities for advancement. Within a few years, Williams found he was leading 18 different programs. That's when he proposed uniting them into a single center — CASE.

"He works so hard to educate staff on best practices and supports us in our career planning," said Development Associate Donald Phan. "Damon has helped me find my place and grow my career here at Georgia Tech, and for that I am forever grateful."

Phan has served on the Stewart School's Diversity, Equity and Inclusion Committee with Williams and credited him for inspiring Phan to take over as committee chair for the coming year.

Master's student Maggie May worked with Williams throughout her undergraduate studies, first when she was struggling with an early ISyE course, then as part of a small team of four students that Williams guided through a semester of learning and studying together and called Team 4.0.

"Damon has this magical gift to be able to connect with others and make them feel like they belong exactly where they are," said May, who emulated his approach when she was a teaching assistant, a peer tutor, and now as a graduate student. "It has stuck with me, because I am able to look back on my college years and remember the wonderful community that I was blessed to be a part of. I look at where I am now and am able to pinpoint Damon's investment in me and Team 4.0 as the catalyst for my success."

Plenty of programs and opportunities exist across Georgia Tech, Williams said, but students and employees often just don't know about them. His job is making those connections — solving what he called "an information asymmetry problem."

Williams said he'll be doing that same kind of connecting in his new role as associate dean, along with leading the College's DEIB efforts.

"Tech is doing a lot; we're just doing it in a very decentralized fashion," he said. "It's creating these connections, creating synergies of things that we are already doing at Tech — I think, very quickly, we're going to see that we're all doing a lot of great work, and we could identify what other people are doing for their staff and for their students, and implement it universally to benefit our entire community."

## A Call to Ministry

Williams' plan always was to teach at Georgia Tech, and his undergrad mentors told him he'd benefit from experience in





another academic environment. That's how he ended up at Michigan. And it was there, during his Ph.D. studies, that things began to shift — thanks, in part, to a roommate who also was working on his engineering doctorate and actively involved in a church. The roommate decided to become a minister, and Williams went to his church to hear his very first sermon.

"I felt something in my heart. I really was moved," Williams said. "I started going to church, and before you know it, I joined the church."

He soon was dreaming, literally, about leading a congregation and preaching from the pulpit. Which he thought was crazy. Meantime, other church members were telling him he was destined to lead a church. His pastor encouraged him to start thinking about ministry and to finish his engineering studies — and then steered him toward seminary. After four degrees and nine years of college, that wasn't exactly what Williams wanted to hear.

"I was like, 'not interested,'" he said. "But I'm a good minister, and I did what my pastor told me to do. My only require-

ment — and prayer to God — was that I wanted to go back to Atlanta, because ultimately, I wanted to work at Georgia Tech."

That's how he ended up at Columbia Theological Seminary in Decatur, where he earned a master's in divinity in 2012. A year in, Williams found himself craving math and science to complement the reading and writing at seminary: "I need engineering" he recalled thinking. "This is not how my brain is wired." And, once again, things lined up perfectly: The chair of ISyE at the time had been one of Williams' professors at Michigan. He made a call, hoping the School might need extra instructors. By the fall, Williams was teaching his first courses.

A decade later, as he steps into a new role as associate dean, Williams said he remains grounded by faith and his family. He's also guided by the example of his parents, who pushed him to pursue his strengths in math and science and planted seeds throughout his childhood about serving and helping other people.

"I've been in every position at Georgia Tech: I've been a student, I've been staff, faculty, alumni. I've had an amazing

**"This position as associate dean gives me an opportunity to make a greater impact across the entire College of Engineering."**

— DAMON WILLIAMS

experience," Williams said. "But since I've been in every position, I know people who haven't had an amazing experience. Part of it had to do with inclusivity and belonging — there was not an environment being created where they could excel and thrive. This position as associate dean gives me an opportunity to make a greater impact across the entire College of Engineering." • JOSHUA STEWART



# ISyE MentIEs Program: Gaining Career Insights with Alumni Mentors

ISyE students, mentors look for a match at speed dating-style MentIEs kickoff event



Just about a year ago, the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) launched MentIEs, a mentorship program designed to connect undergraduates with ISyE alumni who can offer real-world practical insights students might not otherwise receive inside the classroom.

“Students who want to have a career outside academia need to learn from people who have been there and know how it is done,” Damon P. Williams said at the time. Williams is a senior lecturer and director of ISyE’s Center for Academics, Success, and Equity (CASE), and was recently named the College of Engineering’s first associate dean for inclusive excellence and chief diversity officer.

After a pilot program this past year, which saw high levels of participation from both students and alumni, Williams heard quite a bit of feedback from the students. Students loved the opportunity and gave great reviews of their mentors, but most had one specific request:

They wanted the opportunity to meet

and network with other mentors around the program, whom they had heard about from their peers throughout the year.

This year’s cohort of mentees got that opportunity at the program’s kickoff event. Students and alumni mentors from around the country came together for an evening of food and networking, where no question was off limits and students were able to hear advice from individuals in a variety of fields.

“Simply put, it just broadens your scope,” second-year student Quincy Howard said of the event. “You get so many different perspectives through people’s careers and their experiences at Georgia Tech. It broadens your scope on what you think you can do and what your degree can do for you.”

The dinner was modeled like a speed dating event. Students and mentors were assigned to a table to begin the evening, where they ate dinner and got to know each other. After dinner and a 15-minute networking round, the bell sounded and students moved to a new

table. There, they spoke with a new cohort of mentors who had entirely different experiences and perspectives than the group they left behind.

There were presidents of technology companies and consultants, sales excellence managers and optimization experts, CEOs, and business founders. There were those who had long since graduated and others who were in the early stages of their careers.

“There’s no way we were getting another opportunity like this,” said Harish Kanthi, another second-year student who said he couldn’t pass it up when he heard about it in Williams’ class. Laughing, he added, “The net worth in this room is off the charts.”

Students involved in the program will continue to connect with their mentors, as well as their new connections developed at the dinner. For the mentors, it’s a great opportunity to pass on their experience to a new generation and to find bright minds they may be able to call upon in the future. • DAVID MITCHELL

**“This is an opportunity to remember your roots and remember that it’s the next generation of talent coming up that will make a difference. We’re the has-beens, and they’re the to-bes. I think that reminder is always important.”**

– REID BOND (IE '07),  
EASTMAN CHEMICAL  
COMPANY



**“As a recent graduate, I remember how much students can benefit from something like this. I lead a couple senior design projects at Coke, and I think students can really benefit from seeing what it’s like to work with a real company. How do you communicate and present effectively. Being able to supplement the curriculum with those skills is a good thing.”**

– SAEED SIDDIQUI  
(IE '16), COCA-COLA



**“There aren’t that many women majoring in industrial engineering, and there are even fewer Black people. Particularly, Black women are largely underrepresented.**

**Finding a mentor with similar experiences is important to me, so that I can ask questions that pertain to my life and how I move through the world.”**

– NACHARLESIA  
FLOYD, SECOND  
YEAR IE STUDENT



**“I switched my major in the spring from Math to IE and I really didn’t have any clue what to do with it. I had Damon’s class over the summer, and he introduced the idea, and I thought it was a great opportunity to jump right in.**

**... There are so many mentors here that have done different things with their degrees, it just helps show what the possibilities are. I haven’t heard of this anywhere else.”**

– CAROLINE KASTENSMIDT,  
SECOND YEAR IE STUDENT



**“There are so many things I’ve learned, and the most important I learned the hard way. There are things I wish I’d known then that I know now. So, I would at least like to help people along with things that I’ve learned that I know are really helpful lessons.”**

– DAN SHINEDLING (IE '92),  
KS2 TECHNOLOGIES, INC.



# Graduate Student Leaders Take Action on Mental Health Support

ISyE Ph.D. student Miguel Campos shares his mental health journey

*Campos, who has bipolar disorder, wants other graduate students who may also have mental health issues to know they are not alone. Together with several other ISyE graduate student leaders, Campos founded the ISyE Bee Well group for mental health support.*

When Miguel Campos began his ISyE graduate studies in August 2018, he expected the experience to be exciting and challenging — particularly because, as an international student from Colombia, he was coming to the U.S. for the first time. Describing himself as “a usually happy person,” he didn’t anticipate one of those challenges being his mental health.

When the fall semester began, Campos plunged into his studies. As anticipated, they were demanding. Then he began noticing that he was having memory issues. He booked an appointment at Georgia Tech’s Counseling Center, which offers free mental health counseling and resources to students. But before his first session, Campos began suffering from both fatigue and sleeplessness, an inability to focus and a lack of appetite. He eventually saw a counselor who recommended group therapy, meditation, and exercise. While he followed her advice, his mental state didn’t improve.

## The First Diagnosis

Then, a few months later, the situation became dire.

“I was in China working on a research project, and I had a really bad episode,” Campos remembered. “I just couldn’t take it anymore.”

He ended up being taken to a hospital in Hong Kong, and a few days later, Campos

was back in Atlanta, still struggling.

That was when ISyE Director of Student Services Dawn Strickland got involved.

“Because of what happened in China, because it was part of my studies, the incident was reported to her, and she asked me to come see her,” Campos said.

Strickland made a phone call to Stamps Health Services and was able to get Campos an appointment with the psychiatrist for two days later.

“The doctor listened to me for 10 minutes, told me I was chronically depressed, and that she was prescribing an antidepressant,” he said. “That was the end of November. A month later I was fine.”

As the spring semester began, Campos found himself feeling happy and appreciating life. His Ph.D. studies were going well. Everything else in his life was too.

A couple of months later, Campos felt energized. Sleep was less of a necessity. He noticed a change in his spending habits, parting with money recklessly. While his girlfriend, friends, and professors all noticed Campos’ increasingly bizarre behavior, they weren’t sure what was going on.

## The Second Diagnosis

Campos was in China once again for an ISyE project when he had another major mental health incident — this time, a psychotic break characterized by delusions and a partial loss of his connection with reality.

He was hospitalized for 13 days in Hong Kong before his family flew him back to Bogotá, where he was hospitalized for 15 more days. There, a psychiatrist finally recognized an error.

Campos, they said, had been misdiagnosed with depression. Instead, it was much more likely that it was bipolar disorder. The antidepressant

he was on was contributing to Campos’ mania, a common occurrence when bipolar disorder is incorrectly treated.

Americans are typically familiar with depression and anxiety as common mental health issues. They may be less familiar with bipolar disorder, except for depictions in movies or TV that show a character experiencing wildly elevated moods (mania) or debilitating low moods (depression). These are indeed characteristics of the disorder, but a range of symptoms accompany it.

Around 5.7 million Americans are affected by the condition. In 2019, the World Health Organization estimated that globally 970 million people, or 1 person out of 8, suffered from a mental health condition. This included 40 million with bipolar disorder.

It was a relief for Campos to finally have the correct diagnosis and to be prescribed the right medication for it, although he had to pause his studies for a full year as part of the process.

“I have a very good specialist back home, and he got me on the right medication,” he said. “I’ve had mild episodes since, like hypomania, but I treat them with medication.”

His psychiatrist also encouraged him to stop eating sugar, which can artificially heighten the highs and lows of mood swings. He has a sanguine outlook on his diagnosis and everything that happened to him leading up to it.

“So, it’s a chronic disease,” he said. “This is what happened to me.”

## Sharing His Story

This perspective has led Campos to openly share his story with fellow Georgia Tech students. In that crucial conversation he had with Strickland, she told him she had similarly grappled with mental health issues while studying for her ISyE doctorate. She mentioned





**“Every time I talk to someone about this, I tell them it’s an illness. It’s like you have diabetes. Diabetes is a chronic disease, you will have it all your life, and you need to take your medication, because if you don’t, you’ll get sick. It’s the same exact thing with mental health.”**

— MIGUEL CAMPOS

that she knew of numerous other ISyE students who felt isolated with their mental health challenges.

Once Campos’ moods stabilized and he was back in school, he and several other students began considering how to share their personal mental health stories as a way of providing information to and connection for the rest of the ISyE graduate students.

“Our initial idea was to do an information session for first-year ISyE Ph.D. students,” he said. “They have a mandatory seminar they

have to attend every week, so we attended one of those sessions as an initial point of contact.”

Then they developed a broader event and invited all doctoral students and faculty. That created an opportunity to discuss the mental health resources provided by the Institute.

“We also shared our own stories, so everyone would know mental health issues are normal, they need to be discussed, and they’re nothing to be ashamed of,” he said.

Over 50 people attended the event.

### Creating the ISyE Bee Well Group

In addition to presenting to the ISyE Ph.D. community, Campos and some members of the School’s Graduate Student Advisory Council put together the Bee Well Group in Spring 2022. Strickland and Graduate Programs Manager Amanda Ford, who had also recognized the need for such a group, serve as its advisors.

“The group came about partly because of my own experience as a grad student, as well as seeing how some of our students struggle,” Strickland said.

In the spring, the group met occasionally for breakfast, inviting any students who needed support to attend. They also organized a few walks around campus as a way of highlighting how important physical activity is for mental health.

Campos and the other leaders plan to expand the Bee Well group activities in the fall. In the meantime, several students have reached out to them to affirm their interest in the group and to share their own personal struggles.

Campos sees this as a success.

“The idea of the group is that when they hear our stories, they will know they can make it through this,” Campos said. “I’m in my fourth year already, and I got sick in my first semester. So, it’s going to work out, but you would never believe that if it wasn’t coming from someone who has been there already.

“Every time I talk to someone about this, I tell them it’s an illness. It’s like you have diabetes. And I ask if they would apologize for having diabetes or try to hide it. Diabetes is a chronic disease, you will have it all your life, and you need to take your medication, because if you don’t, you’ll get sick. It’s the same exact thing with mental health.” • SHELLEY WUNDER-SMITH

*If you are a Georgia Tech student and need mental health support and assistance, please visit the CARE homepage. For information about the ISyE Bee Well Group, contact Dawn Strickland and Amanda Ford.*

# Mitigating the Foster Care to Homelessness Pipeline

ISyE Ph.D. student Meghan Meredith and her partner, public policy master's student Raine Sagrarsingh, created a model that helps organizations predict how many youths aging out of the foster care system are in danger of becoming homeless

**F**or a young adult in the U.S. foster care system, their 18th birthday may prelude a precarious time for them. In most states, including Georgia, adulthood means that they are emancipated — or “age out” of the system — and most of the social support and state services on which they have depended cease to be available to them. Consequently, 20-40 percent of these youth become homeless within two years of emancipation. Although the U.S. Department of Housing and Urban Development (HUD) recently began a program that distributes housing vouchers to any aged-out youth, millions of dollars in vouchers go undistributed.

