INDUSTRIAL AND SYSTEMS ENGINEERING

TECH

ATLANTA

Metz France

GT

ABU DHABI
HHL CONFERENCE

GLOBAL INTERNSHIP
京都市
KYOTO, JAPAN

SF EXPRESS
深圳
SHENZHEN, CHINA

Making A WORLD of Difference

SANTIAGO
Chile
GLOBAL INTERNSHIP

SUMMER PROGRAM
BEIJING
SINGAPORE
VIETNAM
IN ASIA

WHY PANAMA?

India
ALUMNI SPOTLIGHT:
BENT CHAIR

MACHINE LEARNING MOU
U.S. JAPAN & GERMANY

GLOBAL INTERNSHIP
INDONESIA

DEMOCRATIC REPUBLIC
STUDENT ESSAY
SOEUR, LÈVE-TOI
OF CONGO

On behalf of all of us at the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), I am delighted to share the latest issue of the ISyE alumni magazine with you. In this issue we have highlighted the tremendous impact of our students, alumni, and faculty, both at home and abroad. While these stories are impressive, they are only a small sampling of the many areas in which we make a difference every day.

As the leading industrial engineering program in the country, ISyE's influence reaches far beyond the boundaries of Georgia Tech. Our faculty and Ph.D. students are involved in international collaborations — both with academic institutions and industry partners — worldwide. These partnerships provide not only different perspectives to a research team but also increase the reach and potential impact of the research. They bring this knowledge with them into the classroom, enriching and enhancing the educational experience for our students. This allows us to attract top students who are eager to be taught by some of the best and brightest minds our industry has to offer. I invite you to read about a few of these activities, including the exciting projects currently underway at the Georgia Tech Panama Logistics Innovation & Research Center where ISyE faculty, alumni, and students are using their ISyE tools to help an entire country.

While the classroom experience we deliver is strong, it is also up to us to provide our students with additional tools to compete in the global economy after graduation. Learning to work in diverse teams, adapt to new cultures, and understand different perspectives will help our students excel. We believe it is crucially important for our undergraduate students to have a variety of opportunities to gain international experience, which includes studying abroad, participating in exchange programs, and experiencing the Global Internship Program. In this issue you will learn about the experiences of more than 30 ISyE undergraduates who participated in the ISyE Summer Program in Asia and get a glimpse into global internships in Chile, Japan, and Indonesia.

I am proud to be part of such an inspiring and engaged community of students, alumni, faculty, and staff, and I encourage you to stop by for a visit if you are in the Atlanta area. We have numerous opportunities for alumni to stay connected with ISyE, which include student projects, recruiting, and mentoring. I hope you enjoy this year's ISyE alumni magazine, and I hope you will stay in touch.

Warm regards,
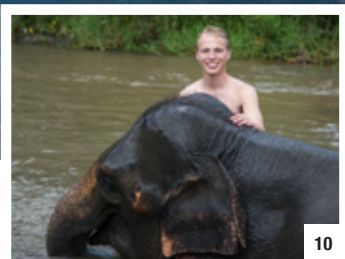
Edwin

H. Edwin Romeijn, Ph.D.
H. Milton and Carolyn J. Stewart
      School Chair and Professor
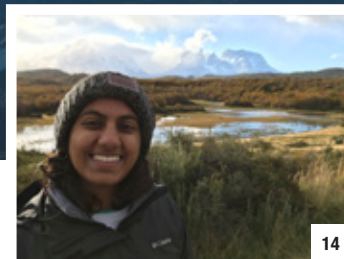H. Milton Stewart School of Industrial
      and Systems Engineering

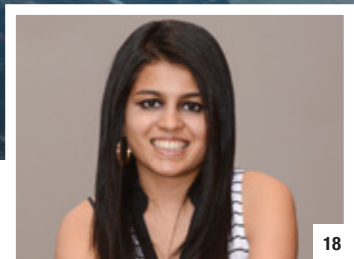## FEATURE STORY

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ISyE Alumna Natasha Jain Elevates Home Décor for a Global Market — 18

ISYE NEWS & ADDITIONAL FEATURES

ISyE by the numbers

Rankings

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

1

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

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

Degrees Offered

1 B.S. in IE Degree

WITH 5 CONCENTRATIONS IN:

- Economic and Financial Systems
- General Industrial Engineering
- Operations Research
- Quality and Statistics
- Supply Chain Engineering

8 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

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 Doctorate Degrees

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

Enrollment

Undergraduates: **1,353***

Masters: **281** on-campus; **1,260** online/video

Doctoral: **180**

includes co-op and study abroad students

Faculty

59 tenured/tenure-track faculty

5 academic professionals

8 research faculty

1 professor of the practice

6 lecturers

Academic Year 2017-2018

ISyE Degrees Awarded: **337** B.S. degrees **+** **188** M.S. degrees **+** **28** Ph.D. degrees

Among ISyE undergraduates...

- **36** participated in research.
- **160** participated in an internship.
- **274** participated in a co-op.
- **16** participated in the Denning Technology & Management Program.
- **24** were Stamps President Scholars.
- **201** participated in study abroad.

Of the 337 B.S. IE degree recipients in 2017-2018...

- **69%** graduated with honors.
- **23%** graduated with a co-op designation.
- **44%** were female.
- **$70,000** was the median starting salary for a B.S. IE.

Alumni

ISyE Alumni by Country (Top 15), as of August 2018

1. United States
2. China
3. India
4. Singapore
5. Germany
6. South Korea
7. Panama
8. Mexico
9. Taiwan
10. Thailand
11. Colombia
12. Turkey
13. France
14. Ecuador
15. Indonesia

Summer Engineering Institute

For the past 10 years, the Georgia Tech Center for Engineering Education and Diversity (CEED) has hosted 48 minority rising high school juniors and seniors from across the U.S. for its Summer Engineering Institute (SEI). Participants are immersed in the Georgia Tech student experience during the three-week program — from Georgia Tech dining halls and dorms to the daily rigor of a Georgia Tech engineering classroom.

This year, for the first time, one of the three projects was from the H. Milton Stewart School of Industrial and Systems Engineering (ISyE). Led by Francisco Javier Castillo Zunino, a second-year ISyE Ph.D. student in operations research, four of the 12 SEI

teams were charged with creating a hypothetical company to solve a problem in a health or humanitarian system, both at home and abroad.

"We want to be sure to showcase the different types of engineering in SEI," said Jackie Cox, program and operations manager for CEED. "This project was a great opportunity for us to feature ISyE."

After submitting a project proposal, the teams learned how to structure their companies, which included giving each team member a job and title within the organization. They also learned the basics of web design and logo creation, and some groups even developed an app.

> "It was the perfect opportunity to immerse myself in the Georgia Tech experience to see what it was like. Tech was one of my top choices before coming to SEI — it is a great program and a great school — but when I was on campus and experiencing what it would be like as a student here, it really felt like home."
>
> Juliana Mena

On the technical side, Castillo Zunino gave his teams a crash course in industrial engineering. They started with the basics of probability and statistics, and then moved into creating the simulation models.

"The students had not used simulation software before, but they were able to understand the logic behind it and use simulations to effectively solve their problems," said Castillo Zunino.

Participants also fine-tuned their communication and presentation skills throughout the program. SEI culminates with a team competition that is judged by Georgia Tech faculty and staff.

There are currently 42 undergraduate students enrolled at Georgia Tech who have participated in SEI, including ISyE third-year Juliana Mena, who attended SEI the summer before her junior year in high school.

"It was the perfect opportunity to immerse myself in the Georgia Tech experience to see what it was like," said Mena. "Tech was one of my top choices before coming to SEI — it is a great program and a great school — but when I was on campus and experiencing what it would be like as a student here, it really felt like home."

As a result of her SEI experience, Mena decided that Georgia Tech and ISyE were the right fit for her college career, and she couldn't be happier with her choice. She even served as a resident assistant for SEI during the summer following her freshman year.

In addition to teaching the basics of engineering, the CEED team builds strong relationships with the students during their time on campus. "We pride ourselves on the fact that we start out as different people from all over the United States, but we end up a family at the end of the three weeks," said Cox. ▪

Energy and Environmental Leadership Camp (EELC)

What originally began as an idea for a solar cooking camp developed into much more for Valerie Thomas, Anderson-Interface Professor of Natural Systems at the H. Milton Stewart School of Industrial and Systems Engineering (ISyE). For the third year in a row, 19 high school students built and raced solar cars, roasted marshmallows using solar parabolic stoves, participated in a climate simulation and negotiation game, and learned about leadership as part of the week-long EELC. This year's lead instructors were ISyE fifth-year student Michelle Garcia and Nishant Bilakanti, a Ph.D. student in the School of Electrical and Computer Engineering (ECE).

The EELC is a multidisciplinary program that covers a wide variety of topics. "We cover public policy, industrial engineering, electrical engineering, and science," said Thomas. "Many participants are going to be seniors and are thinking very actively about the next step in their educations. We want to help them think more broadly about what they want to do, even after college."

The leadership discussions began with a visit from ISyE's General Ron Johnson, who spoke about his work on reconstruction of the Iraqi energy system in 2003-04. Bilakanti led activities in the ECE lab on human-powered generators and wind energy, and Garcia conducted a leadership exercise in which students considered the strengths and weaknesses of their own leadership styles. The students also calculated their personal environmental footprints and played an environmentally friendly city planning simulation in the ISyE computer lab.

Thomas was awarded the Class of 1934 Outstanding Interdisciplinary Activities Award by Georgia Tech's Faculty Honors Committee in April 2018. The award was established to recognize Georgia Tech faculty who have made significant interdisciplinary contributions to teaching and research.

Prior to starting the camp in 2015, Thomas had not worked with high school students and wanted to participate in Georgia Tech's high school outreach efforts. "I had been doing some work on solar cooking, and I wanted to see how regular people would use solar ovens," she said. "I wondered if using small solar and other energy devices would be a good way to learn about energy systems."

Thomas put together a plan for the solar cooking camp and shared it with her daughter, Irina Bukharin. "She said, 'Nobody is going to want to go to a solar cooking camp,'" Thomas recalled. "So I handed her my design to see what she would come up with." Thomas' daughter thought it over and came back with the broader topic of environmental leadership and helped develop many of the camp activities that are still conducted today.

Thomas enjoys her time working on the camp each summer, and the climate simulation game was this year's highlight. During this activity, camp participants act out the negotiation of climate agreements at the United Nations and view a computer model of how the climate will develop based on the negotiating positions of the world blocs that are in the game.

"The Secretary General of the U.N. (who was the instructor) opened the meeting, and they fell into a hushed, awe-filled silence," Thomas explained. "It was great. The whole richness of the interaction of the different students negotiating with the other world blocs and taking that on was fun to watch." ▪

Mission Possible

Twenty-eight rising 9th-12th graders gathered at the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) in June for five days of Mission Possible, an educational outreach program designed to teach the basic principles of industrial engineering to promising high school students.

From an interactive demonstration on machine learning to the seemingly simple task of assembling fruit baskets, participants learned how industrial engineering tactics can be applied to solve everyday problems.

"We cover the traditional applications of industrial engineering, but we also want students to see that these concepts can be applied anywhere," explained Dawn Strickland, ISyE's director of student services. "Yes, the tools and methodologies can be used to streamline a company's processes or supply chain, but they can also be used in health and humanitarian systems or in sports."

In addition to the hands-on experience and presentations, participants toured The Coca-Cola Company and Norfolk Southern Intermodal to see industrial engineers in action. This was a highlight for many of the students. "My favorite part of the program was touring the Coke headquarters, seeing what happens to trucks and trains at Norfolk Southern, and learning about supply chains and how complex they are," said one participant.