This past spring, in partnership with Georgia Tech, the University of South Carolina hosted a Master Modeler Competition to find data-driven solutions that address this voucher distribution problem. ISyE Ph.D. student Meghan Meredith and her partner, Raine Sagrarsingh, who is earning a master's degree in public policy, identified risk factors for aged-out youths becoming homeless; they also created a predictive model to help organizations understand how many youths could become unhoused each year — and thus how many vouchers they should request. For this work, they earned first place among the Georgia Tech teams that competed.

In this Q&A, Meghan talks about the importance of solving the voucher distribution issue, the solution she and Raine developed, and the challenges they faced in the process of creating their predictive model.

*This interview has been edited for clarity and length.*



Meredith

## Tell us about the problem you and your team were trying to address.

Typically, when a child in the foster care system turns 18, they “age out” of the system; this means they're no longer eligible for a lot of state-provided services. We know that nationally, 20-40 percent of this population ends up homeless in the first two years after aging out; when we looked at DeKalb County in Georgia, the number is slightly on the lower end.

However, there's a national voucher program, developed in 2020 and called the Foster Youth to Independence (FYI) Initiative, which is sponsored by HUD, and it's meant to address this issue of homelessness. These vouchers are called Housing Choice Vouchers, and technically, every single person aging out of foster care can be directly given one.

While there's not really a resource problem — we know there are enough

vouchers to go around — there's a distribution problem. The vouchers are distributed hyper-locally by public housing authorities and county organizations. And a lot of these groups are stretched too thin or may not even be aware of the program.

## How did you begin approaching this challenge of the housing vouchers not being distributed?

We spent a lot of time on understanding how the voucher program works. The woman who helped create and runs the FYI Initiative is named Ruth White; she lives in Washington, D.C. and works for HUD, and she brought this larger problem of unsheltered aged-out youth to the Master Modeler competition. When I communicated with her, she provided insight into this issue, especially along the lines of where she has seen counties fail and what they could be doing differently. She also provided data about foster youth, on who hadn't received vouchers.

We focused considerable effort on understanding where the gap occurs for organizations that are supposed to be connecting people to this resource. Raine and I called and emailed many organizations working in DeKalb County, and most of them said they had never heard of the initiative.

## So, there's a gap in the supply chain of information?

Yes, exactly. We found that these local organizations need to be better educated about foster youth in general: What are issues with foster care in the counties in which they're located, what the organizations could do about it, and what role they can play in the FYI

Initiative. That was one area we identified that Raine and I couldn't do much about — the education piece — because the Master Modeler Competition is a data-driven analytics competition.

But then we also knew that the FYI Initiative has been around for two years, and we could see which counties have been using the vouchers. We ended up focusing on DeKalb for the rest of our analysis because it hadn't received any vouchers — they hadn't requested any, and it has the highest number of youths aging out of foster care in Georgia.

We also wanted to figure out if we could predict how many people in a county would need the vouchers. The foster care population has a lot of data surrounding it, because there are so many contact points with the government while they're in care. If we know, for example, how many 13-year-olds will age out in five years, can we predict how many will need housing?

**Are there any specific markers for who will leave the foster care system before aging out — and thus are less likely to become homeless?**

Yes, we used odds ratios produced by a logistic regression model to understand which factors are associated with aging out of the foster care system. We found that if the reason a child entered foster care was because they experienced abandonment, they have a 56.8% higher relative risk of aging out. Conversely, we also found that if a youth is being fostered by a single female caretaker, they are less likely to age out.

Knowing these factors means that more targeted interventions can be provided for the people who are more

**“The foster care population has a lot of data surrounding it, because there are so many contact points with the government while they're in care. If we know, for example, how many 13-year-olds will age out in five years, can we predict how many will need housing?”**

— MEGHAN MEREDITH

likely to age out. And additionally, we can predict how much need there will be, so counties can more accurately order the vouchers they need, instead of overcompensating by ordering too many — or not ordering any at all.

**Demographic data on people who are unhoused is notoriously difficult to come by — obviously most homeless people aren't using computers that track their data the way we do daily. How did you work around that for this competition?**

That was an interesting data aspect of the problem. Every person in foster care has an annual evaluation that collects information about what they experienced — how many times they were in and out of care, and so on. When they age out, all that data becomes lost. There's a lot of work being done now that bridges the gap between 18-year-olds who aren't receiving services anymore to 25-year-olds who have jobs and social support — programs to help young adults with that transition.

Raine was an expert in this area, and that was a huge help. As a public policy student, she knows so much about how the government functions and about public housing authorities, and about how to work with the data we currently have. We talked about what data we'd like to have collected in the future,

and what policies actually would be helpful. To your point about unhoused populations not using computers much, we thought a lot about how to provide solutions that could be distributed and used as a physical paper document.

**What's next for your team and this model you've created?**

Our HUD collaborator, Ruth White, told us that she would personally bring information from our presentation to DeKalb County to help them introduce the FYI Initiative and better serve age-out youth in that area. It was wonderful to work with someone who could directly implement our interventions, and I hope to continue working with Ruth White and HUD to reduce the burden of homelessness on age-out foster youth.

But more generally, social justice issues are something I've cared about for a long time — vulnerable populations like kids in foster care and human trafficking, and how the government — or really any organization — can interact with these groups and support them. As an undergrad at the University of Wisconsin, I worked with a student organization to raise money to end human trafficking. So, the social justice aspect of this Master Modeler competition really appealed to me. • DAVID MITCHELL





# Covid-19: Looking Back on Lessons Learned During Deadly Pandemic

When the Covid-19 pandemic broke out in early 2020, many around the world were caught unprepared for the largest health emergency of the 21<sup>st</sup> century. The disease brought about widespread illnesses and deaths, and the ensuing lockdowns brought forth questions about economies, supply chains, mental health, and more. ISyE researchers were on the frontlines of trying to solve many of the issues that arose as a result of the pandemic, and much of their work has offered insight into how future emergencies may be handled.

## **New Study Shows Hybrid Learning Led to Significant Reduction in Covid-19 Spread**

*As communities continue a shift toward normalcy in the wake of the Covid-19 pandemic, researchers in Georgia Tech's H. Milton Stewart School of Industrial and Systems Engineering have helped quantify the effectiveness of one of the most commonly-debated mitigation measures taken across the country.*

A new study published in *BMC Public Health* shows that hybrid learning utilizing alternating school days for children offers a significant reduction in community disease spread. Total closure in favor of remote learning, however, offers little additional advantage over that hybrid option.

This research will help decision-makers in the event of another Covid-19 outbreak or one from a similar infectious disease.

“Early in the pandemic when school closures were becoming the norm,

many debated the pros and cons of this measure,” said Pinar Keskinocak, the William W. George Chair and Professor in ISyE and the principal investigator on the study. “Do we get enough benefit to offset the social costs and impacts on education? This research shows that there is a benefit in infection reduction, especially in the absence of effective pharmaceutical interventions, and most of the benefits can be attained with a hybrid approach.”

This study is particularly relevant for the early days of an infectious disease outbreak when policymakers face the

**“The implementation of an alternating day model can be challenging but could have public health benefits early in the pandemic or during a new wave, providing social and learning benefits as well.”**

— PINAR KESKINOCAK, WILLIAM W. GEORGE CHAIR AND PROFESSOR

difficult decision of enacting school closures in their respective districts. Using an agent-based simulation model of Covid-19 spread, researchers projected the impact of various school reopening strategies: complete closure, alternating school days where one cohort attended in person twice a week and another cohort on the opposite days, younger children only, and regular (i.e. all students return to in-person learning).

Results showed that compared to schools reopening with regular attendance, the percentage of the population infected reduced by 13, 11, 9, and 6 percent with each respective strategy. The conclusions were that some level of closure — younger children only, alternating days, and completely remote — offers significant reduction in community-wide infections.

The benefit of complete closure over a hybrid approach, however, was minimal.

The assumption in all cases was that individuals who contracted the virus would remain at home.

“The additional benefit of complete school closure compared to hybrid was relatively small,” Keskinocak said. “The implementation of an alternating day model can be challenging but could have public health benefits early in the pandemic or during a new wave, providing social and learning benefits as well.”

Other challenges remain that were not investigated in this particular research — costs on families in the event of school closures, learning tradeoffs, properly equipping students for virtual learning, and others. This is just one element of many for policymakers to consider, Keskinocak said. • DAVID MITCHELL



## Does it Matter When We Lift Non-Pharmaceutical Interventions?

*Research from the Lab of Virginia C. and Joseph C. Mello Chair and Professor Turgay Ayer*

**THE QUESTION** At some point in the pandemic, there was always going to be an adjustment to non-pharmaceutical interventions at the state level. These interventions include masking, school or business closures, and more. The question researchers wanted to understand was whether the timing of these reduced restrictions would have any impact on rebound effects in mortality and morbidity.

**THE RESULTS** Across all 50 states and Puerto Rico the results were clear. Yes, there would be an uptick in mortality and morbidity rates when lifting non-pharmaceutical interventions. However, that uptick in rate did not change based on when those interventions were lifted. In other words, there would be an uptick at a similar rate whether mask mandates were lifted in March or two months later in June. “There is likely no amount of additional waiting time in any state after which removing [Covid-19 restrictions] will not lead to a rise in morbidity and mortality,” the study said.

**WHY THIS MATTERS** As with Keskinocak’s research into school closures and subsequent reopenings, this provides context for policy decisions in future health crises. How should state and local governments intervene to curb the spread of disease, and how should communities return to normal?

# AI4OPT Faculty Training Program Helps Grow Data Science Programs Around the U.S.

The NSF Artificial Intelligence Research Institute for Advances in Optimization (AI4OPT) aims to deliver a paradigm shift in automated decision making at massive scales by fusing AI and Mathematical Optimization to achieve breakthroughs that neither can reach independently. Announced in 2021, the institute aims to meet these goals through research, development, education, and, as in this case, faculty advancement.

Professor Michael Butros has been teaching physics and mathematics at Victor Valley College (VVC), a Hispanic-serving institute, since 2000. His passion for mathematics and enthusiasm to explore all educational opportunities landed him a spot as a participant in the first cohort of the AI4OPT Faculty Training Program.

The program, held at both Georgia Tech and Clark Atlanta University campuses, consisted of faculty members from Historically Black Colleges and Universities (HBCUs) and Minority Serving Institutions (MSIs) from states including Georgia, California, Texas, and Virginia. The three-year program is comprised of courses in artificial intelligence (AI), data science and course design. For Butros, the opportunity has proven to be both useful and beneficial.

“There were people who had Ph.D.s in computer science and people like me, who had never done any data science or computer programming in Python or Acorn RISC Machine,” said Butros. “Everything was great, and everyone was willing to help each other.”

## The Goal of Faculty Training Program

The Faculty Training Program aims to establish a minor or major data science program for each of the participants’ home institutions. Each participant will then set up joint research projects with AI4OPT researchers at Georgia Tech, UC Berkeley, and the University of Southern California to eventually host their own data science seminars and workshops.

“The training program not only benefits Georgia Tech. It’s a STEM pipeline for campus communities across



Van Hentenryck

the country,” said Pascal Van Hentenryck, director of the Faculty Training Program and AI4OPT. “This program creates a much more diverse and trusting environment, and we are trying to build this pipeline with various organizations, while also gaining the attention of bright-minded students. These students will become role models for other students and then they become faculty. We are fostering this virtuous cycle.”

Before Butros retires from VVC, he plans to further that cycle of STEM programs by applying for Georgia Tech’s Online Master of Science in Analytics (OMS Analytics), and also create a culture of data science research for undergraduate students at VVC.

“A lot of the students I deal with are going into engineering, pre-med, and computer science. Nowadays it’s very difficult if you don’t have any research

under your belt,” said Butros. “It’s going to be very difficult to expose our students to the latest technology, but we’re trying and that is why programs like the Faculty Training Program are a shining light for us because they are willing to share their facilities and resources.”

## About AI4OPT Faculty Training Program

The AI4OPT Faculty Training Program is the brainchild of AI4OPT Director, Pascal Van Hentenryck, A. Russell Chandler III Chair and professor in Georgia Tech’s H. Milton Stewart School of Industrial and Systems Engineering (ISyE) and Dr. Charles Pierre, a professor in the Mathematical Sciences Department at Clark Atlanta University and Advisory Committee Interim Chair. Participants of the program are hosted at Georgia Tech and Clark Atlanta University for the first four weeks where Pierre and his team provide training while AI4OPT researchers visit, give research talks and make connections. After the visit to Georgia Tech, the participants will continue training online for another four weeks to complete the first course. The multi-year collaboration will ultimately give participant basis to start AI and data science programs at their colleges and universities. • BREON MARTIN

*For general information about the AI4OPT Faculty Training Program, contact Cami Douglass, AI4OPT executive assistant at 404-894-5953 or via email at [camille.douglass@isye.gatech.edu](mailto:camille.douglass@isye.gatech.edu).*



# Senior Design

## Fall 2021 Expo

ISyE Senior Design team “Provision with a Vision” won the Capstone Design Expo award for the Best ISyE project. They worked with the on-board services group at Delta Air Lines to develop a data-driven methodology that determines the optimal amount of beverage items to load on a flight. The project motivation came from unused items adding extra weight to the aircraft resulting in excess fuel costs and carbon emissions. The team delivered an optimization model that takes into consideration passenger demand as well as an impact analysis tool which allows Delta to visualize how small changes in beverage quantities can have significant economic and environmental impact across the system.