Jon Lowe, an academic professional and instructor at ISyE, spent the week with the Mission Possible participants. "Our goal is to build on the concepts learned from day to day," said Lowe. "A lot of the students had a better appreciation for industrial engineering and what it is at the end of the program."

"We get amazing participants in this program," added Strickland. "In some cases, they even become future ISyE students." ▪

Mission Possible participants assemble racecars according to customer specifications in a hands-on lesson to understand the importance of customer input.

ISyE: Making a World

At the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), the world is our lab. The unique and versatile problem-solving abilities of our students, alumni, and faculty translate seamlessly to make processes better for companies, countries, and most importantly, people, both at home and abroad.

Georgia Tech's considerable portfolio of international activities allows our students to take their education abroad to build on their ISyE skills and experience the world. To make the most of their time at ISyE, students may choose from more than 150 international programs and locations, such as a semester at Georgia Tech-Lorraine in France or a faculty-led summer experience in Asia.

# of Difference

In the previous academic year, 220 ISyE students participated in various international activities, which included global internships in 14 countries. ISyE also had the highest number of graduates with the International Plan — a degree designation recognizing students who have committed to making global competence a core part of their Georgia Tech experience.

Similarly, our faculty and Ph.D. students frequently travel the globe to work on cutting-edge research with academic institutions and industry partners around the world. These multicultural collaborations enrich the research by adding different perspectives and furthering its reach. In the following pages, you will read some of the international stories our ISyE students, faculty, and alumni have to tell.

ISyE Summer Program in Asia

SINGAPORE
VIETNAM
BEIJING

More than half of all graduates from the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) participate in an international experience during their time at Georgia Tech. One of the most popular options for ISyE undergraduates is the ISyE Summer Program in Asia, a faculty-led experience in which students visit three of the most influential locations in global supply chain: Singapore, Ho Chi Minh City in Vietnam, and Beijing, and take classes at partner universities with local students.

"The three locations are very different from each other," explained Chen Zhou, associate chair for undergraduate studies and associate professor in ISyE. "We begin in Singapore, which is a very modern city with excellent public transportation

and many of the similar comforts of the Western world. In contrast, when we visit Ho Chi Minh City, there are fewer luxuries, it is very crowded, and very few people speak English. In China, the students see the rapid development of the country and gain a better understanding of what it is like to work with Chinese companies."

The ISyE Summer Program in Asia is 12 weeks

long, and students complete a full summer course load while abroad. Classes include three upper-level industrial engineering courses taught by ISyE faculty and professors at the local universities and an Asian history course. This past summer, students from ISyE and Vietnam's International University visited the War Remnants Museum, the Cu Chi Tunnels, and the Mekong Delta to learn about the history and geography of the area. They also learned about the different cultures through planned excursions and company visits in all three locations, leading to a better understanding of the people and cultural variances in each of these areas.

"The interactions between the Georgia Tech students and the local students are the most valuable aspect of the experience for many of our undergraduates," said Zhou. "They take classes together, work on projects together, and participate in activities together outside of class. So, when our students are looking at a scenario, they get the local students' perspective, which in many cases is very different from that of an American student. That education you cannot learn in a book."

Classes are held Monday through Thursday each week, leaving long weekends to further explore Asia. Trips for some of the students included camping on the Great Wall of China, feeding and bathing elephants on a reservation in the northern mountains of Thailand, and climbing 1.8 km to a peak on Mt. Huashan in Huayin City, China.

Participants also learned how to navigate foreign countries without speaking the local language. "The language barrier was very difficult to overcome in Asia, particularly in China," said ISyE third-year Andrew Yowell. "Even though Google Translate is always a handy resource, it is never flawless. I have certainly become better at communicating with only hand symbols!"

"Every weekend we were getting on a plane, bus, or train and heading to a new location,"

said Farhan Digonto, a fourth-year ISyE student. "We went to places like Cambodia and South Korea and fit as many activities into our free time as possible. It was definitely a work hard, play hard experience."

Spending three months abroad has given Digonto a new outlook. "I think my experiences have heightened my sense of adventure and willingness to explore boldly," he said. "Furthermore, being engrossed in different cultures really has opened up my perspective of how different cultures can operate in different ways and that there is no right way to live. Specifically, I think going into the future, this program has helped me become more open-minded."

The international experience will also set the students apart after graduation from Georgia Tech. "In today's global economy, the likelihood that these students will one day work with an organization that imports something from Asia is pretty high," said Zhou. "Having visited these locations will help them make better decisions because they will have a better understanding of the various cultures and local industry."

"It was an absolutely unbelievable experience," concluded Yowell. "I learned so much about the world and my place in it." ▪ LAURIE HAIGH

Opposite page: A group of ISyE students take public transportation in Shanghai. Above: ISyE third-year Andrew Yowell visits an elephant reservation during a weekend trip to Chiang Mai, Thailand. Left: With the help of a Vietnamese student, ISyE fourth-year Emma Hamilton learns how to play the đàn tranh, a traditional Vietnamese instrument.

Georgia Tech's many study abroad programs don't afford just students the chance to travel overseas — the Institute's faculty have the opportunity as well. In the case of ISyE Fouts Family Early Career Professor Kamran Paynabar, he was able to spend a summer semester at Georgia Tech-Lorraine (GTL) in Metz, France.

At GTL, Paynabar taught ISYE 2028 (Basic Statistical Methods) and ISYE 3039 (Statistical Methods for Quality Improvement) to a small group of ISyE students. He noted that one of the unexpected pleasures of the experience was getting to know his students well.

"Because you see the students every day, and it's a smaller group — compared to the Atlanta campus where classes are 60-70 students in size — getting to know individual students on a personal level was easier," Paynabar said. On Thursdays, in preparation for the students' long weekend, Friday through Sunday, he would ask each student to share their travel plans.

Another change from teaching on Tech's Atlanta campus during the regular fall or spring semester was that Paynabar quickly learned to be a little more flexible in his lesson planning. Because students traveled on the weekends, they didn't always make it back to Metz in time for classes on Monday morning. This could be because students got lost in their new cities and missed the trains returning to Metz, or because there were transportation strikes that kept the trains from running. So Paynabar made sure not to schedule tests or hard deadlines for the first day of the week.

Despite this needed flexibility, Paynabar said that his students worked hard in their classes. "They're still at Georgia Tech, even though they're abroad," he reflected. "They're still taking classes that count toward their degrees."

Like his students, Paynabar enthusiastically took as many opportunities as possible to travel throughout Europe. Teaching at GTL gave him the chance to explore Eze, Barcelona, Gordes, and Palermo, among other cities. "I enjoyed experiencing the different cultures," Paynabar said. "I'm a food person, so I enjoyed the variety of dishes that different countries had to offer."

Travel aside, he also said that Metz, perhaps unexpectedly, has much to offer, and he encouraged future GTL students not to neglect exploring the small historic city: "GTL is close to downtown, which is very beautiful, with the river passing through the city center. Metz hosts several festivals throughout the summer and has good museums. One even features artifacts from ancient Gallo-Roman ruins." And — returning to the subject of food — Paynabar noted that Metz's restaurants offered a high-quality experience, "amazing taste and presentation," that was unrivaled, even in Paris.

"I absolutely would go back," he added. ▪

ISyE second-year Aashika Jikaria spent this past summer studying abroad at Georgia Tech's Lorraine (GTL) campus in Metz, France. She was drawn to the GTL program specifically because she had the opportunity to take several courses required for her ISyE degree.

When asked about the most challenging part of her summer, Jikaria said that while she worked hard at her studies, planning and negotiating all the weekend traveling she did required the most flexibility and spontaneity. GTL students have three-day weekends built into the summer semester, but they are responsible for planning their own trips to other European cities. The transportation strikes in France were an immediate complication. As a result, trains were frequently cancelled — sometimes at short notice.

"I traveled with groups of friends," Jikaria said. "We had to figure out how to get to our destinations safely, cheaply, and quickly. Once we had 12 hours to figure out how to get back from Prague for class on Monday, and all the trains had been cancelled.

"Another time, we were traveling to Budapest and got stuck in Zurich. We wanted to take a bus out at 11 p.m., but the bus was full. So instead, we explored Zurich until 2 a.m., went back to the train station and slept on benches for four hours, and then took the 6 a.m. train to Budapest. Luckily, Zurich had a nice train station!"

Jikaria's favorite international experience, however, was closer to home in Metz. Early in the semester, GTL coordinated an event that matched students with host families in the local area.

"Another GTL student and I spent the evening with a French family, including their two teenage daughters, 10 km from campus," she recalled. "We had a traditional French dinner—flatbread pizza with no marinara sauce, just cheese and ham — and swam in their pool. We took a walk and met some of the family's neighbors. They spoke a little English, but they also taught us some French. I truly feel this was the best way to immerse myself in the French culture and study the language." ▪

FRANCE

The Global Internship Program Creates a World of Possibilities

CHILE

When inodú, a company focused on providing energy and sustainability services to its clients, was hiring an international industrial engineering intern, they turned to Georgia Tech to help find the right person. "We needed someone to perform data manipulation, analysis, and programming to aid in the development of new solutions and tools for our clients," said company co-founder Donny Holaschutz. "We have hosted Georgia Tech interns in the past, and they have always brought a lot of value to our organization."

Abhita Moorthy, a third-year ISyE student specializing in economic and financial systems, saw the job posting and was excited about the opportunity to put her education — in Spanish and industrial engineering — to the test. Her skill set was a perfect fit, and, less than two months later, Moorthy was boarding a flight to Chile for a four-month internship in a new country. "I was

really nervous!" Moorthy said. "I didn't know what to expect."

Despite a few bumps in the road, which included a major housing switch just a few days after arriving in Santiago, Moorthy quickly adapted to the Chilean lifestyle and her work at inodú.

"We had a client that was looking to identify opportunities in the natural gas market in Chile," explained Holaschutz. "The analysis that Abhita did in terms of how gas is being used — and some of the historical trends associated with the use of gas in the electricity and industrial sectors — was very useful to provide our client insights."

Moorthy used her data manipulation skills in Python to gather data from the Chilean power market and then created data visualizations and graphics to provide insights to clients.

The professional highlight of her time at inodú was seeing the graphs and value chain maps she prepared included in the presentation Holaschutz and his team delivered to the client.

"It was really exciting to see the work that I had done in the past four months come together," Moorthy said. "I think that the information was very useful for the client as they made their decisions about the Chilean energy market."

Creating solutions that truly made an impact on the company and its clients made her experience at inodú even more valuable. "The projects that I worked on and the tools I developed are things they can continue to use even though my internship is over," Moorthy said. "It was so much more than just an 'intern project.'"

When she wasn't in the office, Moorthy used her free time to travel — from the Andes Mountains to the Atacama Desert. Toward the end of her time in South America, she and her sister traveled south to Torres del Paine National Park in Chilean Patagonia. "We were 760 miles from Antarctica," she explained. "We were in the southernmost part of the world. More south than South Africa, more south than Australia and New Zealand. It was so amazing just to think about that."

In addition to her global internship, Moorthy participated in the Language for Business and Technology (LBAT) program in summer 2017 and spent 10 weeks immersed in the language and culture of Peru and Spain. She will also be spending a semester at Georgia Tech-Lorraine in spring 2019. Taking advantage of the many international opportunities available to ISyE students has helped Moorthy figure out her future goals. "Before I went to Santiago, I didn't really know what I wanted to do after Georgia Tech," she said. "But I've realized that I want to either work abroad or for a company with a global focus."

The interns aren't the only ones benefiting from the Global Internship Program — the skills, knowledge, and fresh perspectives that they bring add significant value to the organizations as well. "Companies today are competing in a very global and dynamic marketplace," Holaschutz said. "One way for a company like ours to really differentiate ourselves is through the people that we hire and the environment that we create. We bring in very talented interns from top universities in the U.S. and Chile because it creates a multidisciplinary and multicultural environment in our office. Diverse backgrounds and perspectives lead to a different work environment and also produce outputs that are much more interesting because of the creative tension that is created."

The inodú team is looking forward to a long and successful partnership with Georgia Tech. "We are definitely eager to continue to bring more industrial engineers from Georgia Tech to our company," added Holaschutz. "Not only as interns, but also in the future as full-time employees." ▪ LAURIE HAIGH

"Before I went to Santiago, I didn't really know what I wanted to do after Georgia Tech. But I have realized that I want to either work abroad or for a company with a global focus."

Abhita Moorthy

Opposite page: Moorthy during her visit to Torres del Paine National Park in the Chilean Patagonia region. Right: Moorthy outside of Palacio De La Moneda, the seat of the president, in the heart of Santiago.

Windsor is pictured here during a visit to the Fushimi Inari Taisha, a Shinto shrine in southern Kyoto.

JAPAN

"I've always wanted to try working abroad," explained Austin Windsor, an ISyE fifth-year, who spent his final summer as an undergraduate completing an internship with NTT Communication Science Laboratories in Kyoto, Japan. "Thought processes, work cultures, and company structures vary so much from country to country. I find this diversity of thought and practices extremely interesting, in that it not only makes me challenge my own practices and beliefs, but it also makes me learn to approach problems from new perspectives.

"Living in Japan was an incredible experience. By business day, I commuted to work with the hordes of people taking the trains and buses, worked eight or nine hours, and then participated in various activities with coworkers, leaving just enough time to shower and go to sleep before another day of work. It was a very busy schedule, but the relationships and skills I built as a result made it more than worth it.

"On weekends, I participated in new activities or explored new places. It was an astounding opportunity to gain amazing cutting-edge work experience and to travel such a beautiful and exciting country."

NTT provides a wide range of innovative global information and communications technology and has hosted Georgia Tech interns for more than a decade. "They make a positive impact on our organization," said Hiromi Narimatsu, a research engineer at NTT. "They contribute new thoughts and ideas to our discussions and deliver excellent results." ▪

Gideon Yuwono, an ISyE fourth-year who hails from Jakarta, Indonesia, returned to his home country for a summer internship with Electric Vine. The startup company builds solar-powered micro-grids (power for about 50-100 houses per site) in difficult-to-access areas. The company currently has ½ MWp of solar-PV and 2MWh of batteries installed across 12 sites: one in Papua that serves around 50 houses, and the rest in Sumba that power around 900 houses.

"I took notes in the field on operational activities, such as transportation of technicians to and from sites that required maintenance, and I wrote reports on mobile money integration to Electric Vine's existing business model," Yuwono said. "I also wrote a Python program to optimize the number of solar panels and batteries a site needs, given its demand profile and other parameters, based on data provided by the simulation software Electric Vine uses. Formerly, this process was manual and took five to 10 minutes for each site. It can now be completed in one to two seconds."

"I was pleased to personally supervise Gideon's internship with Electric Vine Industries," said Matt Basinger, CTO and co-founder. "As a micro-grid and technology company, we operate complex technical systems in extremely remote settings. When given the option of where to work and with which teams, Gideon did not select the easy route but instead chose to spend the bulk of his internship living and working in off-grid settings — remote villages with little or no electricity or piped water.

"As a member of our field engineering and operations team, he quickly came up to speed in a matter of weeks and offered valuable insights regarding our operations, helping to provide important analysis that immediately shaped near-term and future operational decisions," Basinger noted.

"Gideon possesses a rare combination of skill, enthusiasm, critical thinking ability, cross-cultural savviness, and passion. Unlike many young engineers, he balances people skills with a good technical foundation. Even though he is still a student, he was already able to start to contribute in an engineering setting, providing useful analysis with little oversight. It's clear Gideon is bound for success, and I expect great things from any endeavor he takes on." ▪

INDONESIA

Yuwono is pictured here on a weekend trip to Saukabu, Waigeo Bar, a star-shaped lagoon in West Papua, Indonesia.
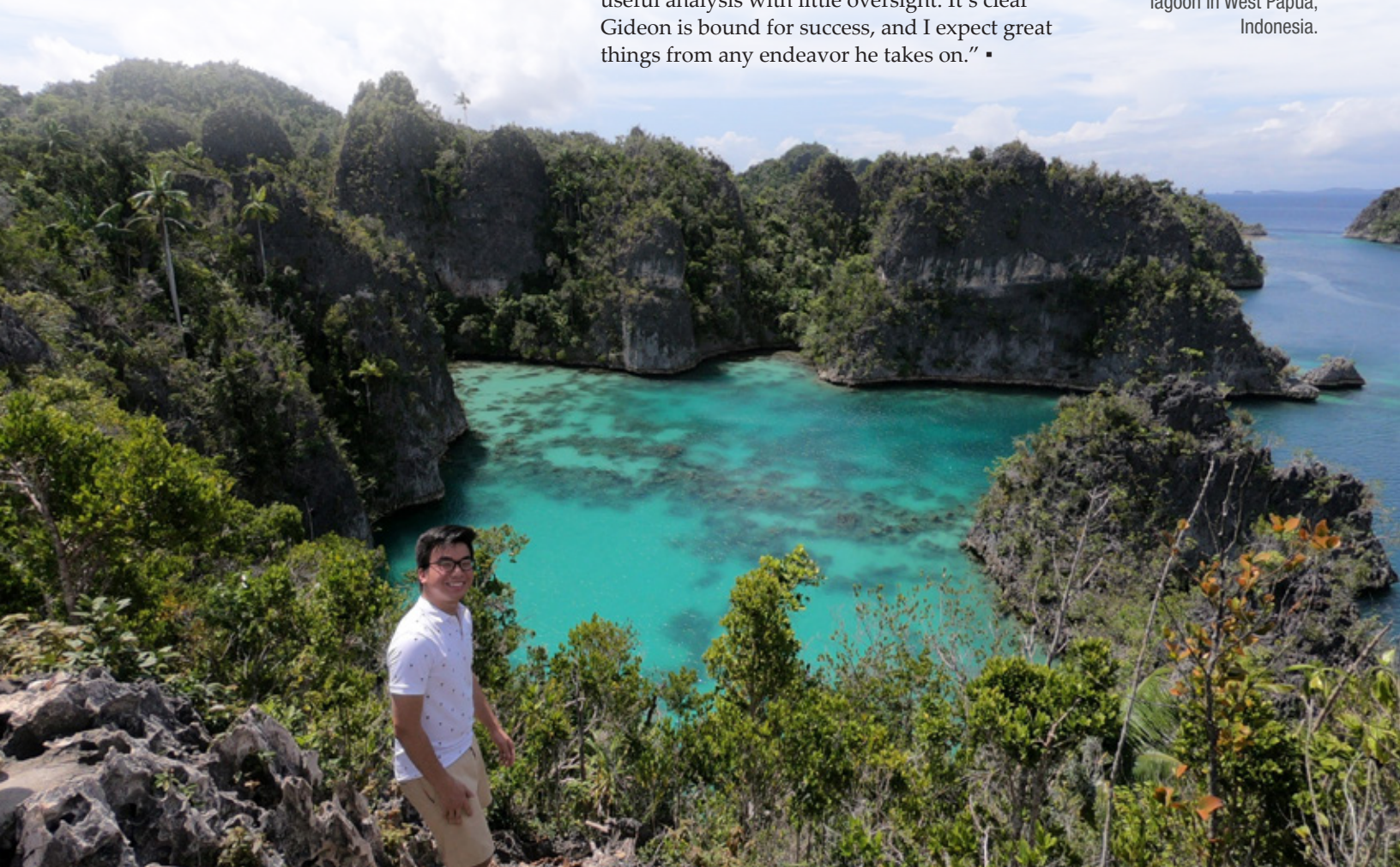
ISyE Alumna Natasha Jain Elevates Home Décor for a Global Market

INDIA

Despite her young age, Natasha Jain is nothing less than a serial entrepreneur. She attributes this mindset to being involved with her family's company — a global manufacturer and supplier of medical microscopes — while still in high school, when she created a supply chain for the company.

"There was a lot of room for optimization, and I saw gaps that existed in our processes that could be fine-tuned," Jain said.

Born in Ambala, India, and brought up in Delhi, Georgia Tech was always on Jain's radar, thanks to family and friends who attended the Institute. With her burgeoning interest in supply chain, logistics, and optimizing processes, it made sense for her to enroll in the H. Milton Stewart School of Industrial and Systems Engineering's No. 1 program.

After Jain graduated in 2010, she attended Stanford University for her master's degree in management science and engineering. While there, she co-founded Freshmentors, a web platform that matched college applicants with current college students who offered advice on admissions, applications, and campus life. Jain continued to work on Freshmentors after she graduated in 2012 and eventually saw the startup successfully scaled for use in India, but as the founding team disbanded, she decided it was time to try something new.

Back in India in 2014, Jain founded Ruplee, a mobile payment app similar to Apple Pay. Ruplee allows users to pay offline retailers, restaurants, and lodgers via a mobile phone.

"At the time, mobile payments were nascent in India," Jain said. "It was a great time to enter the market because the system was taking over globally, so it made sense to explore it in India."

After Ruplee was acquired by another company in 2016, Jain then turned her attention to the home décor market. Along with her father, who is one of India's few three-time Red Dot Design winners, she co-founded Bent Chair. The company now has about 240 employees.

In the following interview, Jain discusses her passion for home décor and how Bent Chair is growing as a company.

What drew you to start a décor company? I was at the junction where I was phasing out of Ruplee and thinking of what should be next in terms of work, and I was also in the process of doing up my own house. I realized that when I was living in the U.S., there were a lot more options for me as a young professional to decorate my home in terms of brands I could identify with.

That does not exist in India. It's a very fragmented market when it comes to home décor. There are a lot of boutique stores, but nothing really exists within a uniform brand identity. There's a market gap.

The second thing was the increase in the imports of furniture from China. In India, we have a longstanding tradition of people who carve and weave and make beautiful products, but their skills were being completely neglected. Everything was import-oriented.

So my father and I thought that given our family's strong manufacturing background, it would make sense to gather these skilled artisans and create a platform to showcase their skills and products.

Would you say that's what sets Bent Chair apart — the focus on the local, the historical, on art and culture? A lot of people, especially younger people, may not want to have traditional-looking items in their homes. We decided that since we are targeting a global market, our products should be something many people can relate to. At the same time, we want to showcase the different techniques our artisans use.

If you browse through the Bent Chair website, many products show a blend of the traditional and the contemporary. We've tried to be consistent with that design aesthetic. We try to make home décor fashionable.

How do you stay current with design trends?
The best way to stay on top is to constantly

accommodate customer feedback. You have a vision for your brand, but at the end of the day, your product needs to sell to your customers.

We also reach out to the design community and get their input because interior designers and architects are key influencers in this industry. It's about having a very inclusive approach and keeping everyone's preferences in mind.

What markets can Bent Chair be found in besides India? China has become a huge consumer of home décor products, and a lot of Chinese buyers want products that aren't necessarily made in China. We were approached by a very large Chinese home décor brand called BD Homes; they have over 200 stores in China. They wanted to collaborate with us to open up a store in China, so we recently opened a 5,000 square-foot store-within-a-store in Ningbo. We're very excited at the response. It's a good way for us to see how our products compete with products already in China, given that it's such a big manufacturing hub for furniture worldwide.

The next market we're actively targeting is Dubai. We're in the process of talking to designers there to come up with new products that are more suited to the Dubai market.

What's next for you and for Bent Chair? We're determined to expand omni-channel, so in addition to enlarging our digital footprint, we're also aggressively opening stores in different cities in India and then hopefully will expand to cities outside India as well. What we've realized is that it's not really an either/or scenario for our industry. People want to be able to see the products online and also be able to come experience them — to get the touch and feel of what they're buying.