Team members included Anneliese Conrad, Carolina Howell, Niral Jagtap, Ellie Johnson, Nico Knutzen, Sofia Laval, Brad Peterson, and Libbee Stallone. They were advised by Associate Professor Anton Kleywegt.

From among the ISyE teams, three were selected as finalists for the Best of ISyE Senior Design Competition.

Team “Shoulda Put A R(INGO)n i(T)” was selected as the first-place winner. The team partnered with Novelis, an aluminum manufacturing company, to improve ingot availability in its Oswego, New York, facility. The goal of the project was to ensure that when a customer makes an order, Novelis could supply the right ingots at the right time on hand to immediately start production. The team’s solution was to build an ingot “supermarket” that would increase ingot availability from 50



“Provision with a Vision” took the top prize among ISyE teams at the Institute-wide Capstone Design Expo.

percent to 90 percent and reduce overall lead time by up to 40 percent. To achieve this, the team created an optimization model that recommended the best replenishment strategy for each ingot SKU and used a simulation model to measure the impact of the supermarket on the production process. With this new tool, Novelis can dramatically increase their operational efficiency and save millions of dollars per year.

Team members included Tobin Abraham, Joseph Abrokwa, Elvin Chirackal, Joseph Cochran, Lorenzo Guerrero, Grace Anne

Muller, and Tim Ryan. They were advised by part-time Lecturer and Tennenbaum Institute Principal Research Engineer Douglas Bodner.

Finalist team “Can’t Stop, Won’t Stop, Bus Stop” worked with the Atlanta Department of Transportation (ATLDOT), a recently formed government entity tasked with promoting transportation infrastructure. The team worked to provide ATLDOT with a data-driven methodology to allocate funding to bus stop improvements and a platform for closer collaboration with MARTA. Only 7 percent of

bus stops (out of nearly 4,000) in Atlanta have shelters, which provide riders with proper seating, protection from weather, and ADA accessibility. The team's solution combines process design with an interactive web tool and a greedy heuristic web app. Through the team's solution, an additional 1.5 million trips per year will now originate at a sheltered stop. The City of Atlanta voted to back the project with a \$3.4 million non-fungible funding source.

Team members included Soobin Baek, Aaron Brown, Ananya Ghose, Sanghwa Lee, Sung Kyu Lee, Alea Legg, Hetu Patel, Tejas Santanam. They were advised by ISyE Lecturer Gamze Tokol-Goldsman.

Finalist team "Keep it Simply" worked with The Coca-Cola Company to minimize the overall cost of the distribution network of two recently acquired dairy brands: Fairlife and Simply Oat & Almond. The team provided a data-driven method of

formulating network expansion plans and determining safety stock levels by building and validating a mathematical optimization model that recommends not only the optimal distribution center (DC) opening location and timeline, but also the capacity expansion and safety stock level at each DC over a given horizon. This provided an annual value of several million dollars across the two dairy brands. To help Coca-Cola design the network expansion of any brand in the future, the team generalized the model to a standardized template wrapped within a user-friendly graphical user interface with three different model options.

Team members included Joseph Chanin, Yizhi Huang, Minrui Liang, Yufei Liu, Naren Reddy, Xinran Yu, and Emily Zhang. They were advised by Leo and Louise Benatar Early Career Professor and Associate Professor Alejandro Toriello. • DAVID MITCHELL

## Spring 2022 Expo

Team "Put A Ring On It" were selected as the spring semester's Capstone Design Expo winners for the Best ISyE Project. The team partnered with Tiffany & Co. to restructure their warehouse to lower high cycle times at the distribution center located in Parsippany, New Jersey. To improve the order fulfillment process, the team assessed the warehouse and determined that the problem was caused by ad hoc slotting and build-up of "Value-added Services" stations. The result of this bottle-necking is attributed to items going through an additional layer of alterations, such as laser engraving and price-tagging. The team determined that there were two efficient solutions: re-slotting the items in the warehouse and wave planning.

Collectively, they created an optimization model with 1.6 million decision variables and 1.7 million constraints and a heuristic model to allow the client to dynamically find the most optimal location for each item. Once the group re-slotted items filtered by how often they were selected, they developed an application for the client to run the models independently for one year. Along with this recommendation, they offered additional criteria for the waves of items moving through the warehouse at a time, such as grouping by shipping carriers and adding a capacity on the number of items that need to go through Value-added Services. The two solutions of re-slotting and wave planning will provide a supportive process that can be managed for future inventory obstacles. The team delivered the simulation and sequence table to the client, which included additional data and justification for their methodology.

Team members included Shreya Desai, Ozashwee Ghimire, Fares Hasan, Saman Muhammad, Will Reich, Neha Srivatsa, and Asli Yucebilgin. The team was advised by Dr. Gunter Sharp and worked with client sponsor Stephanie Brumby. • CAMILLE C. HENRIQUEZ



"Keep it Simply" worked with Coca-Cola to formulate network expansion plans.





"Put A Ring On It" was the Best ISyE Project at the Spring 2022 Capstone Expo.

## Runners Up



**Santa's Industrial Helpers** partnered with Empty Stocking Fund, a 501(c)(3) nonprofit that serves disadvantaged children in the metro Atlanta area. The team reengineered the order fulfillment process to increase the capacity of the operation and reach thousands more families before Christmas Eve. The solutions allowed the client to better serve their beneficiaries and remain flexible for growth, as they hope to increase the number of children served by 75 percent in the coming season.

Team members included Etienne Batiste, Haoxuan Huang, Schuler Kleinfelter, Peyton Kliewer, Madison Luney, Asha Redhead, and Jaylen Williams.



**Saia-zing Up** worked with the Industrial Engineering team at Saia LTL Freight to aid in their terminal expansion implication process. Saia has set out an aggressive growth goal of opening 10-15 terminals in the next year. The model simulated a quantification of network changes as a result of additions to Saia's network, including operational, freight flow, and cost. The system model provides Saia with proactive, data-driven insight to the impacts on their network during their terminal expansion.

Team members included Joey Abi-Sarkis, Abhishek Mattipalli, Maya Menon, Jay Patel, Santhosh Saravanan, Abhinav Sehgal, Pooja Sharma, and Yashvarman Singh.



**Truck Yeah!** worked with Convoy to identify solutions to decrease the rate of conflicting appointment time (CAT) exceptions that happen during shipment pick-up and drop-off. They analyzed specific attributes of shipments that were more likely to experience CAT exceptions and conducted further quantitative and qualitative research to confirm their findings. The team then presented Convoy with recommendations for improvements to the internal UI platform, communication processes, and automated rescheduling process to reduce the number of CAT exceptions over the long term.

Team members included Erika Acon, Neel Edupuganti, Alfredo Gateno, Alejandro Hernandez, Jason Lu, Rohit Ramachandran, Akash Shah, and Vy Tran.



# Engineering

*for*

# HUMAN

# NEEDS

Engineering plays a critical role in addressing the daily needs and challenges faced by our communities. By focusing on human needs, engineers aim to design products, systems, and services to improve and prioritize people's well-being — which creates solutions that address their most pressing needs. The launch of the MARTA Reach pilot, a six-month, on-demand ride-share service partnered with Georgia Tech, is a prime example of how engineering can improve individuals' lives by providing convenient and accessible transportation options. This application's objective was to increase efficiency, attract new users, and solve the "first-mile, last-mile" issue faced by residents who don't have easy access to transportation. This type of service is now being evaluated as a tool to continue investing in building a more inclusive and equitable society by providing access to essential services and opportunities for all individuals, regardless of their background or socio-economic status.

# MARTA and Georgia Tech Team Up to Give Passengers a “First-Mile, Last-Mile” Solution

When LaQuetta Ferrell learned about MARTA Reach, an on-demand pilot ride-share service in Atlanta, she eagerly started using the service that same day.

Ferrell’s commute to and from work had become a slog. She was getting up at 4:30 a.m. on weekdays to catch a bus and train to get to her job in downtown Atlanta by 7. She had to walk uphill and several blocks to the bus stop, wearing a brace for a worsening knee issue. Her knee hurt, and on days when the heat descended on Atlanta like a stifling blanket, she’d arrive home soaked in sweat. The one-way trip took 45 minutes on a good day but sometimes up to an hour and a half, versus the 15 minutes it would take to drive to work if Ferrell had a car.

MARTA Reach, a six-month pilot launched in March by the Metropolitan Atlanta Rapid Transit Authority (MARTA) in collaboration with Georgia Tech, offered both convenience and a shorter commute. Each weekday morning, Ferrell called for a ride through an app on her phone, and a MARTA Reach shuttle picked her up across the street from her home and took her to a MARTA train station.

On the way home, she’d call for another ride from the train station and usually got picked up in less than five minutes, instead of waiting sometimes an hour for a bus.

“MARTA Reach really came in handy for me,” says Ferrell, an administrative assistant at the U.S. Environmental Protection Agency. “It’s great for me. It works well.”

## Improving Convenience

MARTA and Georgia Tech launched the pilot to address what’s known as the “first-mile, last-mile” issue facing many residents like Ferrell, who don’t have easy access to a bus stop or train station. During the pilot, which ran from 6 a.m. to 7 p.m. Monday to Friday through August,



Passengers in the MARTA Reach pilot could call for a ride from the app.

users could call for a MARTA Reach ride by app or phone. A ride cost \$2.50, the same as a regular MARTA fare, and transfers were free. All MARTA Reach vehicles, repurposed from the agency’s paratransit service for people with disabilities, are wheelchair accessible.

The pilot was initially launched in three zones and expanded in May to include several other neighborhoods. In collaboration with Georgia Tech, MARTA chose zones that were different from each other, seeking to determine how on-demand transportation would work in a residential area versus a mixed-commercial one or a more industrial location. Would riders be using the service mostly to get to work? To go shopping? Meet friends? The goal was twofold: to improve service for existing

MARTA users and ideally, attract new users who might opt for transit over driving if it’s convenient enough.

Demand grew quickly, from fewer than 100 rides weekly when the pilot launched to more than 600 in early August. By late August, when the pilot ended, MARTA Reach had served more than 8,300 passengers and was projected to hit 1,250 rides weekly if the service had continued into September.

MARTA is now evaluating data from the program to understand how riders used it and determine, as the agency undertakes a redesign of its bus network, whether to extend the pilot or make the service permanent. Anthony Thomas, MARTA’s program manager for customer experience innovation, says preliminary data showed that many riders, like



Pascal Van Hentenryck at the launch of the MARTA Reach program.

Ferrell, were using the service regularly.

“People are really excited about the program,” he says. “And we have been very excited about the uptake in service. We see lots of riders as well as very committed riders, individuals that were taking multiple rides a day, every day.”

And though MARTA Reach was designed to carry passengers relatively short distances, that convenience can make a profound difference in people’s daily lives, Thomas says.

“On paper it might look like, oh, that bus is pretty close. It’s only a 10-minute walk,” Thomas says. “But when you’re on the ground and it’s 95 degrees or you have groceries or you have kids with you or a stroller, that 10-minute walk becomes a barrier for folks, and they might just decide to hop into a car.

“For people who are on the lower-income spectrum, having to afford a car is a big burden. So being able to replace that trip with a \$2.50 trip with MARTA is, I think, something that is extraordinarily powerful and very beneficial to the communities we operated the service in.”

### Thinking Bigger

The origins of MARTA Reach date back a decade, when ISyE’s A. Russell Chandler III Chair and Professor Pascal Van Hentenryck was leading a group of researchers in Australia focused on using data science to solve major challenges in areas including public transportation. Working in Canberra, Australia’s capital, the team at NICTA – Australia’s national information and communications technology research

center – noticed taxis going back and forth from the airport to the Parliament building and many buses that were running empty or with few passengers.

The researchers envisioned a system that would remove some of the empty buses and instead use taxis to connect passengers with high-frequency buses. The group did some early planning, and when Van Hentenryck returned to the U.S. to work at the University of Michigan, he launched a ride-share pilot that offered free transportation on shuttle vans around campus and to several surrounding neighborhoods. Van Hentenryck and a team of students built an app for the service, which ran for four months in 2018.

“It was amazingly successful,” says Van Hentenryck. “It was only running





Van Hentenryck believes the MARTA Reach model could be replicated in other cities to connect riders with rapid transit bus or train service. The application architecture is ready to scale to other metro systems if and when needed, without the need for a huge investment in staff or infrastructure.

potential solution. He and his students had secured a \$1 million grant from the National Science Foundation to develop an on-demand ride-share system. Drawing on the University of Michigan pilot, Van Hentenryck's team would build out the technology and apps needed for the service and partly subsidize its operation.

Van Hentenryck and a team of about seven Ph.D. students developed an Azure-based suite of technology for the pilot, including a routing system and separate apps for riders, drivers, and the administrative system.

Azure enabled the automation of some tasks that would have been difficult to build from scratch, but since the system was new, there was no data to inform machine learning algorithms. The team quickly learned there were variables they hadn't accounted for — in particular, driver behavior.

For one thing, MARTA Reach drivers drove more slowly — *much* more slowly — than Van Hentenryck had anticipated. That was great from a safety perspective, but it required the team to adjust the system accordingly. And in the early days of the pilot, drivers had few passengers and would sometimes not be paying attention to alerts about ride requests, so the team added functionality to quickly reallocate another vehicle when a driver was unresponsive.

"It's human nature that if you're sitting idle for 20 minutes, you're going to zone out," says Connor Riley, a former Georgia Tech student who worked on the pilot with Van Hentenryck. "We had to do things to make sure that when a request came in, a driver had the information and was alerted to that request so that performance didn't suffer."

In response to feedback from passengers and MARTA, Van Hentenryck's

team added additional shuttle stops to the system and several new features, including a trip history so riders can easily repeat a route by clicking a button, and the ability to enter an address and find the nearest stop. The team also developed functionality for MARTA dispatchers to request rides for passengers who wanted to call rather than using the app.

Over time, patterns emerged. Rising before 6 a.m. to monitor MARTA Reach rides real-time on a dashboard, the Georgia Tech team noticed many passengers traveling the same routes daily; Van Hentenryck estimates about 60% to 70% of MARTA Reach trips were commutes to work. Other regulars used the service for shopping, with Walmart and Kroger stores among the most popular destinations.