So we have to innovate in terms of how we showcase the product to people — that's what's next. ▪ SHELLEY WUNDER-SMITH

Top: Natasha Jain calls Plum India's "first true retail restaurant." The newly opened Plum offers Pan-Asian cuisine in a high-end environment where diners can purchase any of the décor to bring home. Above: The Bent Chair Studio in Gurgram, a part of the National Capital Region, is one of more than 10 Bent Chair stores in India.

Health & Humanitarian Logistics Conference Celebrates 10 Years

Decision makers in health and humanitarian fields are faced with unique challenges, which include potential supply chain disruptions, uncertainty, and limited infrastructure, supplies, and personnel. To help address these issues, the 10th Annual Health & Humanitarian Logistics Conference (HHLC) addressed topics such as health emergencies, health systems strengthening, and disaster preparedness, response, and recovery. HHLC is one of the few conferences that brings together leaders and practitioners from both health and humanitarian arenas to highlight such challenges and share best practices from around the world. It also serves as a forum for collaboration and coordination across multiple sectors and organizations.

"The motivation for convening this conference has been twofold: to address natural and man-made disasters that affect thousands of people every year, as well as ongoing development needs in health and well-being and other key areas," said Pinar Keskinocak, William W. George Chair and professor in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), the College of Engineering's ADVANCE Professor, and co-founder and director of the Center for Health and Humanitarian Systems (CHHS).

In collaboration with INSEAD, MIT Humanitarian Response Lab, Northeastern University, NC State, People that Deliver, and the International Association of Public Health Logisticians, the conference was held on July 18-19 in Dubai, UAE. It featured numerous workshops and panel discussions, with approximately 200 speakers and attendees from 44 countries and 122 organizations, including current and former ministers of health, representatives from governmental and non-governmental organizations, industry, foundations, and academia.

In his keynote speech, Jagan Chapagain, the Under-Secretary-General for Programmes and Operation for the International Federation of Red Cross and Red Crescent Societies, discussed several challenges faced during public health emergencies and the strategies to strengthen the system to better meet the needs of the public during normal times and beyond.

"Strong health systems help prevent humanitarian crises," explained Chapagain. "They provide a basis for early interventions so that quick action can be taken to stop the spread of epidemics and also help reduce the impact of non-communicable diseases. At the same time humanitarian issues could provide the necessary resources and impetus to strengthen the health systems in the countries affected by crises. Each approach reinforces the other."

Keskinocak was presented with the Outstanding Professional Education Award from Georgia Tech in April 2018 for her leadership and contributions to professional education. In bestowing this award, the Faculty Honors Committee recognized Keskinocak's leadership of CHHS, as well as her efforts to promote health and humanitarian services through professional education.

L-R: Joscelyn Cooper, CHHS program coordinator, Georgia Tech; Julie Swann, CHHS co-founder, NC State; Kevin Etter, UPS; Abhishek Wasan, UPS; Pinar Keskinocak, co-founder and director of CHHS, Georgia Tech; and Özlem Ergun, co-founder of CHHS, Northeastern University.

"We hope that the presentations and discussions the conference hosted over the years help us articulate the pressing challenges related to health and humanitarian systems and inspire new ideas and practices toward positive change," added Keskinocak. "Given the complexity of these problems, collaboration among different entities is essential in generating sustainable solutions. We hope that the conference will continue to foster new partnerships and synergies across the many different organizations represented by the attendees."

Celebrating 10 years could not have been possible without the generous sponsorship from key partners such as UPS Foundation, Chemonics, The Coca-Cola Company, Imperial Health Sciences, Johnson & Johnson, Kühne Stiftung, Ryder, Pfizer, and Walmart. ▪

*To learn more about CHHS and its activities, visit **www.chhs.gatech.edu**.*
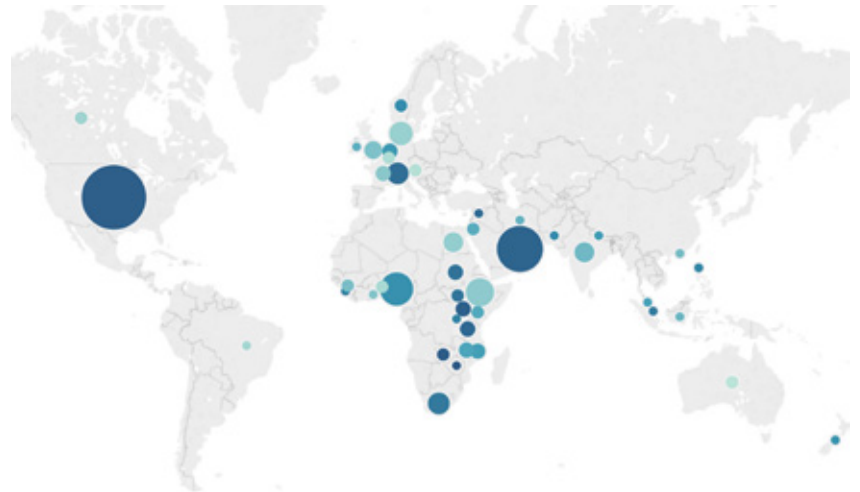
2018 conference participant representation by country.

Why Panama?

From a logistics and distribution perspective, the answer seems to be "why not?". Due to its central location, robust distribution platform, and world-class logistics facilities, Panama appears to be a natural partner for any international company. In many cases, a redistribution hub in Panama allows these organizations to increase distribution speed, enhance customer service, and decrease inventory costs.

However, before making the investment in Panama, companies must evaluate if it is the right business decision. To aid in this process, the Why Panama? project was born. A partnership between the Georgia Tech Panama Logistics Innovation & Research Center (GT Panama) and Proinvex, Panama's Agency for Investment Attraction and Export Promotion, the Why Panama? project provides the necessary information and analysis to help companies decide if a redistribution hub in Panama makes financial sense.

"The partnership between Proinvex and GT Panama provides a unique capability for multi-national companies to quantitatively analyze Panama's potential as a hub for their particular distribution needs," explained Don Ratliff, Regents' Professor Emeritus at the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) and co-executive director of GT Panama. "It also allows the companies a single point of contact — connecting them with the various stakeholders, both private and government — to facilitate their analysis and help

them to be successful if they decide to locate in Panama."

The Why Panama? tool was developed by professors at ISyE and researchers at GT Panama, many of whom are also Georgia Tech alumni. According to John Bartholdi, co-executive director of GT Panama and ISyE Manhattan Associates/Dabbiere Chair and professor, the tool compares the cost of in-transit inventory when distributing directly from the origin or through an intermediate site, such as Panama. This initial result gives executives an idea of whether or not Panama should be included in the short list of potential locations for a redistribution center. After running the tool, companies can also reach out to the government of Panama to further discuss partnership, and GT Panama can serve as a neutral third party to provide additional analysis to help with the decision.

Launched in 2010 and fully funded by the country of Panama, GT Panama provides logistics tools and strategic research to "aid in developing the logistics and trade capabilities that will enable Panama to become the trade hub of the Americas." It serves as the technical arm of the Panamanian government's Logistics Cabinet and is led by Ratliff and Bartholdi.

What makes GT Panama unique is that the research conducted is to help an entire country, rather than a single company, which leads to greater impact.

"By working for a country, we can be involved in a broader spectrum of relevant issues," said Bartholdi.

"For example, consider the problem of improving last-mile delivery. If working for a company, we are typically restricted to routing and scheduling. But because we are sponsored by the government of Panama, we can be involved with the various entities that design the road network, control the flow of traffic, license trucks, and determine work requirements."

REPUBLIC OF PANAMA
MARITIME ROUTES
AIR ROUTES
TELECOM CONNECTIVITY
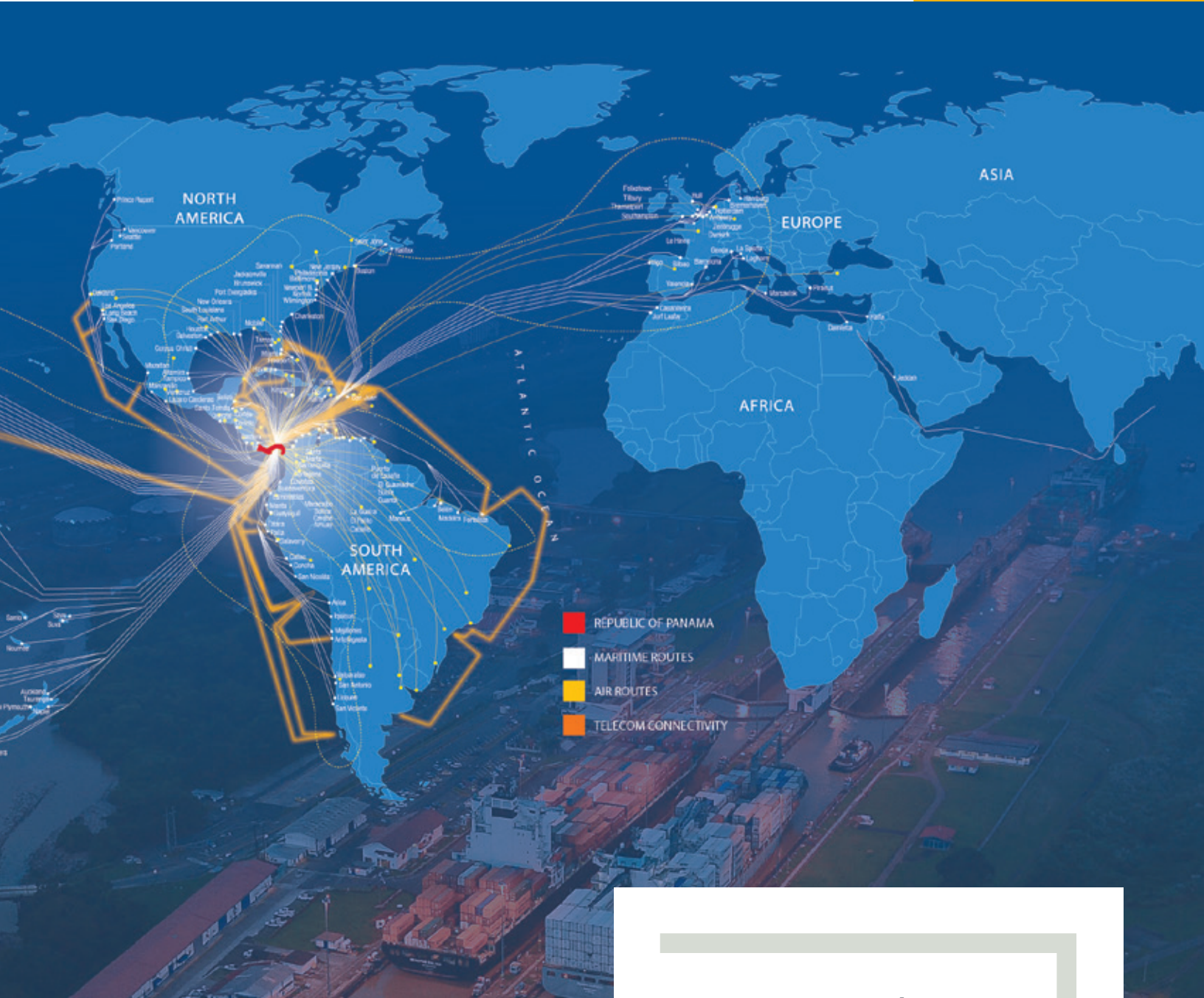
In addition to the Why Panama? project, the GT Panama team is conducting research in a number of other areas to help benefit the country, including a Panama Logistics Portal, Panahub Portal, Logistics Cabinet Dashboard, and analysis of urban logistics and public transportation to help ease traffic congestion. ▪ LAURIE HAIGH

To learn more about the exciting projects at GT Panama, visit **www.gatech.pa**.

"The partnership between Proinvex and GT Panama provides a unique capability for multinational companies to quantitatively analyze Panama's potential as a hub for their particular distribution needs. It also allows the companies a single point of contact."

Don Ratliff

Researchers from ISyE Partner with China's SF Express on Data-driven Design of Logistics Networks

As Shenzhen continues to rapidly grow and evolve as the high-tech hub of China, companies are looking for ways to improve their supply chains and logistics. In order to address challenges and expand opportunities, researchers from the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) are partnering with SF Express, the largest Chinese express delivery and logistics service provider headquartered in Shenzhen.

Led by ISyE's Benoit Montreuil, Coca-Cola Material Handling & Distribution Chair and professor, director of the Physical Internet Center, and co-director of the Supply Chain & Logistics Institute (SCL), the research team includes James C. Edenfield Chair and Professor and SCL co-director Martin Savelsbergh; Schneider National Chair in Transportation and Logistics and Professor Chip White; Associate Chair for Graduate Studies and Professor of Logistics Alan Erera; David M. McKenney Family Early Career Professor and Associate Director of the Center for Machine Learning Sebastian Pokutta; Leo and Louise Benatar Early Career Professor Alejandro Toriello; and A. Russell Chandler III Early Career Professor George Lan; and engages dozens of graduate student researchers.

Shenzhen is China's fastest growing high-tech megacity. Considered the Silicon Valley of China, the city sits on the Pearl River Delta and borders Hong Kong. With a population of 18 million people, Shenzhen has the highest gross domestic product per capita among medium and large Chinese cities. The Shenzhen port is the third largest container port in the world.

In 2017, ISyE researchers traveled to Shenzhen where they met with representatives from SF Express to discuss partnership opportunities. The discussions led to the co-development of several multiyear research projects, some of which will focus on the data-driven design and operation of both inter-city and intra-city logistics service networks, as well as the design and operation of smart hyperconnected fresh supply chain solutions.

The smart hyperconnected intra-city and inter-city logistics service network projects center on enhancing delivery performance, respectively between cities across China and within China's megacities. Both projects aim to enable expanding coverage, enhancing service, and improving speed efficiency, cost-effectiveness, agility, sustainability, and resilience. Both favor a data-driven approach adapted to the cultural, economic, demographic, and geographic reality of China and its global connectivity. They will establish models and methods for designing flexible service network configurations and operating those configurations efficiently and cost-effectively, which will, in turn, be assessed, improved, and enhanced after initial implementation.

As SF Express invests in developing an end-to-end supply chain for delivering fresh products, the hyperconnected fresh supply chain project builds on the smart intra-city and inter-city logistics systems projects currently underway. This project will lead to the development of the framework and methodologies for designing and operating smart hyperconnected fresh product supply chain solutions. The project will support SF Express in pilot testing the overall concept and approach for targeted fresh products.

All projects will draw on machine learning, optimization, simulation, and systems design methodologies, and will use Physical Internet concepts and principles to design hyperconnected logistics networks and supply chain solutions.

Describing the impact of the partnership with SF Express, Montreuil said, "This is a tremendous opportunity for the faculty and students involved, and strategically positions Georgia Tech, ISyE, SCL, and the Physical Internet Center in China, advancing our position at the forefront of smart city, Physical Internet, and logistics innovation across the world." ▪

ANNE STANFORD

International Research Collaboration Leads to New Opportunities

Machine learning is one of the fastest growing technologies today. The ability to analyze large amounts of data — and learn from it — helps organizations make better business decisions, increase productivity, and improve the customer experience. The applications are seemingly endless, from online shopping suggestions to self-driving cars.

To further their research opportunities in this growing field, researchers from the Center for Machine Learning at Georgia Tech recently signed a memorandum of understanding (MOU) with the RIKEN Center for Advanced Intelligence Project (RIKEN-AIP) in Japan and is in the process of signing a similar MOU with the Fraunhofer Institute for Integrated Circuits IIS (Fraunhofer IIS) in Germany to formalize a collaborative working relationship on machine learning.

"The goal of the MOU is to combine the strengths of the different players in order to be more competitive, to be able to tap into different companies, and work on different large-scale projects and activities," said ISyE David M. McKenney Family Early Career Professor and Associate Professor Sebastian Pokutta, who also serves as associate director of the Center for Machine Learning. "On a very fundamental level, different research cultures inform different problem-solving approaches. If you look at how research is conducted in Japan, Germany, and the U.S., you will see that they are all very different. Diverse perspectives often lead to better outcomes. It was a very natural fit to bring these three units together."

Both RIKEN-AIP and Fraunhofer IIS are independent research centers designed to provide agility in projects and facilitate industry interaction. They employ world-class researchers and are making an investment in machine learning. Georgia Tech naturally fits into the picture.

"We have a very integrated approach to machine learning," explained Pokutta. "We look at it from both a purely machine-learning or methodology perspective, but we also integrate engineering and the sciences. That's what makes our approach unique. In addition, our machine-learning Ph.D. program is very tightly integrated with the other machine-learning efforts, which creates this seamless interaction between the students and the faculty. I think that is the strength of Georgia Tech in this set-up."

The partnership also reduces cultural barriers and leads to improved interaction with companies in Japan and Germany. "It helps to have a local partner that speaks the local language, especially in Japan," said Pokutta. "It allows us to be more effective when working with Japanese companies. And they like to have an international partner because they can tap into international talent that they might not have in their respective locations."

Another aspect of the collaboration is to foster knowledge exchange in machine learning by hosting workshops in the various locations. The most recent was a three-day conference on machine learning and discrete optimization held in Tokyo this past summer. The goal was to bring together discrete optimizers and machine-learning researchers in an effort to bridge the fields and stimulate cross-disciplinary interaction. Approximately half of the attendees were affiliated with the MOU, but the workshop also drew speakers and companies from a wider audience.

The team is currently in discussions with companies about potential research opportunities and hopes to begin a project in the near future. "The next steps are now to further intensify the collaboration, which includes a Ph.D. student and faculty exchange, as well as interacting with various industries both in Japan and the U.S.," said Pokutta. ▪

LAURIE HAIGH

Accurately Evaluating Pediatric Dental Access for Medicaid-insured Children

"[N]ationwide, the majority of publicly insured children live within 15 minutes of a Medicaid dentist, and in some states it's as high as 99 percent," said Marko Vujicic, chief economist and vice president of the American Dental Association's (ADA) Health Policy Institute (HPI). "Moreover, when it comes to why people avoid going to the dentist, not being able to find one is pretty far down the list."

However, the data actually seem to be telling a different story, according to H. Milton Stewart School of Industrial and Systems Engineering (ISyE) Professor Nicoleta Serban. With a team of undergraduate and graduate students from ISyE, and using extensive data on the Medicaid population — data unavailable to the ADA — she found problems with the ADA's results: "The estimates provided by HPI substantially overestimate access for children with public insurance. The overestimation comes from both data limitations and the shortcomings of the methodology employed."

The ADA is considered by policymakers to be *the* source of data in support for dental health care-related policies and laws. If the organization decides there is no access problem, policymakers may be inclined not to pursue national and state policies to improve access for children on Medicaid.

Serban and her students developed a mathematical model for matching need/demand and supply for particular health care services under a series of realistic constraints. These constraints were specified by data about dentists who accept children with Medicaid, as well as how many of these patients the dentists have seen over the course of a year. Other factors include whether the children's parents have a car, and the preference of parents to not have to travel too far to take their kids to a dentist.

Serban's methodology uncovered an even more dismal state of affairs for children in the state of Georgia than portrayed by the ADA: 23 percent of children on Medicaid do not have access to dental care within the state access standards (30 miles for urban areas and 45 miles for rural areas). This is in significant contrast to the six percent estimate by the ADA. Additionally, Serban's model found that in Georgia, 23.8 percent of children had a distance of five miles — or, equivalently, 15 minutes of travel time. In the city of Atlanta, the average travel time was considerably longer than 15 minutes.

"There are potentially major policy and practice implications to substantially overestimating spatial access to dental care," noted Serban. "State policymakers may erroneously conclude that advancing policy to improve access to dental care for publicly insured children is not needed in their jurisdiction."

Her research is ripe for substantive impact because many states are considering enacting bills that would grant more flexibility for providing and supporting basic dental care services by dental hygienists and therapists — providers who tend to work in rural areas and administer care to children on Medicaid. Moreover, local health departments also may use this research to receive funding to support programs addressing access barriers.

Serban's research is building momentum among public health decision-makers, many of whom have reached out to her ISyE health analytics group to search for evidence to accurately portray the barriers parents face in finding a dentist who accepts Medicaid insurance. This is a multiyear endeavor, but Serban hopes that not too far in the future — and as a result of correctly interpreting the available data — all U.S. children will have access to basic dental care in their schools. ▪ SHELLEY WUNDER-SMITH

The Next Frontier in Data Privacy

Earlier this spring, Facebook and Cambridge Analytica brought data privacy into the spotlight. The UK-based data firm acquired millions of Facebook users' personal data to build software that could target swing voters during political campaigns. Essentially, Facebook data was leveraged to create targeted ads for political gain, leading to questions around the legality and moral state of data privacy.

Data privacy can be a grey area for thousands of companies that use online behavioral data to target consumers every day — from ads on the websites we visit to the coupons we get at the grocery store. These choices are tracked, collected, and analyzed en masse. It can help consumers: You watched a certain movie on Netflix, so it suggests another you might like in the same genre. But it can also be intrusive, creating a feeling of "Big Brother": Your running route was recorded by a workout app and shared with others.

Rachel Cummings, an assistant professor in the H. Milton Stewart School of Industrial and Systems Engineering, is working to better understand data privacy and how it relates to both human behavior and the economy.

"The issue with Facebook and Cambridge Analytica highlights that data privacy is a highly nuanced issue," said Cummings. "Unlike traditional data breaches, these two companies were legally sharing data according to an agreed-upon contract. The issue in this case is downstream data use: Once a person shares their data, who is allowed to use it and for what purposes?"

Cummings recognizes that challenges exist for companies that want to use their data — they stand to gain valuable insights from it but are hesitant for fear of bad press. So, to effectively capitalize on data in a nonintrusive way, differential privacy can help, which is Cummings' area of focus.

Differential privacy is a type of database privacy that guarantees the input data from a single individual (your home address, for example) has a very small impact on the output of a computation (Zillow reporting how many people live in a neighborhood, for instance). The goal of differential privacy is to ensure you only learn from the global database aggregate, rather than any specific individual.

Cummings' lab develops and optimizes the algorithms that support differential privacy for corporations like Google, where data can be turned into dollars. Google uses it when a Chrome web browser crashes. To identify the problem without exposing the search history of users, a differential privacy algorithm is used to strip out personal identifiable user information. It's designed to protect the privacy of individuals but still provide Google with helpful information to make their browser service better.