Transit agencies around the country have grappled with a shifting landscape impacted by competition from ride-share services such as Uber and Lyft, lower ridership during the Covid-19 pandemic, and labor shortages. Agencies in several other cities, including Los Angeles and Salt Lake City, have also launched on-demand ride-share services.

Van Hentenryck believes the MARTA Reach model could be replicated in other cities to connect riders with rapid transit bus or train service, in large part because it was achieved by just a handful of students working in cooperation with Microsoft. The application architecture is ready to scale to other metro systems if and when needed, without the need for a huge investment in staff or infrastructure.

"I think the biggest potential is going to be in mid-size cities, where you can connect people with a backbone of rapid transit using shuttles," Van Hentenryck says. "I think that's where the market is." • DEBORAH BACH

from 6 p.m. to midnight, but we had 400 students using the system every day."

That success led Van Hentenryck to think bigger — about combining public transit with an on-demand ride-share service for Atlanta residents lacking access to transit. A sprawling metropolis with the ninth largest metro area population in the country, Atlanta has a network of MARTA bus routes linked to a rapid transit train system with 38 stations. But providing transit access for the region's nearly 6.1 million residents is a pressing challenge as Atlanta continues to grow. Buses don't serve the entire region, and some routes are underutilized.

Leaders at MARTA had been thinking about how to address the first-mile, last-mile issue when Van Hentenryck approached the agency in 2021 with a

# Exploring the Use of Operations Research in Concussion Diagnosis

**A**ssistant Professor Gian-Gabriel Garcia, who joined ISyE after a year as a postdoctoral fellow at Harvard Medical School, loves sports. Whether it's watching American football or playing golf or tennis, he draws plenty of entertainment from those athletic diversions.

He also draws plenty of inspiration for his work.

"I was an undergraduate at the University of Pittsburgh trying to apply for the National Science Foundation Graduate Research Fellowship Program, and I was trying to propose some work that was really unique," he said.

He knew he wanted to do something in the realm of health care and operations research. He had seen plenty of work on chronic diseases like heart attacks, strokes, or cardiovascular disease, but he was looking for something perhaps somewhat untapped in the vast world of research.

So, he thought about what he knew.

"I was watching tennis and thinking about injuries," he said. "In that sport, you're usually playing a single-elimination tournament. Once you say you're out of

this one, you're done for the tournament. So, that means you give yourself more time to recover, but it also means your chances in this one are over."

His faculty advisor at the time took this inspiration and mentioned one specific area of injury — concussions, an area of research that was in its relative infancy. Garcia realized the opportunity to examine something without a real gold standard for diagnosis and offer new ideas and approaches.

## Challenges in Concussion Diagnosis

Garcia was thinking back to some of the work he had done at the intersection of health care and operations research. Drawn to a field known as "medical decision making" where people use the available tools in operations research to try and model questions about things like thresholds for diagnosis of certain diseases, he realized that in some instances — concussions, especially — there's no objective biomarker for clear determination. And even if there is a biomarker, he explained, there's usually not one cutoff that indicates that once you meet a certain criterion you have it or don't.

"That's optimal," Garcia said. "In medicine, maybe you go to your primary

care physician, and they test your blood pressure. The reading shows a number above this threshold, so now you're considered hypertensive."

That isn't true in the case of concussions.

For one, there is rarely, if ever, a clear objective biomarker. Concussion assessment is based on self-reporting of the individual or subjective cognitive assessment by a trainer or physician. Sometimes these tests are administered when the injury is in an acute stage — symptoms are flared up and cognitive deficits near their maximum. Other times, trainers may be attempting to decide whether an athlete can return to play and what the risks of reinjury will be.

"What are the tradeoffs between protecting the patient from going back prematurely versus, in the case of professionals, returning to an activity that is their career, that pays their bills," Garcia said.

Operations research, he figured, could help.

## Combining Data for More Accurate Diagnosis

It's clear to Garcia that there exists no gold standard that can offer clear diagnosis of concussions. Likewise,



**There is rarely, if ever, a clear objective biomarker. ... What are the tradeoffs between protecting the patient from going back prematurely vs. returning to an activity that is their career?**



CAMILLE HENRIQUEZ

there's no clear threshold that an athlete can meet to indicate fitness to return to action. Trainers rely on honesty of reporting and their own judgment based on years of study and experience.

Still, wouldn't combining all the data offer a much more accurate assessment?

Garcia and his collaborators studied that early in his interest in the field. It was understood, he said, that a multidimensional approach was better than examining any one risk factor in a vacuum. To what degree, though, he wondered did that offer an improvement.

"The first paper I wrote, our goal was just to quantify that," he said. "What is the value of combining things

and having this multidimensional assessment? We found a difference in accuracy in about 20 percent."

A significant leap.

Armed with that information, now Garcia and his collaborators can pursue more robust data in other areas: What about demographic data? How does sex affect diagnosis decisions given similar measurements? Which assessments matter most? How quickly and effectively can we help this individual return to competing in athletics or doing their jobs in other domains?

"Our primary contribution is that the model we came up with is simple enough that if you wanted to put it

in an Excel spreadsheet, you could," Garcia said. "You can take some of these various measurements, plug them in, and the model can estimate the relative risk of having a concussion."

In the future, this might find its way into a mobile application, something that trainers could use on sidelines for timely diagnoses in the face of intense pressure to get the decision right. It's not to replace trainers or clinicians, Garcia insisted.

"We still want them to use their judgment," he said. "This isn't a shortcut. We want these new approaches to help them make assessments more quickly and more accurately using all the information available to them." • DAVID MITCHELL



# Helping Houses Become Homes

A team of Georgia Tech students, including one from ISyE, designed a renovation to a 102-year-old house to achieve net zero energy

**S**tewart School of Industrial and Systems Engineering master's student Samantha Morton was skeptical as she looked down the length of Atlanta's English Avenue. The street was filled with older houses, many in need of great care.

*None of these are going to work,* she thought.

Most of these houses lacked basic features that would make a home hospitable. How could they be expected to retrofit one of these homes to net zero?

"I wasn't intending to be overly cynical, but I was worried we were taking on a greater challenge than even the competition intended," said Morton, a member of Georgia Tech's multi-disciplinary team in the Department of Energy's Solar Decathlon. "I thought it was, perhaps, one we could not meet.

"The line between renovation and completely gutting a building is gray, and I wasn't sure how much of the existing house we could confidently save. If we're trying to show that a renovation is feasible then are we true to ourselves if it's mostly a new project?"

They settled on a 102-year-old home in dire need of an update. Or perhaps "update" doesn't adequately encapsulate what the project called for. The house, Morton said, was completely unlivable in its current state. Open to the elements, it was in dire need of repairs and weatherization, and amenities like a water heater where a previous one was removed.

Against all initial challenges, however, the team developed a design that won the Renovation division and went on to win the grand prize for the entire residential division at the Decathlon.

Calling upon her background in building science and five years in consulting, as well as some information learned in Professor Valerie Thomas' Life Cycle Analysis class, Morton and her teammates were able to implement a strategy that has potential for real-world impact. It's something Morton has been building toward as far back as she can remember.

## Seeking Sustainability

Morton has always been captivated by the concept of sustainability. Like her own two hands, the desire to learn about, understand, and ultimately make a difference in that domain has always been a part of her.

"It's kind of cliché to say you've always been interested in something," she said, "but I have been. I was involved in environmental stewardship and



RENDERING COURTESY: ENGLISH AVENUE YELLOW JACKETS/SCHOOL OF ARCHITECTURE

**“This isn’t just about winning a project. It has to be about actually changing lives. You may look at a house and say it’s just a building, but it’s more. It’s shelter. It’s comfort. It’s stability.”**

— SAMANTHA MORTON



Samantha Morton (second from left) with the English Avenue Yellow Jackets team. SOLAR DECATHLON/DOE/ENERGY.GOV

sustainability growing up from high school to college. Even before high school.”

She remembered back to a time when she was president of the environmental club as a high schooler at Riverwood International Charter School. Even long before that, at 9 years old, she forced her parents to throw out their microwave because she didn’t like the extra packaging and film associated with single-use meals.

She interned at the sustainability office at the University of Georgia, where she spent her undergraduate years studying environmental economics. She consulted for a few years after earning her bachelor’s degree, spending time at Atlanta-based nonprofit Southface, which focuses on the research, design, and implementation of a regenerative economy.

She found herself daydreaming about the differences that could be made by businesses if only they would adjust their operations to reduce energy consumption.

It was here she discovered industrial engineering.

“I found a definition somewhere that industrial engineering was the study of reducing waste,” Morton said with a smile. “I was like, ‘Oh, I know they don’t mean that the way I think of, but waste is waste, so

what if I could make those connections and apply them to what I was interested in?”

In ISyE, she’s discovered optimization. Admittedly, it was a new idea to her.

“I hadn’t previously thought of how many more efficient ways there can be to solve these problems of limited resources,” she said.

It was that willingness to look through a different lens at the same types of challenges she’s looked at for years that helped her identify solutions on English Avenue.

### Solutions Towards Stability

To achieve the net zero retrofit — net positive, actually, by the end of the project — the team provided solutions for rainwater harvesting and graywater reuse, a financial model that included land trust subsidies and an additional 60 years’ worth of projected weather data that proved the house would stay net positive even in cases of extreme weather.

“It was important that if we were trying to show that a renovation is feasible, then we needed to be true to ourselves and develop something that can be applied in reality,” Morton said. “At first, I looked into this through a lens of too much reality: ‘This can’t work. We’ll be down

to the studs.’ I think one of the most rewarding parts was just taking a deep breath and thinking that we were doing something not necessarily rooted in the reality of contractors today, but in what could help for the future of construction.”

For Morton and many on the team, the future includes continuing this project. Many who compete in competitions like the Solar Decathlon complete their work, earn their prize, and move on to the next challenge. Instead, the team was approached by individuals within the Department of Energy who encouraged them to continue to move the project forward.

The next steps vary: Build the house as a proof of concept, which was beyond the scope of the design challenge. Take that model and expand to the rest of the English Avenue neighborhood. Show how this neighborhood can be replicated in other neighborhoods in the southeast and potentially throughout the country.

“This isn’t just about winning a project,” Morton said. “It has to be about actually changing lives. You may look at a house and say it’s just a building, but it’s more. It’s shelter. It’s comfort. It’s stability.” • DAVID MITCHELL

# Building Back Georgia's Logistics Workforce

ISyE researchers will improve the supply chain and logistics workforce in four corners of the state thanks to a new grant secured through the Build Back Better Regional Challenge

**W**hen Tim Brown became the managing director for the Supply Chain & Logistics Institute (SCL) at Georgia Tech in 2013, he noticed that the interdisciplinary research center had become somewhat distanced from its home university.

It had centers in Panama and Singapore and was continuing to grow its presence internationally. But when Brown looked closer to home, he saw too many resources right outside their own front door not being taken advantage of.

"We have Home Depot and Coca-Cola and so much within the state with regard to supply chain, and we weren't engaged with any of it," Brown said. "We wanted to focus deliberately on strengthening our ties to Georgia Tech, to the state of Georgia, the United States, while also keeping our international reputation."

Fast forward nearly a decade, and that's exactly what SCL and its home unit, the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), has done. Recruiting improved. Cooperation with other units, leading to over 100 faculty members across Georgia Tech's campus, did too.

And all of that is what led to one of the biggest announcements in SCL's history early last fall.

Along with four other schools represented from the College of Engineering and 13 partners around the state, ISyE researchers were part of a new \$65 million grant from the U.S. Department of Commerce's Economic Development Administration. Announced by President Joe Biden on Sept. 2, the awardees were selected as one of 21 Phase II grants in the \$1 billion Build Back Better Regional Challenge competition, part of the Investing in America's Communities initiative under

**"We're in a state school in a state that is all about supply chain and logistics, and we're the Supply Chain and Logistics Institute. It's something we're supposed to do, and we've got the pieces."**

— TIM BROWN, MANAGING DIRECTOR OF THE SUPPLY CHAIN AND LOGISTICS INSTITUTE



the American Rescue Plan Act of 2021.

Money in hand, now ISyE's researchers are turning to a handful of ambitious goals: modern workforce development and developing new technologies for artificial intelligence and manufacturing.

## Training for Tomorrow Today

For the everyday person, "the supply chain," historically, was often just an empty term. Most people shop for groceries or purchase a new car without considering the procurement, production, and distribution of these products.

A car needs steel, an engine, plastics, carpeting, leather seats, rubber tires, and so much more. A consumer typically just pays the money, drives off the lot, and doesn't think too deeply about how all those separate pieces came together into that vehicle that ended its journey in their driveway.

Until, perhaps, the Covid-19 pandemic when that chain came to a screeching halt. "Everybody realizes now that supply

chain is a term," Brown said. "You can't just have plants, the plants need to have materials coming into them, they need to have chips, they need to have boats and trucks, they need to have the logistics network feeding them."

And they need to have more people who understand these things, especially in an increasingly digital and automated world, to help keep the process moving. That's where SCL, ISyE, and their partners come into play.

Among all the projects, their chief focus lies beyond manufacturing, a primary focus of other projects within the grant. They'll look at procurement, logistics flows between plants and distributions centers, planning, and more.

A key part of that will be increased engagement, education, and workforce development in four key sectors of the state:

- Savannah — a natural choice because of the volume of logistics needs present. It is one of the nation's





ALBANY



DALTON



GAINESVILLE



SAVANNAH

premier ports and has seen an uptick in manufacturing in the area. A target audience for workforce development is also the military, which Savannah features as well.

- Dalton — an inland port. Brown also considered the flooring industry, which has a large foothold in the area. Flooring has also been an industry that has been somewhat resistant to changing dynamics both in production and in the economy. Brown hopes that projects like this can help nudge companies that haven't invested much in new technologies in that direction through new training, proofs of concept, and academic support.
- Gainesville — gaining a new inland port in the area to support the poultry industry. Also, many big box Amazon facilities have grown in the area, driving larger need for logistics support.

- Albany — an area that has suffered much in recent years, from natural disasters (a hurricane and tornado) to a massive hit from a Covid-19 outbreak early in the pandemic. Brown called it a “plagued area” that can benefit greatly from education and development.