Other Fortune 500 companies, like Apple, are leading the way in piloting differential privacy to make better business decisions based on their data. Companies can better understand customers' preferences, explain why they made the choices they did, and predict their future behavior. The algorithms can also be applied to health care and medical records to determine patterns in diseases or discern treatments that work on specific demographics, without violating medical privacy laws.
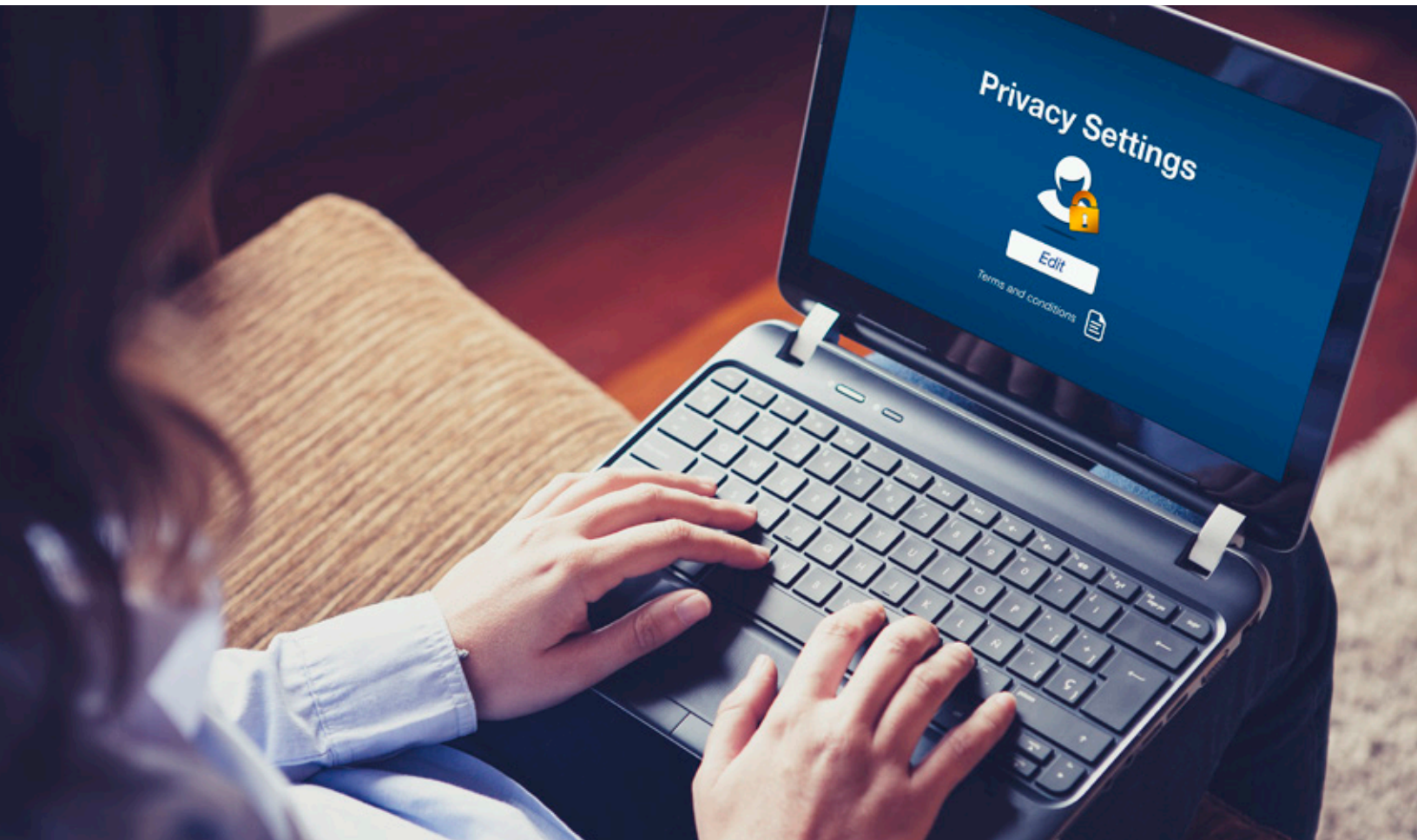
Cummings works within the field of differential privacy — a type of database privacy that guarantees the input data from a single individual has a very small impact on the output of a computation. The goal of differential privacy is to ensure you only learn from the global database aggregate, rather than any specific individual.

"With great data comes the potential for great privacy violations," said Cummings. "As companies make more efficient use of personal data, they must also respect the privacy needs of the individuals who share their data. I'm hoping to revolutionize my field, as well as U.S. business practices, by redesigning privacy policies so individuals have some say over how companies use the data they create."

Cummings plans to continue her work at the intersection of economics, machine learning, and data privacy. She proposes that companies need to think about how to incentivize people to share their data, while still giving them privacy guarantees. By striking the right balance between protecting consumer privacy and monetizing data, companies will be able to leverage differential privacy to their advantage. ▪

GEORGIA PARMELEE

Left to right: Professor Joel Sokol, Chris Anderson, and Kevin Chan

Develop an Understanding of Big Data and Analytics from the Comfort of Your Own Home

In today's competitive business environment, companies are seeking individuals with strong analytical backgrounds to examine large amounts of data and use it to make effective business decisions. According to a 2016 McKinsey Global Institute report, by 2024 the U.S. workforce will face a shortage of nearly 250,000 workers with these necessary analytical skills.

"Companies need people who can take data, big or small, and use it to make educated decisions," explained Joel Sokol, professor in the H. Milton

Stewart School of Industrial and Systems Engineering (ISyE) and director of Georgia Tech's interdisciplinary Master of Science in Analytics (MSA) degree. "Most organizations now have the ability to collect large amounts of data, but they need employees who can analyze it and make recommendations. We are definitely seeing an increase in the demand for analytics-minded individuals in the job market."

In response to this need, Georgia Tech launched an online version of its top-10 ranked MSA degree

program in the fall of 2017. The interdisciplinary program leverages the strengths of Georgia Tech faculty in ISyE, the Scheller College of Business, and the College of Computing. The Online Master of Science in Analytics program (OMS Analytics) provides students the same quality and rigor of the on-campus program with the flexibility to complete classes on their schedule. Many students are expected to finish their studies in two years, but they have up to six years to complete the degree.

"Technology in the world of business is rapidly evolving, with machine learning and artificial intelligence," said current OMS Analytics student Chris Anderson (BSIE 08). "Those concepts are big selling points and intrigue executives, so I think that the need is there for someone to be able to decipher and understand how to use those technologies to develop a business advantage."

Anderson knew he wanted to go back to school for his graduate degree, but quitting his job to attend a full-time program was not an option. "When I learned that the M.S. in Analytics was going to be offered online, it was music to my ears," he said. He discussed the program with Sokol and others from his undergraduate years with whom he kept in touch. As a result, he decided the OMS Analytics was the right fit.

Anderson is currently a senior market intelligence analyst at Georgia Power Company and is using his new knowledge at work.

"In this program they really make the connection between the theoretical framework and how to use and leverage it in everyday business," he said. "They've done a great job of closing that gap to let us know how we can apply the skills that they have taught us on the job."

With more than 1,200 applicants worldwide, the first cohort included 258 students — 97 percent of whom are working full time — from 32 states and 22 countries. Targeted toward mid-career professionals, the OMS Analytics program offers a flexible schedule that can be customized to each student's career goals.

Kevin Chan (BSIE 06) was part of the inaugural group of students. He brings 12 years of work experience to the program and is currently a senior principal business analyst at Manhattan

Associates. He chose the program for its flexibility, cost, and unique curriculum. In addition to the core courses, students choose from three track options — analytical tools, business analytics, or computational data analytics. The OMS Analytics is just a fraction of the cost of competing programs, with a price tag of less than $10,000.

"The ability to customize your education was very attractive to me," explained Chan. "There are 10 classes required to complete your degree

> ## "In this program they really make the connection between the theoretical framework and how to use and leverage it in everyday business. They've done a great job of closing that gap to let us know how we can apply the skills that they have taught us on the job."
>
> Chris Anderson

— five are core courses, but the other five can be tailored to your needs — so you can select the best combination to fit your career goals."

Chan has chosen to focus his degree in business analytics. "I'm not trying to get too deep into the theory; I'm more interested in the business application side of analytics. I want to pivot my career toward managing projects that deal with big data and analytics, so I am more interested in how the data can be used versus the theory and the codes behind it," he said.

In his position with Manhattan Associates, Chan plans to identify a problem he can solve for the company as his capstone project. He is currently on track to graduate in the summer of 2019. ▪
LAURIE HAIGH

To learn more about the OMS in Analytics, visit *omsanalytics.gatech.edu*.

Senior Design Teams Find Innovative Solutions for Clients

Twenty-four Senior Design teams from the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) completed real-world capstone projects for the spring 2018 semester.

"Spring semester capstone design teams worked on projects with clients large and small, and across a number of industry segments, from health care to breweries. It was very difficult to select four finalist teams, and the four selected were very representative," said Leon McGinnis, professor emeritus and Senior Design coordinator. "These teams, and the other 20 Senior Design teams, demonstrate once again the breadth of opportunity and the depth of excellence for our graduates."

"This semester we had many outstanding teams who brought great value to their clients. ISyE should be proud of its senior undergraduates who contribute to our No. 1 ranking," added George Nemhauser, A. Russell Chandler III Chair, Institute Professor, and Senior Design coordinator.

The teams presented their projects at the Capstone Expo on April 24, 2018. At the Expo, FedEx Fleet Mix took home the ISyE Judges' Choice award. Cycle-Ops and Shaw Industries were selected as finalists in the ISyE Best of Senior Design competition, and Team Textron was chosen as the first-place winner.

First Place: Team Textron

The goal of this project was to increase the throughput of Textron GSE's TUG tractor manufacturing line. The team used an optimization model to rebalance the manufacturing line, verified this output in a simulation model, and synchronized the workers on the line through Lean tools. If Textron GSE implements this design, the daily tractor throughput has the potential to increase by 50 percent based on the students' analysis, which could enable them to meet demand and capitalize on their backlog to increase yearly sales by $20 million.

Jonathan Edwards, Sam Millson, Taylor Green, Erin Gant, Lauren Boulger, Nitin Singh, and Charlie Lebby

Finalist: Team Cycle-Ops

Cycle-Ops partnered with Relay Bike Share to reduce the number of understock events. Understock events occur when a user attempts to rent a bike but finds a station is empty. To minimize understock events, the team solved an optimization model using Python code, which was given to Relay as a decision tool. When the team's solution is implemented, Relay will see an 84 percent reduction in understock events. As a result, Relay can make, on average, $27,300 in additional yearly revenue.

Elizabeth Ball, Ije Okafor, Harika Kankipati, Kaitlin Rizk, Suzanne Kastens, Heer Patel, Brianna Honeywell, and Nicole Redder

## Finalist: Team Shaw Industries

Senior Design team Shaw Industries partnered with the company to revamp its reverse logistics process for returns. They redistributed the work from one central facility to 29 regional distribution facilities around the country. These regional facilities equipped them with an extensive desktop application that iterates through possible return decisions and returns both the top five feasible options and the costs associated with them. By rerouting returns to be more cost-effective, as well as standardizing processes and reducing holding time, this team saved the company over $740,000 per year.

Kara Pendley, Jacqueline Weiland, Katherine Sledjeski, Talia DeBenedictis, Sean Ruff, Sarah Edwards, Nick Shepherd, A. Russell Chandler III Professor Alexander Shapiro (Advisor), and John Preston Green

Capstone Judges' Choice: Team FedEx Fleet Mix

The team worked with FedEx on a project designed to optimize the fleet mix of delivery trailers in order to minimize operational costs while maintaining service quality. Elements of the problem formulation included enforcing capacity constraints, ensuring service standards were upheld, and exploring the integration of lower-cost transportation modes. By thoroughly analyzing the cost-factor tradeoffs of alternative trailers and developing an optimization-based scheduling tool, the team proposed a change to the fleet mix that would save the company several hundred thousand dollars per week in operational costs if implemented.
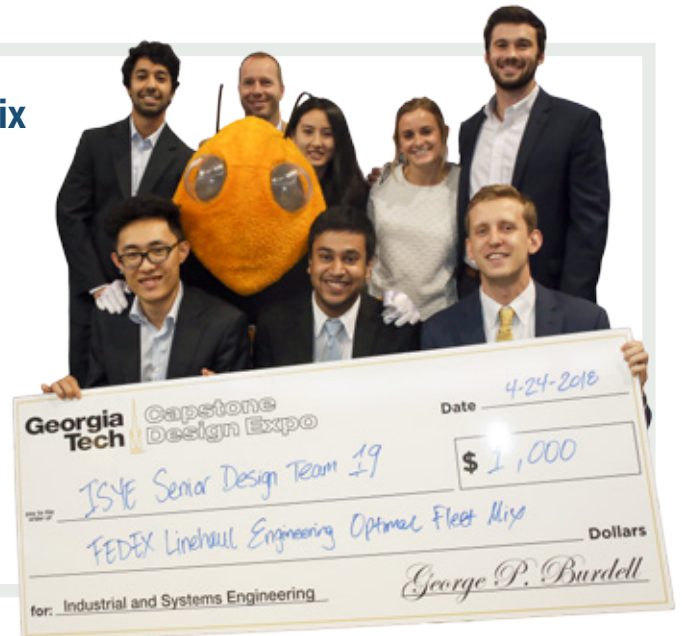
Soheil Faghihi, Shuhao "Jackson" Fan, ISyE School Chair Edwin Romeijn, Ziwei Miao, Raghav Garg, Catherine Burns, Alexander Wandrick, and Grant Herman

Welcoming New Faculty to ISyE

The H. Milton Stewart School of Industrial and Systems Engineering welcomed five new faculty members in the fall of 2018.