“I do a lot of workforce development down there,” Brown said of Albany. “We train students on logistics topics and other faculty work with the Georgia Tech Research Institute on simulation of new processes like 3D printing and drones for inventory control.”

#### Targeting the Middle

Brown said projects will target middle managers to create change agents within their respective environments. Giving exposure to new capabilities in artificial intelligence and other new technologies can teach them ways to improve their operations, which they can in turn sell to executive management.

Courses will likely be a mix of business case development, exposure to emerging technology, and project management.

In each area, cohorts of students will be able to take courses and earn certificates. Potentially, they might have opportunities to work on real-world projects like those done by ISyE students for senior design.

Courses will offer development on both the physical and digital. On the physical side, it will increase the number of people who can operate robotic manufacturing or transport equipment, making their jobs more secure and supply chains more resilient. On the digital, individuals will learn how to use planning tools, perhaps many with AI applications that must be coded.

“Something like this is why we're here,” Brown said. “We're in a state school in a state that is all about supply chain and logistics, and we're the Supply Chain and Logistics Institute. It's something we're supposed to do, and we've got the pieces.” • DAVID MITCHELL

### Artificial Intelligence Manufacturing Pilot Facility

A large portion of the grant will transform the Advanced Manufacturing Pilot Facility into the Artificial Intelligence Manufacturing Pilot Facility. It is a 24,000 square-foot facility located on 14th Street that is a test bed where research results are scaled and translated into implementable technologies.

CANDLER HOBBS



# Establishing Connections, Improving Electrical Outcomes in Rwanda

A trio of research projects centered on electricity challenges in Rwanda were the beginning. Now, there are new projects that promise impact on cooking options and give ISyE students a chance to study abroad in the country

ISyE Professor Valerie Thomas was working in her office one day when a man walked in to ask about the work that she and her students had been doing in Rwanda. The man, Paul Rugambwa, was a visiting research scholar at Georgia Tech and, as it turned out, part of the Ministry of Infrastructure in the country.

That chance encounter has helped transform the initial research that Thomas and three of her Ph.D. students had pursued at home into new research projects that could bring safer and more energy efficient cookstoves to schools across Rwanda. It is also the foundation upon which a new study abroad program is built.

It began with Todd Levin, once one of Thomas' Ph.D. students and now an energy systems engineer at Argonne National Laboratory. Levin was interested in electricity development in underdeveloped countries and had developed a model that he wanted to apply in a test location.

"He asked me where he should apply it," said Thomas, the Anderson-Interface Chair of Natural Systems. "I said I didn't care so long as it was a country where they didn't yet have an electric grid."

Levin went with Rwanda. It was a smaller country, one for which his personal laptop would be capable of running his model. Also, because he had already run a case study of Rwanda, he had data on power plants, costs, population, and more.

Not long after, another student — Amy Musselman, now with Lawrence Livermore National Laboratory — expressed interest in working on a similar topic. Yuang Chen, now an assistant professor

at Georgia Tech Shenzhen Institute, came along shortly thereafter.

Each had different takes on the unique challenges the country had, particularly in the development of its energy grid, but they offered diverse new approaches.

"In a country like Rwanda where not everyone has electricity yet, how can that be provided?" Thomas said. "That's what they were all focused on solving."

It was all this work that brought Rugambwa into Thomas' office. Through Rugambwa, Thomas has found a new project. Working with Liliane Uwabyaye, an instructor at the Rwanda Polytechnic Colleges, they are looking to address a challenge with cook stoves in the country.

The standard way of cooking in Rwanda is over an open fire, but that poses a couple of issues. One, there is a wood shortage in the country. Wood is expensive and less accessible. Two, the particulates given off by the fire pose a health hazard to anyone breathing them in.

Uwabyaye had designed a more efficient cook stove that was being distributed to thousands of schools across the country, but it also uses wood. This has driven their collaboration to find better, safer, and inexpensive options.

"It's a very good project," Thomas said. "What I think is great about it is that, first, we're working with a designer there, a mechanical engineer, who is working at a college. So, we're partnering with people at a university. And it's supported by the Rwandan government already to help put them into schools.

"Because it is so embedded in the educational system and institutionalized, it is more promising than just design-

ing a stove and trying to connect with households. That's a challenge. This offers us a chance to have real impact."

Through all the work, Thomas eventually concluded that there was a larger opportunity for her students to participate, as well. She had taken on a couple of advisees from the African Center of Excellence in Energy for Sustainable Development. It is a Ph.D. program sponsored and supported by the World's Bank and based at the University of Rwanda.

Given the connection, she began to devise a way to get students at Georgia Tech an opportunity to travel to Rwanda. The Rwanda Study Abroad Sustainable Development Program was set to launch during spring break of 2020 before the Covid-19 pandemic forced them to postpone travel. This spring, however, the program will finally get off the ground.

"We are offering specific classes that will be part of the study abroad," Thomas said. "It will be open to undergraduate and graduate students if they take the right classes."

She hopes that the opportunity will encourage more students to connect on projects in the country, particularly the cookstove project which she said needs more participants. • DAVID MITCHELL

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*Partner units at Georgia Tech on the study abroad program include the George W. Woodruff School of Mechanical Engineering and the College of Design's School of City and Regional Planning. Students interested in either study abroad or the cookstove project should contact Thomas at [valerie.thomas@isye.gatech.edu](mailto:valerie.thomas@isye.gatech.edu).*





CAMILLE HENRIQUEZ



Top Left: Professor Valerie Thomas.

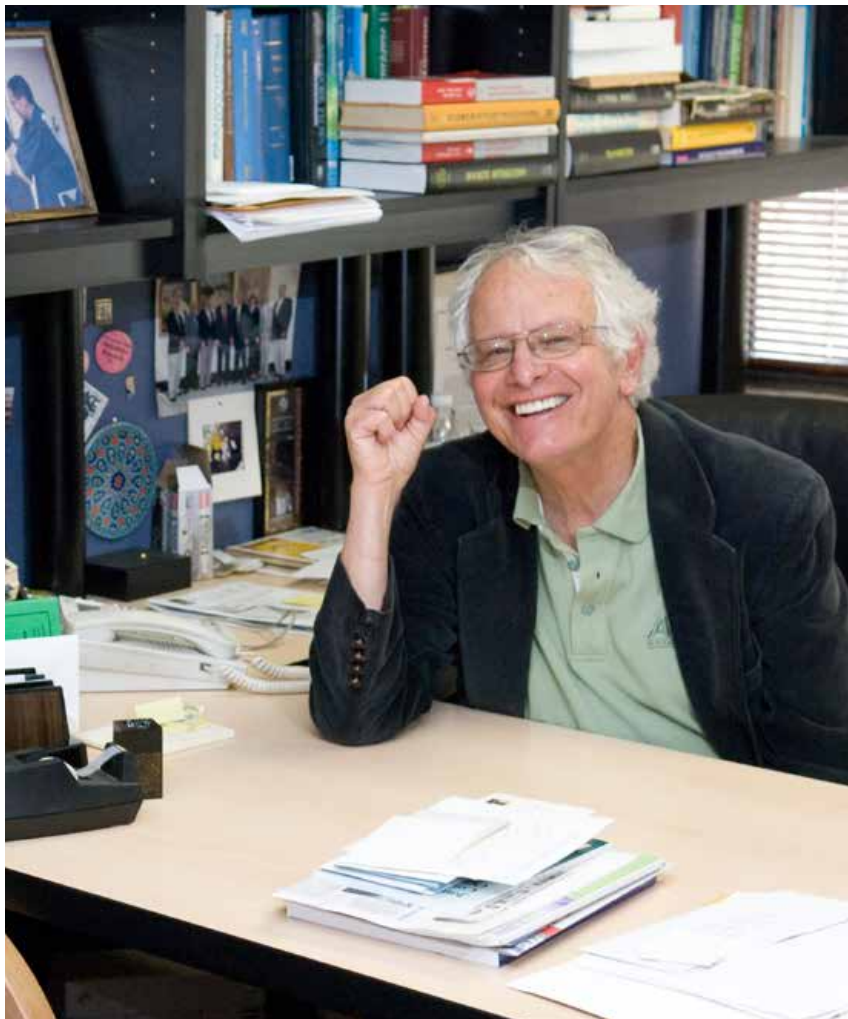
Right: Vestine Makahalisa (right) is the headmistress of the Gahanga II Primary and Elementary school that is working with ISyE to test institutional stoves. Charles (left) is the cook.





# George Nemhauser's Farewell to Tech: A Toast to his Research and Fellowship

George Nemhauser, a renowned faculty research professor in the field of Industrial and Systems Engineering, recently retired after a successful career of 60 years in research and higher education. In honor of his legacy, his former Ph.D. students established a fellowship in his name, raising over \$170,000 to award annual fellowships to students.



ROB FELT

The H. Milton Stewart School of Industrial and Systems Engineering (ISyE) at Georgia Tech celebrated the retirement of one of its most esteemed long-tenured and distinguished faculty members, George Nemhauser.

In April, Nemhauser was recognized for his continued legacy in academia and research and was presented with a fellowship in his name, established by his Ph.D. students. Collectively, they raised over \$170,000 for the endowment which will continue to provide fellowships to students annually in the program.

With more than 60 years of committed research within higher education, Nemhauser has served various roles and dedicated his career to the growth of ISyE.

Nemhauser has an extensive career which began when he enrolled in City College of New York (CCNY), where he earned a degree in chemical engineering. He went on to continue his education and pursued operations research (OR) at Northwestern University which pivoted his career and led him to build an impressive portfolio, serving as faculty at John Hopkins University, Cornell University, and Georgia Tech. Nemhauser's career shifted once again when he joined ISyE, where Michael Thomas, the School Chair ('78), reiterated to Nemhauser that he "would play a substantive role in looking for opportunities to shift ISyE's trajectory." With the end goal of expanding and growing interest in the program, transformative change was created by Nemhauser, as he produced results that elevated the structure and visibility of ISyE.

During his time, one of the essential decisions that Nemhauser made was including pedagogical within ISyE, which ultimately inspired a new set of courses in optimization and stochastics. This action soon led to Nemhauser becoming one of the foundational organizers in the creation of the Algorithms, Combinatorics, and Optimization Program (ACO), a joint doctoral program supported by ISyE, the School of Mathematics, and the College of Computing.

Tom Magnanti, Institute Professor, former Dean of Engineering at MIT and National Academy of Engineering (NAE) member once said "It is unusual for any academic program, like Georgia Tech's ISyE, to become top-tiered in a short period. It is no coincidence that this rise has taken place in parallel with the arrival of my dear friend, George Nemhauser.



Quality follows him wherever he goes and in whatever he does, and the presence of someone of his stature and infectious disposition at ISyE has shined a beacon onto the academic community and been a magnet for attracting top-flight faculty and doctoral students that are essential to any leading academic program.”

In addition to his teachings, Nemhauser had a great influence on expanding credible faculty placement in the program which further motivated the discussion and need for investment in operations research and industrial engineering. His work with ISyE continues to attract arguably some of the world’s best and most innovative Ph.D. applicants and faculty candidates around the world. Along with his grit and dedication, Nemhauser naturally spreads positivity to all facets and members within the industrial engineering community which formed his own reputation that speaks to his character every day. His influence not only enhanced the environment in ISyE but

**“It’s the students who have been my greatest accomplishment. All of my Ph.D. students, there’s no doubt about that, the whole career. Having all these great students and seeing that they’ve appreciated me as well – that’s what it’s all about.”**

— GEORGE NEMHAUSER

also encouraged like-minded candidates to compete and win prestigious awards for their impactful research. Fundamentally, Nemhauser’s energy and intellect pushed the program to success incredibly, which has been an abundance since his arrival at Georgia Tech. • CAMILLE C. HENRIQUEZ



# Undergraduate Putting Her Stamp on ISyE

Sydney Mudd was working her way through her junior and senior years at Parkview High in Lilburn, Ga., when she started to feel that pressure. It's the same pressure most high schoolers begin to feel when the first of their friends start to make college selections, setting out plans for their majors and, it felt like, their entire lives.

"You have to choose a school," she said, thinking back to those formative final years before moving out of her parents' house and into the great unknown of higher education. "I'm 16 or 17 years old, and I'm supposed to be choosing what I'm going to do for the rest of my life."

Even though she wasn't ready to lay out a mental itinerary for the next 50 years of her life — and, really, who is? — Mudd did something so simple, and yet so difficult for so many.

She asked questions.

She spoke to teachers and advisors, older students, anyone with an ear and experience who could offer some direction on how they got into their degrees or professions. When she came to Georgia Tech in 2020 in the midst of a global pandemic that made her initial college experience far different than most she had talked to, she still didn't know exactly what she wanted. But she also knew that part wasn't as important just yet.

"I realized everyone's journey is different, so I just have to focus on mine," she said.

Flash forward a little over a year and a half. Mudd has transitioned from a mechanical engineering major to industrial engineering (IE), gone through an internship with UPS, started a club for minority students within industrial engineering called Black IEs at Tech, served as the undergraduate representative for ISyE's Diversity, Equity

**"One day, I hope to start my own foundation. I was given opportunities others weren't, and I feel a moral obligation to help those who don't have the same privileges I do."**

— SYDNEY MUDD

& Inclusion committee, served as the advisor for Emerging Leaders, a first-year leadership organization, connected with peers through the National Society of Black Engineers, and, most recently, been named a Stamps President's Scholar.

## A Stamps Scholar

Damon Williams, a senior lecturer and the director of the Center for Academics, Success, and Equity (CASE) in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), received an email asking if he had anyone to recommend for the walk-on process for the Stamps President's Scholar program at Georgia Tech.

Established in 1981, the program recognizes the most promising first-year students based upon excellence and potential in scholarship, leadership, progress, and service.

Williams already had a name in mind.

"After working with her for a few months, I was already beyond impressed with Sydney's leadership skills and passion for everything she does," Williams said. "When I was asked for nominees for the scholarship, she was truly the first student I thought of."

Mudd met with Chen Zhou, an associate professor and associate chair for undergraduate studies in ISyE, to discuss the nomination. Despite some nerves as she entered Zhou's office, where she expected a formal interview, she was quickly treated to an easygoing conversation.

"He genuinely just wanted to get to know me," Mudd said. "We just talked about what I was interested in, things I was passionate about and where I hoped to make a positive impact, specifically with regard to hunger and homelessness."

"After that conversation, he gave me the nomination."

More rounds of interviews followed, including with E. Roe Stamps himself.

"I almost had a breakdown from nerves," Mudd said, calmly and with a smile now, long after the decision had been made. "But it was so smooth."

At the end of the final interview, she was told she got the scholarship, which — in addition to the mentorship, recognition, and academic opportunities — offers a full-ride scholarship.

"It's amazing," she said.

"I started crying."



CAMILLE HENRIQUEZ



### Entrepreneurship and Giving Back

Although the Stamps scholarship may arguably be the biggest boost she gets for her college career, her pursuits don't end at that sizable success. Mudd has always been a bit of a hustler — she bought and sold high-end sneakers while she was in high school — and she's expanded her business acumen during her time in college.

To help fund her education, she and her cousin, who she called a “business partner” in high school, got involved with Turo. Turo is a peer-to-peer car-sharing company that allows private car owners to rent out vehicles via an online marketplace.

“The sneakers weren't really consistent money or anything,” she said, “so we had to find something that's more stable.”

Now, she manages a handful of cars and continues to learn how to deal with customers, maintain cars, and more.

“This is helping me lay my foundation,” she said. “That's how I see my time here. I'm building a foundation so I have options when I graduate.”

She doesn't see herself going straight into business for herself. That may come later. There may be a stop in industry along the way. One thing she knows is that she wants to give back as much as she can.

“One day, I hope to start my own foundation,” said Mudd, who, along with her mom, aunt, and some friends, has helped pack meals for those in need since she was in middle school. “I was given opportunities others weren't, and I feel a moral obligation to help those who don't have the same privileges I do.”

Not bad for someone who wasn't sure what she wanted to do just a few short years ago. • DAVID MITCHELL



## Seeker of Fortune: Quincy Howard Takes Home Grand Prize on Popular Game Show

The sophomore industrial engineering student needed just a few short moments to know he had won the game

Appearing on a college edition of the popular game show *Wheel of Fortune*, Howard, a sophomore student in the H. Milton Stewart School of Industrial and Systems Engineering, had already won more than \$37,000 in money and prizes. He was standing next to host Pat Sajak for the bonus round.

As Howard's selected letters appeared on the big puzzle board, he smiled and dropped his head backward.

"Kids at play?" he said confidently, but with the tone of the question as if he couldn't believe his luck.

Howard was correct, and Sajak revealed a Mini Cooper in the prize envelope, adding to Howard's bounty.

Hear all about the Dublin, Georgia, native's experience on the show below.

### How did you end up getting to be on the show?

I knew they were doing a college week. I was watching a college episode in January, and that's when I applied. I got the application out and did the video and went through the whole process. In the summer, they emailed me and told me they wanted me to do the virtual audition. I did the mock version of the show and answered some questions, and then two weeks later that's when I got the email that they wanted me to be a contestant.



**How fun was it?**

It was extremely fun. When I got that email and realized I was going to be on the show, I was like, “Ok, I guess I’m going to have to book these flight tickets and fly out and all of this now.” That’s when it kicked in. And then being in the studio and seeing that and they even took us to the Jeopardy set. The whole day was just surreal.

**Were you a fan of the show?**

Definitely. I think that helped a lot just knowing the show and watching it so much growing up... coming home after school and it’s on every night. I think that was a big part of the interest of going onto the show.

**Did you hear from anyone who saw you on the show?**

Especially from my hometown. There were a bunch of people who watched and they saw me and then they saw my mom and dad and were just like, “Wait, I know this guy!” That was cool.

Luckily, my high school was able to get it out to my general community. I have a smaller hometown, so it was pretty cool for them to get to see that. They had good reactions and all of that.

**What was it like on the show? Nerve-racking? Fun?**

It’s a bit of both. You just start out of the gate having to think about a puzzle on the spot. That toss-up puzzle, that was the hardest part. It was hard to focus. But they practice with you a lot where you get to spin the wheel and call letters. So, they do prep you to get you hyped up and make sure you know the rules and everything. But when we did that first toss-up, it was tough, but I settled in.

**Ok, you have to settle a debate: Is the wheel heavy?**

The wheel is heavy. It’s 2,400 pounds, but when you’re spinning you’re focused so much you don’t even really think about it. I mean, I thought about it a little bit. But I was just so focused on not getting

bankrupt and watching the puzzles and everything that I didn’t really think to much about it. I researched and I saw that there’s a 15 percent chance you can get bankrupt on the wheel, so I want it to stop spinning here and I’ll try to release it here and everything.

**So, you did some research and prep for the show?**

A little bit. It’s a Georgia Tech student thing. I had to do a little research — letter calling, spinning, playing the game with my sister. Just things to help me prepare.

**When you got that final puzzle, what was that feeling like?**

It was surreal. It was a relief. I was like, “Wow, what’s going to be in this envelope?” That was the initial thought, and then I just wanted to make sure I got the words out. The phrase “kids at play” will always be with me now.

**How cool was it to get to represent Georgia Tech?**

I got some messages saying it was a good win, and that was cool to see. It was fun to represent the school. President [Ángel] Cabrera reached out. It was pretty fun. It was fun to meet other college students. I’m more introverted and reserved, so it was cool to see other people who had the same interests as me. I appreciated all the support from all my hometown and everything. • DAVID MITCHELL



Quincy was welcomed back to campus in style, with a greeting from Buzz, swag, and tickets to a basketball game.





School Chair Edwin Romeijn with undergrad award winner Dewang Agarwal and Director of Student Services Dawn Strickland.

# Student Awards

Graduate and undergraduate students were honored at the Spring 2022 H. Milton Stewart School of Industrial and Systems Engineering annual student awards.

From research and academics to teaching assistance and mental health, the awards recognized the full scope of student leadership within the school for the 2021-22 academic year.

## GRADUATE AWARDS FOR EXCELLENCE IN RESEARCH

### **The Shabbir Ahmed Research Excellence Award**

Jiaming Liang (Optimization)  
Sebastian Perez-Salazar (Optimization)

### **The Atlanta Air Cargo Association Research Excellence Award**

Jana Boerger  
(Supply Chain Engineering)

### **The Robert Goodell Brown Research Excellence Award**

Liyang Xie (Data Science and Statistics)

### **The Anderson-Interface Research Excellence Award**

Amin Gholami (Energy and Sustainable Systems)

### **The Thos and Clair Muller Research Excellence Award**

Zhaowei She (Health Analytics and Health Systems)

### **The Angela P. and Reed J. Baker Research Excellence award**

Jialei Chen (Advanced Manufacturing and SIAC)

### **The Margaret and Stephen Kendrick Research Excellence Award**

Keyu Zhu (Analytics and Machine Learning)

### **The Ed Iacobucci Research Excellence Award**

Daniela Hurtado-Lange (Applied Probability and Simulation)

**ADDITIONAL GRADUATE AWARDS****ISyE Outstanding Graduate Student Instructor of the Year Award**

Shangcong Mou  
Tyler Perini

**ISyE Outstanding Graduate Teaching Assistant of the Year Award**

Xinyu Liu

**ISyE Outstanding Master's Teaching Assistant of the Year Award**

Lucienne Loo

**The Phillip J. and Delores A. Scott Graduate Student Health and Wellness Award**

Nidhima Grover  
Miguel Campos Murcia  
Katja Meuche  
Vinaya Krishna  
Ritesh Ojha  
Yassin Watson

**UNDERGRADUATE AWARDS****ISyE Outstanding Undergraduate Teaching Assistant of the Year Award**

Pratyush Agrawal

**Institute of Industrial and Systems Engineers Excellence in Leadership Award**

Dany Shwayri

**The Evelyn Pennington Outstanding Service Awards**

Duncan Siebert  
Hung Doan

**The Evelyn Pennington Student Health and Wellness Award**

Noah Mitchem  
Christina Collins  
Elizabeth Schupp  
Quentin Mot

**ISyE Alpha Pi Mu Academic Excellence Award**

Oscar Aguilar  
Xufei Liu

**College of Engineering Honors Day Award**

Zhiyi Li

**College of Engineering Outstanding Undergraduate Research Award**

Madeleine Pollack  
Adam Profili

**Kurt Salmon Associate Scholarship in Industrial and Systems Engineering**

Maxim Geller  
Michael Cho  
Hope Williams  
Fuad Hossain

**KS2 Technologies, Inc. Entrepreneurship Award**

Christophoros Kontomaris  
Min Sol Lee

**Nicolas & Aurora Suarez Condezo International Award**

Dewang Agarwal

*The awards are sponsored by both alumni and corporate partners, among others. To learn how to get involved, contact ISyE's Senior Director of Development Nancy Sandlin at [nancy.sandlin@isye.gatech.edu](mailto:nancy.sandlin@isye.gatech.edu).*



School Chair Edwin Romeijn with undergrad award winner Madeleine Pollack and academic advisor Sudie Pennebaker Davis.

# Five ISyE Alumni Included in GTAA's 40 Under 40

## Alex Berry, IE 2017

*Technical Program Manager – Intel*

Graduating from Georgia Tech with a bachelor's in Industrial Systems and Engineering and dual Business (T&M)/Mandarin minors, Alex Berry builds bridges between the private, public, and social sectors. His education fuels his ability to enable Intel's global supply chain, where he focuses on technical program management, process improvement, and strategic facilitation. A technologist by day and a social entrepreneur by night, he incorporated CMD LLC, an organization that empowers underserved and untapped communities to craft powerful career narratives. He brought his STEM background, nonprofit board expertise, and team leadership expertise to Berkeley Haas's MBA program this fall, growing into a technology leader.

**FAVORITE TECH MEMORY** | *Sharing the Senior Design Finalist stage with his team and their families who had flown in from around the world.*



## Victoria Bertasoli, IE 2017

*Operations Team – Softbank Latin America Fund*

Victoria Bertasoli is a member of the SoftBank Latin America Operating Team, which supports Latin American unicorns and startups so they can succeed and achieve their best potential. Bertasoli was part of the founding team at Alice, a health-tech company in Brazil, where she served as a product manager for two-and-a-half years. Previously, she was a global technology manager at AB InBev, in their Innovation Office in Mountain View, Calif. In addition to her professional activities, Bertasoli cofounded BRASA, a nonprofit that supports Brazilian students abroad.

**FAVORITE TECH MEMORY** | *White out game against UGA where Georgia Tech won and took over the Tech stadium.*



## Priya Boyington, IE 2011

*Director, New Verticals Consumer – DoorDash*

Priya Boyington has found her passion in launching new businesses. Currently, she leads New Verticals Consumer at DoorDash, growing the company's grocery, convenience, and alcohol verticals nationally. She spent the last decade starting businesses for underserved markets and those at the cutting edge of innovation, including: State Of Menopause, a menopause skincare line; HIKI, a genderless sweat line; Stitch Fix Kids; and Stitch Fix Freestyle, a direct buy offering. She started her career at Bain & Company, where she took an externship at GoldieBlox to inspire girls to pursue engineering, a passion she cultivated at Georgia Tech.

**FAVORITE TECH MEMORY** | *Studying abroad at Oxford. From statics classes in a historic building to Scotland weekend trips, it was an amazing experience.*



## Sonia Sardana, IE 2012

*Senior Vice President – ACS Solutions*

Sonia Sardana is the senior vice president at ACS Solutions, where she leads recruiting operations and is responsible for strategic sales and business development. She oversees the company's global delivery centers for service excellence and is committed to quality and exceeding client expectations. Sardana joined ACS Solutions in 2012 and has since held multiple strategic leadership positions, including IT program manager, where she led digital transformation across the back office and financial systems. In a previous role as director of global operations and delivery she led the restructuring of the operations department by building a global strategy and implementing the plan across several geographies.

**FAVORITE TECH MEMORY** | *I met my husband, Aditya Mishra, at Georgia Tech, and have been blessed with a 3-year-old son.*

## Valerie Williams, IE 2006

*Founder & Managing Partner – Converge Firm*

Valerie Williams is the founder and managing partner of Converge Firm, a boutique DEI consulting firm leveraging her 16 years of experience advocating for fairness and equity in the workplace. Prior to launching Converge, she served as global head of Inclusion & Diversity at Stripe and helped create the foundational Diversity and Belonging Program at Airbnb. She has extensive executive, business, and technical recruiting experience at Google, Airbnb, and Russell Reynolds, as well as four years of supply chain and operations experience at Hewlett Packard. She studied engineering at Georgia Tech and holds an MBA from Emory University. She has served as a guest lecturer at Emory, USC, and the University of California, Berkeley, and is sought after as a thought leader on workforce inclusion.

**FAVORITE TECH MEMORY** | *Final Four game for Georgia Tech Basketball team in 2004.*



# Six ISyE Faculty to Lead Efforts in Diversity, Equity, and Inclusion for DEI Fellows Program

The goal of the ISyE Diversity, Equity, and Inclusion (DEI) Fellows Program is to support activities by ISyE faculty and staff that create and sustain a culture of inclusive excellence within ISyE, Georgia Tech, and beyond. This program supports activities related to

- workplace diversity, equity, and inclusion;
- increasing diversity of the ISyE faculty, staff, and student body and, more broadly, the academic community at Georgia Tech and the field of industrial and systems engineering;
- new collaborations, initiatives, or partnerships aimed at broadening participation.

The ISyE DEI Fellows program fits within the overall vision and mission of the Center for Academics, Success, and Equity (CASE) in ISyE. The program is open to all academic faculty and staff members in ISyE. The 2022 cohort includes six faculty members.