Assistant Professor Swati Gupta joined ISyE in July. Prior to joining ISyE, Gupta was a research fellow at the Simons Institute for the Theory of Computing at UC Berkeley. Her research interests lie primarily in combinatorial, convex, and robust optimization with applications in online learning and data-driven decision-making under partial information. Her work has focused on speeding up fundamental bottlenecks that arise in learning problems due to the combinatorial nature of the decisions, as well as drawing from machine learning to improve traditional optimization methods. She has also worked on providing optimized inventory routing decisions under uncertain demand and dynamic pricing items while incorporating effects of sales and promotions. She has collaborated with industrial research labs such as IBM Research Lab (Zurich) and the Oracle Retail Data Science Group. Gupta is also interested in exploring strategic behavior of customers, fairness and bias in decisions, and unintended consequences of optimization.

Gupta received her Ph.D. in operations research from the Massachusetts Institute of Technology. Prior to that, she earned dual degrees (B. Tech and M. Tech) in computer science and engineering from the Indian Institute of Technology Delhi.

Professor Pascal Van Hentenryck joined ISyE in August as the A. Russell Chandler III Chair. Prior to this appointment, he was a professor of computer science at Brown University for about 20 years, led the optimization research group at National ICT Australia, and was the Seth Bonder Collegiate Professor of Engineering at the University of Michigan.

Van Hentenryck's research focuses on artificial intelligence, data science, and operations research. His current emphasis is to develop methodologies, algorithms, and systems for addressing challenging problems in mobility, energy systems, resilience, and privacy.

Van Hentenryck is a Fellow of AAAI (the Association for the Advancement of Artificial Intelligence) and INFORMS. He has been awarded two honorary doctoral degrees from the University of Louvain and the University of Nantes, the IFORS Distinguished Lecturer Award, the Philip J. Bray Award for teaching excellence in the physical sciences at Brown University, the ACP Award for Research Excellence in Constraint Programming, the ICS INFORMS Prize for Research Excellence at the Intersection of Computer Science and Operations Research, and an NSF National Young Investigator Award. He received a Test of Time Award from the Association of Logic Programming and numerous best paper awards, including at IJCAI and AAAI.

Professor John-Paul Clarke, a professor in the Daniel Guggenheim School of Aerospace Engineering (AE), transitioned to a joint appointment in ISyE and AE in August. In addition to being a College of Engineering Dean's Professor, he is also director of the Air Transportation Laboratory at Georgia Tech.

Clarke's research focuses on the development and use of stochastic models and optimization algorithms to improve the efficiency and robustness of aircraft, airline, airport, and air traffic operations. Of particular note, his research in aircraft trajectory prediction and optimization, especially as it pertains to the development of flight procedures that reduce the environmental impact of aviation, has been instrumental in changing both the theory and the practice of flight procedure design.

Over the years, Clarke has chaired or served on advisory and technical committees chartered by the AIAA, EU, FAA, ICAO, NASA, the National Academies, the U.S. Army, and the U.S. DOT. He is currently a member of the NASA Advisory Council Aeronautics Committee and was co-chair of the National Academies committee that developed the U.S. National Agenda for Autonomy Research related to civil aviation. He is a Fellow of the AIAA and is a member of AGIFORS, INFORMS, and Sigma Xi.

Associate Professor Negar Kiyavash joined the Georgia Tech faculty in August and holds a joint appointment in ISyE and the School of Electrical and Computer Engineering. Prior to joining Georgia Tech, she was a Willett Faculty Scholar at the University of Illinois at Urbana-Champaign (UIUC) and a joint associate professor in the industrial and enterprise engineering and electrical and computer engineering departments.

Her research interests are in statistical learning with emphasis on design and analysis of algorithms for network inference. She is a recipient of NSF CAREER and AFOSR YIP awards and UIUC's College of Engineering Dean's Award for Excellence in Research.

Kiyavash received her M.S. and Ph.D. degrees in electrical and computer engineering from the University of Illinois at Urbana-Champaign in 2003 and 2006, respectively. She earned her B.S. in electrical engineering from Sharif University of Technology, Iran, in 1999.

Professor Srinivas Peeta joined the Georgia Tech faculty in August and holds the Frederick R. Dickerson Chair in the School of Civil and Environmental Engineering with a joint appointment in ISyE.

Peeta's research focuses on applying techniques from control theory, operations research, and advanced computational methods to large-scale transportation networks. It addresses problems in network modeling and dynamics, connected and autonomous transportation systems, traveler behavior/learning, traffic flow modeling, and interdependent infrastructure systems. His work in dynamic traffic assignment is widely considered the research standard.

Before coming to Georgia Tech, Peeta served as the Jack and Kay Hockema Professor of Civil Engineering at Purdue University and the associate director of the U.S. DOT Center for Connected and Automated Transportation. He was the director of the NEXTRANS Center, which served as the U.S. DOT's Region 5 Regional University Transportation Center (UTC) from 2007 to 2018.

Professor of the Practice Ron Johnson Brings Leadership Skills to ISyE

"Leadership is an affair of the heart," according to ISyE Professor of the Practice Ron Johnson. This perspective can be traced all throughout his education and career.

He credits CW4 (Ret.) Don Lesch, the senior military instructor at Lane Tech, a Chicago-area all-boys high school where Johnson was enrolled in Junior ROTC, for setting an example.

"He essentially dared me to go to West Point," Johnson remembered. "When I told him West Point wasn't for guys like me — I grew up on the west side of Chicago and thought I was tough — he said, 'If you don't think you can make it, maybe you shouldn't go.'"

That was enough motivation for Johnson, who ultimately earned a bachelor's degree in mathematics and mechanical engineering in 1976 from the military academy. After serving a few years in the Army, West Point selected him to attend graduate school, with the understanding that he would return to the academy and teach calculus, becoming the course director and assistant professor.

Johnson arrived at Georgia Tech planning to get a master's degree in civil engineering, but the Institute informed him that he didn't have the requisite undergraduate classes to do that. So, with the encouragement of the late Griffin Callahan, an ISyE professor who was also a West Point graduate, Johnson enrolled in ISyE's master of operations research program. And he's used the skills he learned at ISyE ever since.

In 2004, Johnson was given oversight of the U.S.'s $18.4 billion reconstruction project in Iraq after Operation Iraqi Freedom — an assignment tailor-made for an industrial engineer. "It was stochastic project management like we do in ISyE," Johnson said. "The Army Corps of Engineers was supporting the Iraqi people but at the same time was trying to meet the operational desires of commanders like General David Petraeus, who were on the ground. General Petraeus was talking to local leaders, who were telling him what they needed, and it didn't always match U.S. priorities.

"While I was there, we got considerable work done on water projects, some electricity and oil, and began putting infrastructure for education in place. We also had some significant supply chain management challenges. For example, we were moving enormous electricity generators on vehicles through areas that weren't necessarily friendly. If the convoy was attacked, you couldn't move fast because the equipment was so big. So throughout the night, we would track the movement of the generators in the ops center and consider factors like the best route to take based on the threat situation."

After 32 years, Johnson retired from the Army in March 2008 as a two-star general. He had been awarded numerous commendations, including the Combat Action Badge and the Distinguished Service Medal with two Oak-Leaf Clusters, meaning he had received the medal a total of three times, for service and contribution to the nation.

"That had nothing to do with my personal ability," Johnson said. "It had everything to do with the people I had the pleasure of commanding.

"In the military, you lead the country's greatest asset: American sons and daughters. These people sacrifice and commit, and you want them to be well-trained and feel good about what they've accomplished, and then you want them to get back home safely."

A few months after his retirement, the National Basketball Association (NBA) came knocking on Johnson's door. The league was reeling from a scandal in which a veteran employee had gambled on the basketball games he refereed. Then-Commissioner David Stern knew something needed to change. A couple of years previously, he had heard Johnson speak to the NBA's rookie players on leadership and being a role model, and when Stern decided to create a new role overseeing referee operations, he remembered Johnson.

Johnson was about to take a position with Lockheed Martin when his son, Ian, informed him that Stern had phoned. Johnson thought it was a practical joke, right up until he called Stern back, who told him, "Don't take that job." After several conversations, Stern tapped Johnson to be the NBA's senior vice president of referee operations.

Johnson demonstrated his leadership qualities once again when he decided to give back financially to Georgia Tech and endowed two scholarships. He initially made an expendable gift to fund a one-time scholarship for an African American student during the 2009-10 academic year. "During the fall homecoming, I had the privilege of meeting the recipient of the scholarship I funded," said Johnson. "His achievements and his goals for the future inspired me to endow the scholarship in perpetuity. Those of us who benefit from a Georgia Tech degree have an obligation to provide opportunity for the next generation of black students."

In 2013, Tech invited Johnson back as a professor of the practice. (A professor of the practice is a non-tenured faculty position held by a highly qualified individual who has made a major impact on disciplines important to the Institute.)

As a professor of the practice, Johnson is able to perfectly blend his industrial engineering training with his expertise in leadership. He teaches undergraduate ISyE classes, develops leadership and group-work skills within Senior Design teams, and offers motivation and encouragement to students who are struggling academically.

"I teach students how to be people of character, how to persevere, about integrity," he said. "I believe professors are leaders of their classroom, and as leaders, they should display the qualities that they expect. I come to class, and I'm prepared, I'm energetic, I'm passionate about what I'm doing.

"Whenever I have a student who falls short, I'm not going to just let them fail. I send them an email and tell them to come talk to me. So we sit there and have a conversation, and I tell them, 'I know you can do better.' Because they can."

It is a calling Johnson hadn't envisioned for himself. "When I retired [from the Army] I knew I eventually would teach somewhere," he reflected. "Maybe a community or technical college, maybe a smaller HBCU. Never in my wildest dreams did I think I would teach at Tech. I pinch myself every morning. I'm so proud to be here." ▪ SHELLEY WUNDER-SMITH

It was yet another opportunity for Johnson — essentially hired to put new processes in place — to use his ISyE skills.

For each NBA game — a total of 14 games a night, six days per week — he needed to schedule three-man referee crews. "Forty-two refs are either at a game, going to a game, or leaving a game, and then there are 18 who are getting ready to go or come home from a game," Johnson explained. "And then some might be on vacation or unavailable due to injury. So now you're optimizing under constraints."

All told, Johnson spent five years with the NBA, and many of the systems he developed are still in place.

ISyE Inducts New Advisory Board Members and Selects New Leadership

Dennis Frendahl, R. Scott Herren, Richard Lackey, Margaret Pate, and Yvette Smith joined the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) Advisory Board in the spring of 2018.