## Gian-Gabriel Garcia

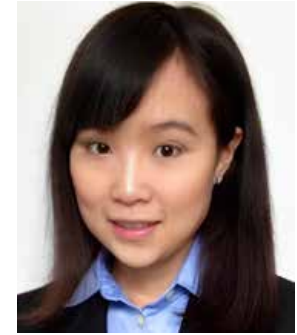
Assistant Professor

Garcia will work with CASE to establish a mentorship program focused on connecting graduate students, postdoctoral scholars, and faculty from diverse groups by facilitating the formation of non-dyadic mentorship relationships. The overarching goals of this program are for every participant: (1) to have mentors at all levels (e.g., senior mentors, peer mentors), (2) to develop their skills as a mentor and mentee, and (3) to have an opportunity to practice mentorship. The project dovetails the MentIEs program and will expand the reach of CASE beyond undergraduate students.

## Pascal Van Hentenryck

A. Russell Chandler III Chair and Professor

Pascal Van Hentenryck plans to design and initiate an educational program for high schools that covers an introduc-



Top row: Garcia, Weijun Xie, and Yao Xie. Bottom Row: Van Hentenryck, Ziani, and Serban

tion to computing, an introduction to computational and data science, and a module on “Deep Learning the Field.” He also plans to initiate a program to help HBCUs and MSIs offer minors and major in AI at their institutions.

## Weijun Xie

Coca-Cola Foundation Early Career Professor and Assistant Professor

## Juba Ziani

Assistant Professor

Xie and Ziani plan to invite researchers from various backgrounds inside and outside Georgia Tech who work on DEI and justice research as well as students from underrepresented communities to deliver a seminar, either in person or virtual, and meet with our students and faculty members, if possible. Their project aims at promoting DEI as well as justice and social impact-related research to ISyE students and faculty, especially

Ph.D. students, by incorporating DEI and justice topics in the broader sense into the optimization and machine learning seminars. Second, it aims to give students from underrepresented backgrounds and with fewer opportunities to do so a chance to share their research.

## Yao Xie

Harold R. and Mary Anne Nash Early Career Professor and Associate Professor

## Nicoleta Serban

Peterson Professor of Pediatric Research

Yao Xie and Nicoleta Serban plan to engage faculty members in discussions on DEI among faculty and graduate students in ISyE in collaboration with the DEI Committee. A series of mini-retreats will be organized in which participants discuss a set of topics and share their thoughts in a relaxed atmosphere outside of campus and of their work and life responsibilities.

# ISyE Welcomes Five in 2022 Cohort for Postdoctoral Fellowship Program

The ISyE Postdoctoral Fellowship Program was established in 2020. Supported by generous donations from ISyE alumni and friends, this program provides full or partial funding for postdoctoral fellows in all research areas within ISyE, including advanced manufacturing, analytics and machine learning, applied probability and simulation, data science and statistics, economic decision analysis, energy and sustainable systems, health and humanitarian systems, optimization, supply chain engineering, and system informatics and control.

Postdoctoral Fellows in this program perform independent research at the cutting edge of their field in collaboration with one or more faculty mentors within the school. In addition, the program aims to prepare outstanding researchers for faculty careers that will contribute to diversity and equal opportunity through research, teaching, and service.

There are five new members in the 2022 cohort.

## Shubhada Agrawal

Herbert A. Johnson/ARC Postdoctoral Fellow

Shubhada Agrawal received her Ph.D. from the School of Technology

and Computer Science at the Tata Institute of Fundamental Research in Mumbai, India. She joined ISyE as a postdoctoral fellow in January 2023. Her research interests lie in the area of learning theory with a focus on sequential decision-making under uncertainty. She has worked on different problems related to multi-armed bandit algorithms.

**Mentor:** Siva Theja Magaluri



## Caleb Bugg

Jerry & Harriett Thuesen Postdoctoral Fellow

Caleb Bugg received his Ph.D. degree in operations research from the Department of Industrial Engineering and Operations Research at the University of California-Berkeley. He seeks to discover and implement novel interpretations of global issues, and to prescribe simple solutions that we as a global community can implement. Utilizing the mathematical and statistical models native to Operations Research and Management, he synthesizes topics that provide an analytical basis for our society to invest in long-term, social good projects. The basis of the work is to improve the citizenry's value for socially beneficial goods, so that they may live healthy and active lifestyles, while solving their communities' most pressing issues.

**Mentor:** Gian-Gabriel Garcia



## Behshad Lahijanjan

Tennenbaum Postdoctoral Fellow

Behshad Lahijanjan received her Ph.D. degree in industrial and systems engineering from the Department of Industrial and Systems Engineering at the University of Florida. Her research focuses on decision-making by developing methods and algorithms for healthcare systems using stochastic programming, multi-method simulation, and machine learning.

**Mentors:** Nicoleta Serban and Gian-Gabriel Garcia



## Zahra Mobini

George Family Foundation Postdoctoral Fellow

Zahra Mobini received her Ph.D. degree from the Department of Operations Management of the Jindal School of Management at the University of Texas-Dallas. Her research interests revolve around the design and analysis of human-centric solutions to operations management problems, with a focus on healthcare operations. She is currently working on problems, in clinical settings, that encompass both sides of the human-technology frontier. Using empirical and analytical methods, her research aims to improve quality of care by leveraging the capabilities of technology while also accounting for the behavior of the caregivers who use it.

**Mentor:** Turgay Ayer



## Bento Natura

Ronald J. Beerman/ARC Postdoctoral Fellow

Bento Natura received his Ph.D. degree from the Department of Mathematics at the London School of Economics. His research interests are in operational research, combinatorial optimization, convex optimization, and game theory.

**Mentor:** Mohit Singh







DAVID MITCHELL

## ISyE Helps Break Ground on its Future Home in Midtown Atlanta's Technology Square

The H. Milton Stewart School of Industrial and Systems Engineering is officially building a new home

Georgia Tech kicked off construction on a Midtown Atlanta development that will further expand Georgia Tech's footprint in the area. The groundbreaking ceremony for Tech Square Phase 3 happened in the shadow of structures like Coda, Centergy, and the Technology Square Research Building where Tech has rapidly cultivated one of the country's fastest-growing business and technology ecosystems.

This third phase of Technology Square will be anchored by two multi-story towers. The entire project is planned to add more than 400,000+ square feet of new space for research and collaboration. The primary buildings situated on the site, located on the

blocks between 5th, Spring, and West Peachtree Streets, will both be named for philanthropists who have played a vital role in advancing Georgia Tech's mission of progress and service. One tower named for principal donor Ernest Scheller, will be the new home of graduate and executive education programs of the Scheller College of Business. The second tower will be named George Tower, in recognition of Bill and Penny George, and will house the nation's top-ranked industrial engineering program.

Georgia Tech transformed abandoned and blighted areas across the Midtown/Downtown Connector to open Technology Square in 2003. The second phase 21-story Coda Building

opened in 2019 and has drawn more top-tier tech companies to work as close to Georgia Tech's campus as possible.

"A successful innovation ecosystem requires not just good hardware — the right buildings in the right locations — but also good software: the right talent and programs and a culture of innovation," said President Ángel Cabrera at the groundbreaking ceremony.

Tech alumnus and Atlanta mayor Andre Dickens was also on hand to celebrate the launch of the transformative project.

"Metro Atlanta's diverse and thriving tech industry is the envy of many, and Tech Square has helped make that a reality," Dickens said.



Since 2021, companies including Microsoft, Google, Cisco, Micron, Airbnb, and Nike have made significant investments to expand their presence in the neighborhood.

“Having this collaboration here between companies and one of the world’s great academic institutions and different departments is critical,” said George, a graduate of Tech’s industrial engineering program.

“The new facilities of Tech Square Phase 3 will offer our students the ability to learn, collaborate, and develop in a new, innovative environment. Thanks to the generosity and support of our community, we are now better positioned than ever before to fulfill our mission of cultivating principled business leaders who thrive in a tech-driven world,” said Dean Maryam Alavi of the Scheller College of Business.

Tech’s business programs have been growing and expanding, consistently ranking among the top 20 nationally.

“Dean Alavi and the Scheller college team have consistently been moving up the ladder and have number one for the entire college well within sight. This new tower should give a big boost toward that goal,” said Ernest Scheller.

University System of Georgia Chancellor Sonny Perdue joined to help turn over the first shovels of earth where the towers will soon sit.

“These types of initiatives are happening around the state, and it’s the students that we are impacting,” said Perdue.

Jeb Stewart, a Georgia Tech graduate and son of H. Milton Stewart, the namesake of Tech’s school of industrial engineering, recognized the positive momentum this groundbreaking represented.

“Hope can start with things like education and opportunity – things that are going to happen in these buildings,” Stewart said.

“Hundreds of years from now when people come to Midtown and see these buildings, they will know they were built for students to learn and be innovators,” said President Cabrera.

In addition to the academic facilities, Tech Square Phase 3 will also include a large outdoor plaza with street-level retail and an underground parking deck. Project partners include architecture from booth Rule Joy Trammell + Rubio (RJTR) and Eskew Dumez Ripple and Turner Construction. The new development is planned to open in 2026. • STEVEN NORRIS



ISyE will be housed in George Tower, named in recognition of Bill and Penny George (far right).



Tech alumnus and Atlanta mayor Andre Dickens attended the groundbreaking.



Tech Square Phase 3 is projected to open in 2026.

# Get to Know ISyE's Newest Advisory Board Members

ISyE welcomed five new members to its advisory board this fall: Omar Balkissoon, Susan Bonds, Roberto Castro, Scott D. King, and Megan Langley.

These five, along with 15 others, serve as a sounding board for the school, its chair, and faculty leadership to assist with development goals. Each new member will serve a four-year term (2022-2026). In addition to these five joining the board, Catherine Cooper took on the role of board chair and Kenneth Klaer the role of vice chair.



**Omar Balkissoon**

Founder and CEO, GeoSpark Analytics  
IE 2000

Omar Balkissoon graduated from ISyE in 2000 and has spent 18 years in tech startups, among other positions, in the years since. After more than three years as an associate at Booz Allen Hamilton, Balkissoon helped found OGSystems, where he spent 15 years as CEO and executive chairman. In 2017, he helped found ZeroGravity Capital and GeoSpark Analytics, where he currently serves as the executive chairman. He also returned to offer help at Georgia Tech in 2020, taking on the role of council member for CREATE-X. In that role, he helps mentor the next generation of amazing thinkers within Georgia Tech's premier startup generator.



**Susan Bonds**

CEO, Animal Repair Ship  
IE 1984

Susan Bonds graduated from Georgia Tech in 1984 and has invested twenty-five years in her career focusing on gaming, theme parks, location-based entertainment, and new media. As the CEO and one of the original founders of 42 Entertainment, Bonds has built a dynamic portfolio that has resulted in her working on some of the most well-known productions of our time. She is an award-winning transmedia producer, and has gained over 10 million players across 75 countries, for the Dark Knight Alternate Reality game, Why So Serious? She served as the creative director and senior show producer for Walt Disney Imagineering and has produced major attractions including Indiana Jones Adventure (Disneyland), and Mission: SPACE (Epcot, Walt Disney World).





### Roberto Castro

Senior Business Advisor, CapTech  
IE 2007

After graduating from Georgia Tech, where he competed as a member of the school's golf team, Roberto Castro spent the next 15 years competing as a professional golfer. His time as a professional included nine seasons on the PGA Tour. He competed in 192 career PGA Tour starts, including appearances in two Tour Championships, two Masters, and six U.S. Opens. In 2021, he left professional competition and joined CapTech Consulting, a technology consulting firm focused on partnerships to help grow efficient, successful businesses. As a director, Castro is focused on successful client outcomes in golf and sports practice, as well as business development across the broader client portfolio.



### Scott D. King

Director of Worldwide Design  
and Engineering, Amazon  
IE 2004, PMASE 2011

King graduated from the Georgia Institute of Technology in 2004 and after working for several years at Office Depot and The Home Depot, King decided to further his education. In 2011, King obtained a master's degree in Applied Systems Engineering. With a strong foundation in both education and practical experience, King has been able to excel in his career and has held various leadership positions in the industry. In 2020, King was offered the opportunity to serve as the Director of Worldwide Design and Engineering at Amazon, a role he has been fulfilling with dedication and excellence.



### Megan Langley

Associate Partner, Bain & Co.  
IE 2009

Langley graduated Georgia Tech in 2009 and has spent over 12 years at Bain & Company. During that time she has held several positions, beginning as an associate consultant and rising through the ranks to associate partner, a role she has held since 2020. Bain & Company is a management consulting company focused on solving industry-defining challenges in strategy, marketing, organization, operations, information technology, and more.

# ISyE Welcomes New Faculty

ISyE welcomed five new faculty members in 2022: Assistant Professor Eunhye Song, Assistant Professor Weijun Xie, Assistant Professor Arthur Delarue, Professor Xin Chen, and Professor Saurabh Sinha. Learn more about their background and research agenda.



**Assistant Professor Eunhye Song** comes to ISyE from Penn State University, where she was a Harold and Inge Marcus Early Career Assistant Professor. In ISyE, she received the appointment as Coca-Cola Foundation Early Career Professor. Her research interests include design of simulation experiments, model risk quantification, and simulation optimization. In 2021, Song earned a CAREER Award from the National Science Foundation, which will fund her work through 2026. She also served on the INFORMS Simulation Society's Underrepresented Minorities and Women Committee from 2018-20. She earned her Ph.D. in Industrial Engineering and Management Sciences from Northwestern University in 2017.



**Assistant Professor Weijun Xie** spent nearly five years at Virginia Tech in the Grado Department of Industrial and Systems Engineering before joining Georgia Tech in Fall 2022. He is returning home to ISyE after obtaining his Ph.D. in Operations Research at Georgia Tech in 2017. He, too, received an appointment as Coca-Cola Foundation Early Career Professor. Xie's research interests lie in theory and applications of stochastic, discrete, and convex optimization. His works have won awards, including the 2022 New Investigator Award from Virginia Space Grant Consortium at NASA, the 2021 NSF CAREER Award, and the 2020 INFORMS Young Researchers Paper Prize, among other honors. He currently serves as the vice chair of optimization under uncertainty at the INFORMS Optimization Society and an associate editor of *Mathematical Programming* and the *Journal of Global Optimization*.



**Assistant Professor Arthur Delarue** joins ISyE's faculty after recently completing his Ph.D. at the Massachusetts Institute of Technology and serving as a postdoctoral fellow at Lyft Rideshare Labs. His primary goal as a researcher is to leverage data, optimization, and machine learning to solve practical problems that matter to society. More specifically, he is interested in applications of mixed-integer optimization in transportation, machine learning, educational operations, and public policy. In 2020, Delarue participated in the COVID Analytics initiative, which was awarded the 2020 Pierskalla Award. As part of the project, he helped design optimization tools to support MIT's pandemic planning during the 2020-21 school year.



**Professor Xin Chen** joins ISyE as the new James C. Edenfield Chair after 18 years at the University of Illinois, Urbana-Champaign, where he has studied data analytics, revenue management and dynamic pricing, operations research, optimization, inventory and supply chain management, and more. Chen earned his Ph.D. in Operations Research from MIT in 2003 and served as a postdoctoral researcher there for the following year, after which he joined the faculty at Illinois. He received the INFORMS Revenue Management and Pricing section prize in 2009 and is a coauthor of the book *The Logic of Logistics: Theory, Algorithms, and Applications for Logistics and Supply Chain Management*.



**Professor Saurabh Sinha**, the Wallace H. Coulter Distinguished Faculty Chair and Professor, also comes to Georgia Tech from the University of Illinois, Urbana-Champaign. He holds a joint appointment in the Wallace H. Coulter Department of Biomedical Engineering and works to develop techniques to analyze genomics data and study animal development and human disease. His lab's most recent work has focused on understanding how DNA controls the activities of genes and the resulting differences in biological properties, such as predisposition to diseases and response to treatments. His work draws on concepts in computer science, machine learning, statistics, and physics. He earned his Ph.D. in computer science and engineering at the University of Washington.



# Ph.D. Defense Recognition

ISyE has the honor of supporting all our Ph.D. students as they prepare to present their dissertations



## Jana Boerger

Ph.D. student, Machine Learning

Thesis: *Dynamic Prescriptive Analytics for Logistics Service Providers*

This thesis focuses on the application of analytics-based approaches to improve 3PLs capacity management, and the efficiency of warehouse processes such as picking.

With strong growth in e-commerce and distribution volume, it increases the demand for more efficient logistics infrastructure to support the development. A simulation model was created to provide a deeper understanding of the trade-off between order consolidation and timely order fulfillment in multi-order picking systems in warehouses.

### Committee:

Dr. Benoit Montreuil (Advisor), Dr. He Wang (Co-advisor), Dr. Siva Theja Maguluri, Dr. Mathieu Dahan, Dr. Jennifer Pazour



## Anthony Trasatti

Ph.D. student, Operations Research

Thesis: *Data-Driven Network Design of On-Demand Multimodal Transit Systems*

This dissertation discusses the decline in ridership in the United States, as many public transit agencies are beginning to recognize budgeting concerns due to high fixed-costs. Network

redesign has been a developing solution for transit planners who are looking to combat traditional transit system obstacles. With tactical planning, they were able to calculate various solutions regarding the obstacle of post-game ridership, at large events. Proposing a methodology that uses automated fare collection (AFC) data, assisted in “evaluating, anticipating, and managing the performance of transit systems.” Along with that result, the study confirms additional benefits of on-demand multimodal transit systems.

### Committee:

Dr. Pascal Van Hentenryck (Advisor), Dr. Alan Erera, Dr. Alejandro Toriello, Dr. Chelsea (Chip) White, Dr. Kari Watkins



## Yaarit Cohen

Ph.D. student, Industrial Engineering

Thesis: *Optimizing Time Sensitive Supply Chain Networks Design: Restoration and Operations*

This dissertation utilizes optimization tactics to assess and solve obstacles, concentrated on time sensitive restoration and operations of supply chain networks. “In order to illustrate the models’

and algorithms’ capabilities, each problem is associated with a comprehensive case study comparing results to other known algorithms or current practice solutions.” Some of those cases involved evaluating network restoration, supply chain network operations, and for-profit supply chains.

### Committee:

Dr. Pinar Keskinocak (Advisor), Dr. Benoit Montreuil (Co-advisor), Dr. Mathieu Dahan, Dr. Alan Erera, Dr. Ozlem Ergun, Dr. Chelsea (Chip) White



## Yiling Luo

Ph.D. student, Industrial Engineering

Thesis: *Stochastic Methods in Model Estimation: New Algorithms and New Properties*

In this study, the use of stochastic algorithms was utilized to solve optimization problems across multiple studies. Throughout the chapters in their research, they were able to explore directional

bias, implicit regularization, and stochastic natural gradient descent techniques to determine diverse options for multisided analysis. In the final portion of the study, regarding entropic OT, they were able to propose a “primal-dual stochastic algorithm with variance reduction to solve” complex problems.

### Committee:

Dr. Xiaoming Huo (Advisor), Dr. Yajun Mei (Co-advisor), Dr. Arkadi Nemirovski, Dr. Vladimir Koltchinskii, Dr. Kai Zhang

# Faculty Awards, Appointments and Promotions



## Professor Alan Erera

Manhattan Associates/Dabbiere Chair and Associate Chair for Research

Professor Alan Erera has been appointed as Manhattan Associates/Dabbiere Chair, which will work in tandem with his positions as Associate Chair for Research, Faculty Director for the M.S. in Supply Chain Engineering program, Co-Director for Global Transportation in the Supply

Chain & Logistics Institute, and Co-Executive Director of the Georgia Tech Panama Logistics Innovation & Research Center.

Erera's research is centered around transportation and logistics systems, particularly when planning for active operational control in unpredictable circumstances. With his background largely focused on operations research, he's expanded to areas discussing Energy Generation, Storage and Distribution, as well as Hydrogen Storage and Transport.

Some additional research includes System Design and Optimization, and Policy/Economics.



## Nick Sahinidis

Elected Member of the National Academy of Engineering (NAE)

Nick Sahinidis was selected as one of the newest members of the National Academy of Engineering, in which his selection was attributed to his knowledge and benefaction towards global optimization and machine learning.

In his career, Sahinidis has developed two software applica-

tions that have expanded research to monumental heights. His creation of BARON (Branch-and-Reduce Optimization Navigator), "a global optimization software system that solves challenging, nonconvex optimization problems," and ALAMO (Automated Learning of Algebraic Models), "a black-box modeling tool that generates algebraic models from data," have shown that his applications are advancing discussions and research towards an efficient direction.

Along with this announcement, Sahinidis was selected as the first Chair to be appointed for the Gary C. Butler Family Chair in the H. Milton School of Industrial and Systems Engineering (ISyE).



## Siva Theja Maguluri & He Wang

CAREER Awardees, National Science Foundation (NSF)

Two ISyE faculty members received the CAREER Award from the National Science Foundation (NSF), which celebrates and commends their early-career success and commitment to their research and education.

Our faculty members, Siva Theja Maguluri and He Wang, have both been recognized for their high achievements, and with this type of award they are expected to carry out a five-year term with NSF. The CAREER Award is also supported with \$500,000 in funding, which the faculty members and their Ph.D. students can utilize towards their research and expand on their studies.

"It's great because it helps fund our work and will provide opportunities to support our students in this continued research," Wang said. "But it also helps us to build connections with industry partners, who see the importance of our work, and allow us to implement some of it into the real world."

In part, both faculty members will work on their respective research and continue to create notable solutions for the industry and development. Maguluri's research stems from two key parts that are advancing artificial intelligence: optimization obstacles in reinforcement learning, and cloud computing. "Even though neural networks were known about 50 years ago, AI breakthroughs only happened in the last 15 years," Maguluri said. "This is because computers weren't powerful enough earlier, and it was hard to get access to large computing power."

Wang's research is centered on supply chain and logistics in transportation for analyzing and supporting decisions towards designing a marketplace for the freight industry. "The idea here is to improve supply chain efficiencies and also the earning reliability of these truck drivers," he said. His desired outcome would be to build an online digital marketplace that will advance truckers connecting with shippers to remove the brokerage process.

# 2022 LeeAnn and Walter Muller Distinguished Lecture

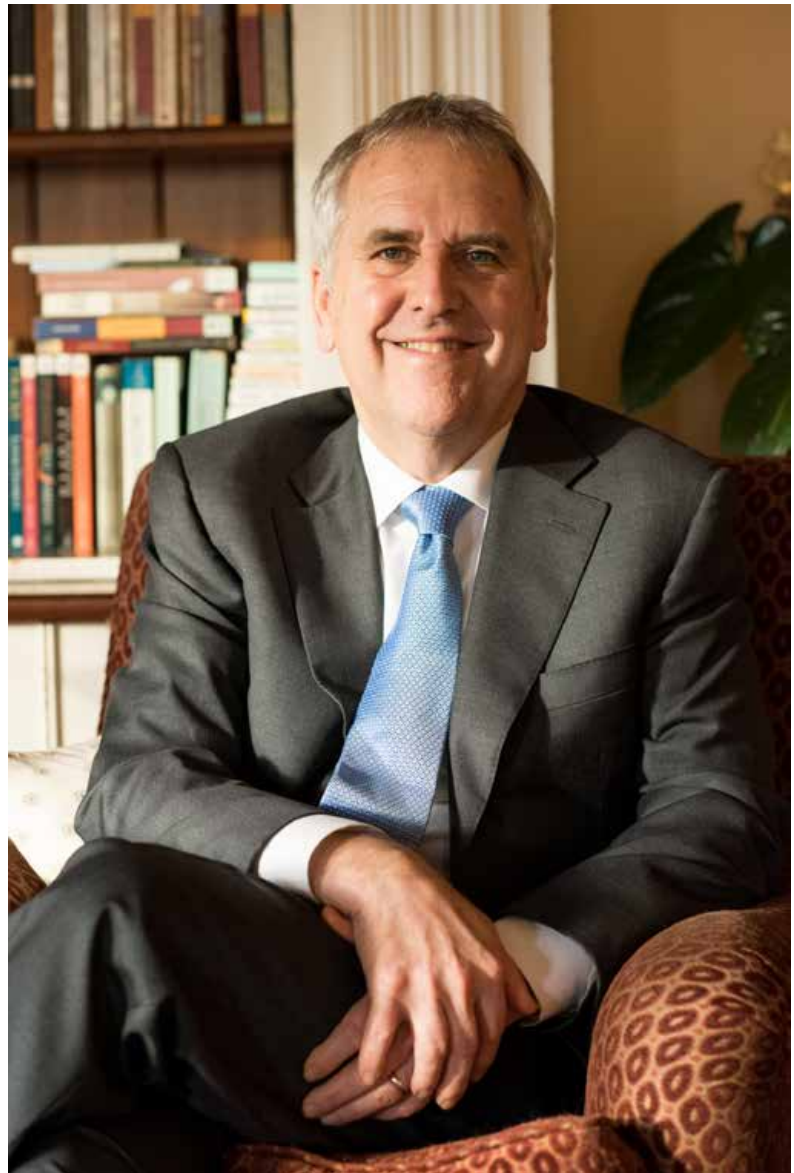
“On Dynamics-Informed Blending of Machine Learning and Microeconomics”

**I**SyE hosted Michael I. Jordan for the 2022 LeeAnn and Walter Muller Distinguished Lecture. Jordan is the Pehong Chen Distinguished Professor in the Department of Electrical Engineering and Computer Science and the Department of Statistics at the University of California, Berkeley. Prior to joining the faculty at Berkeley, Jordan served as a professor at the Massachusetts Institute of Technology from 1988-98. He received his master’s in mathematics from Arizona State University and his Ph.D. in cognitive science from the University of California, San Diego.

In his talk, Jordan discussed several projects that aim to explore the interface between machine learning and microeconomics, including leader/follower dynamics in strategic classification, a theory for matching markets with transfers, and the use of contract theory as a way to design mechanisms that perform statistical inference.

Jordan’s broad research interests bridge the computational, statistical, cognitive, biological, and social sciences. Throughout his career, he has been recognized numerous times for his work including: the Ulf Grenander Prize from the American Mathematical Society in 2021, the IEEE John von Neumann Medal in 2020, the IJCAI Research Excellence Award in 2016, the David E. Rumelhart Prize in 2015, and the ACM/AAAI Allen Newell Award in 2009.

He is a member of the National Academy of Sciences, the National Academy of Engineering, the American Academy of Arts and Sciences, and a Foreign Member of the Royal Society. In 2016, he was named the most influential computer scientist worldwide in an article in *Science*. • DAVID MITCHELL



*In 2008, the H. Milton Stewart School of Industrial and Systems Engineering established the Distinguished Lecture Series to promote discussion on critical issues in the fields of industrial and systems engineering by bringing in prominent scholars and business leaders who engage and share their expertise with students, faculty, and alumni. In 2018, thanks to a generous gift from LeeAnn and Walter Muller, it became the LeeAnn and Walter Muller Distinguished Lecture Series.*



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## Innovators — stay updated!

# Study Abroad

ISyE students participated in the ISyE Europe program in Dublin, Ireland. Clockwise from right: they visited the Department of Foreign Affairs, Parliament, and the Giant's Causeway.





# Connect with ISyE

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Are you interested in collaborating with us? The H. Milton Stewart School of Industrial and Systems Engineering (ISyE) welcomes your engagement and offers many ways to get involved. ISyE works closely with business and industry leaders on a variety of research efforts and other projects, as well as student enrichment activities. You can also connect with ISyE through sponsorships and philanthropy that bring the best education possible to our students and support our faculty as they tackle current issues that improve the quality of life for all.

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In November 2022, second-year ISyE student **Quincy Howard** won first place on Wheel of Fortune during the special edition College Week. His determination for solving puzzles advanced him towards winning the overall grand prize and beating out his opponents.

Howard discussed his strategy when preparing for the game of a lifetime – which embodied taking the immediate chance when he knew he could solve the puzzle correctly. His technique to calculate the probability of his landing, combined with this quick thinking, increased his chances of winning and taking home the bonus prize.

More with Quincy on page 38.



PHOTO: CAROL KAELSON/WHEEL OF FORTUNE/2022 CALIFON PRODUCTIONS, INC. ARR.