These five alumni, along with 15 other distinguished professional and community leaders, serve as a sounding board for the School Chair in an advisory capacity and assist with the School's development goals. Each new member will serve a four-year term (2018-22). Moe Trebuchon (BIE 86), Edenfield Executive in Residence and part-time lecturer for ISyE, was named as the Advisory Board's new chair, and Dan Shinedling (BIE 92), president of KS2 Technologies, was named as vice chair. Both will serve for a one-year term.

Dennis Frendahl (BIE 83) is procurement director, glass and PET packaging, for Diageo's Asia Pacific region and leads the procurement group's quantitative analytical activities. Prior to joining Diageo, he spent 25 years with The Coca-Cola Company, working with bottlers around the world to successfully source glass bottles, crowns, and aseptic fiber packaging. He also used his analytical expertise to develop a forensic understanding of the supply base and to create tools and models to help bottlers understand their procurement spend and forecast commodity prices.

In his six years with Paragon Consulting Group and Cleveland Consulting, Frendahl provided operations and general management consulting services to the food and beverage industry. During his five-year tenure with Frito-Lay, Frendahl rapidly advanced within manufacturing and sales operations.

In addition to his degree from ISyE, Frendahl earned his MBA from The University of Chicago. He currently serves as treasurer for the Coca-Cola Georgia Tech Network and has 34 years of consecutive giving to Roll Call. He hosts an annual golf tournament that has raised over $150,000 for Georgia Tech first-year scholarships.

R. Scott Herren (BIE 84) is the chief financial officer and senior vice president at Autodesk, the company that makes software for people who make things. Herren is responsible for Autodesk's global financial strategy, including operations, corporate development, financial systems, tax, and treasury, as well as the company's procurement organizations. While at Autodesk, Herren has orchestrated the company's business-model transformation — shifting from selling perpetual licenses to selling subscriptions.

Prior to joining Autodesk in 2014, Herren was senior vice president of finance at Citrix Systems where he led the company's finance, accounting, tax, treasury, investor relations, real estate, and facilities teams and held a variety of leadership roles during his 14-year tenure. Before joining Citrix, Herren spent more than 15 years in senior strategy and financial positions at FedEx and IBM.

Herren currently serves on the board of directors of Proofpoint Inc. and also serves as a member of Proofpoint's audit committee. In addition to his degree from ISyE, he holds an MBA from Columbia University.

Richard Lackey (BIE 69) has served as president and CEO of Del-Tec Packaging Inc., a manufacturer and distributor of returnable/reusable and protective packaging solutions for consumer and industrial customers, since 1988. Prior to this role, he worked as vice president of operations for Swisstex/FoamPartner, a joint venture between U.S. and Swiss firms that produces consumer and industrial OEM polyurethane foam products for Fortune 500 companies. He also has experience in electrical circuit board assembly, working on various NSA contracts where he achieved Top Secret and Cryptographic Clearance levels.

In addition to his degree from ISyE, Lackey holds an M.S. in systems management from Florida Institute of Technology. He has been a Roll Call contributor since he graduated, an A-T Fund/Tech Fund contributor for 29 years, and has funded the Richard and Judith Lackey ISyE Co-op Scholarship.

Margaret Pate (BIE 81) is a reliability liaison at North American Electric Reliability Corporation

(NERC). She has more than 17 years of experience in business planning, program and project management, and process improvement in customer service, reverse logistics, and IT software projects in a high-tech environment. She also has more than 17 years of analytical experience in the electric utility sector. Pate is part of a three-generation Georgia Tech family.

Prior to joining NERC, Pate served as business planning manager at Hewlett-Packard. She is a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and treasurer for the IEEE Power and Engineering Society Atlanta chapter. Pate is a registered professional engineer in Texas and holds certifications as a project management professional (PMP) and Lean Six Sigma Black Belt (CLSSBB).

Yvette Smith (BIE 90) is the worldwide support engineering leader of the Customer Service & Support Cloud + Enterprise division at Microsoft. Leading a team of over 3,500 support engineers globally, Smith has end-to-end accountability for both the customer support experience and worldwide technical support delivery across Microsoft Azure, dynamics, data, enterprise cloud, and developer technologies.

Prior to this role, Smith was the senior vice president of delivery and professional services for Xerox Corporation's large enterprise operations in the U.S. She led a team of more than 4,500 professionals responsible for delivering Xerox services to global document outsourcing clients. Prior to Xerox, Smith spent more than 17 years at IBM, leading a variety of sales and IT services businesses and specialized in selling complex international enterprise solutions and developing the delivery infrastructure to support those solutions.

Smith is a certified systems management consultant and holds an MBA from Emory University. She's passionate about women's and children's health and gives back to the community as a board member for the Georgia Tech Women's Alumni Network and INROADS Inc. She is also an ambassador for the Grady Health Foundation.▪
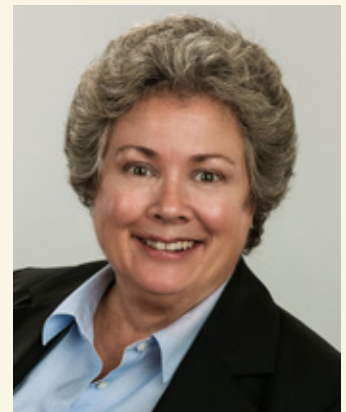
Top row: Dennis Frendahl, R. Scott Herren. Middle row: Richard Lackey, Margaret Pate. Bottom row: Yvette Smith

Toy Story: ISyE Student Aaron Brown Keeps the Love of Vintage Collectibles Alive

It's not uncommon to see young children selling refreshments at a neighborhood lemonade stand during the summer. What's unexpected is a kindergartner building off that initial entrepreneurial experience and starting a business selling vintage toys to customers all over the world.

That kid, Aaron Brown, is now a second-year undergraduate student in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE). The initial idea for his company came after he visited the Museum of Tin Toys in Yokohama, Japan, where he saw hundreds of original tin toys on display. Brown, who enjoyed playing with the tin toys his grandparents and parents had handed down to him, wanted to make these vintage collectibles available to others. And thus — with a box of tin toys, a simple website, and a $500 loan from his parents — Brown started TinToyArcade.com (TTA).

Now a 12-year-old company, TTA employs seven people — including Brown's parents — and is the sole source for thousands of vintage and retro-type toys — everything from bolo paddles to cap guns to Brown's favorite toy: D-Cell the robot.

"D-Cell is a spinoff of one of the first battery-operated robots," Brown explained. "He opens his chest, which contains firing pistols, and spins around as he's firing the guns. Then his chest closes, and D-Cell walks again. It's a pretty cool toy."

The company has provided props for numerous TV shows and movies: *iCarly*, *Heroes*, *Interstellar*, and *Men in Black*, among others. The prop master for *Tomorrowland* came calling, looking for $2,000 worth of robots to blow up in one of the movie's more spectacular scenes.

Brown has grown TTA from his parents' living room to its current warehouse near the Atlanta airport. He instituted same-day shipping for orders placed prior to 2 p.m. on weekdays. He also streamlined the order fulfillment process through simple steps, such as putting the most

GARY MEEK

popularly selling toys closest to the front of the warehouse. Employees wear iPods on their arms that tell them where in the warehouse a particular toy is located and which items are needed for order fulfillment. The warehouse's inventory syncs with the arm tech in real time.

Brown arrived at Georgia Tech in 2017 as something of a self-taught industrial engineer. He had attended ISyE's week-long summer camp, Mission Possible, as a high school sophomore, and quickly realized that ISyE was the perfect major to help him run TTA more efficiently. Now his studies are providing him with the opportunity to learn the theory behind his trial-and-error supply chain optimization.

"I found out in high school that I can teach myself almost anything — how to get a warehouse working, how to build a database — if I have enough time," Brown said. "But I don't have the math foundation at all, and I can't really explain why my system [for TTA] works, except that I can explain what didn't work and why my new method works better. I can't explain queuing theory or bin packing. I know these words, because I've heard them, but I've never used the processes taught here [at ISyE]. And I'm super excited to be able to use what I've learned to explain what I've done, and how to improve it."

Despite the fact that Brown is just now beginning his ISyE-specific studies, he has solid proof that his system functions: During the 2016 holiday season, hundreds of orders unexpectedly came in when both the *Atlanta Journal-Constitution* and *Wall Street Journal* featured articles about TTA.

"It was madness," he remembered. "On a day just before Christmas, we received over 1,500 orders. Never on the same day have we received that many orders. Our system handled it, which I didn't expect at all. I was so happy it worked!"

Tin Toy Arcade is a successful online retailer — in fact, Amazon is the company's main competitor. Brown attributes TTA's ability to challenge Amazon largely because of its same-day shipping policy. In addition, TTA carries exclusive toy lines from manufacturers in Germany and India.

He met Joseph Wagner, his German manufacturer, through the international New York Toy Fair.

"I snuck onto the floor of the toy fair when I was nine — the age requirement is 18 — and started handing out business cards," Brown said,

laughing. "I ran into Joseph, who's the last tin toy manufacturer in Nuremberg, which is the home of the original tin toys."

When Brown was in ninth grade, he visited Wagner in Nuremberg and learned more about the international history behind the original tin toys.

"Joseph's manufacturing plant is his garage," Brown said. "After WWII, he bought the Nazis' bullet presses and turned them into machines to make toys."

> **Brown arrived at Georgia Tech in 2017 as something of a self-taught industrial engineer. He had attended ISyE's week-long summer camp, Mission Possible, as a high school sophomore, and quickly realized that ISyE was the perfect major to help him run TTA more efficiently.**

The toys are litho-plate printed: Paint — now lead-free — is spread onto flat tin, which is then put onto the metal press that indents the toy's shape.

When asked what delights him so much about selling these retro toys, Brown responded, "I think it comes from the first day of this business, at an art show. I was selling photographs of my grandparents' toys and displaying the actual toys alongside the photos. One of my first customers was probably in her mid-40s, and she was super happy to see the toys she grew up with. She brought over her four kids and told them that these were the toys she had when she was a kid. She loved them, and then the kids instantly loved them too. There's no disconnect between generations with these toys.

"I think this is one of the best jobs out there, playing with and selling toys for a living," Brown added. "We say that we sell happiness. I've kept the legacy of them alive. Seeing how I can improve TTA is a lot of fun, and in turn, that made me an engineer." ▪ SHELLEY WUNDER-SMITH

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Faculty Awards & Appointments

FACULTY APPOINTMENTS

Dean's Professor and Stewart Faculty Fellow Shabbir Ahmed has been appointed to the Anderson-Interface Chair, which was created to support an eminent teacher-scholar in a position of academic leadership in the field of sustainability, energy, climate, and natural systems.

Ahmed's research interests include developing methods for large-scale optimization problems and their applications in energy and other networked systems. His work in these areas has been supported by various federal agencies and industrial organizations.

Ahmed is a past chair of the Stochastic Programming Society and serves on the editorial board of various scientific journals. His honors include the INFORMS Computing Society Prize, the National Science Foundation CAREER award, two IBM Faculty Awards, and the INFORMS Dantzig Dissertation Award. He is a senior member of IEEE and a Fellow of INFORMS.

Early Career Professorship Appointments

- **Associate Professor George Lan** – A. Russell Chandler III Early Career Professor
- **Associate Professor Kamran Paynabar** – Fouts Family Early Career Professor
- **Associate Professor Andy Sun** – Anderson-Interface Early Career Professor
- **Associate Professor Alejandro Toriello** – Leo and Louise Benatar Early Career Professor
- **Assistant Professor Yao Xie** – Harold R. and Mary Anne Nash Early Career Professor

FACULTY AWARDS

Carolyn J. Stewart Chair and Professor Jianjun "Jan" Shi was elected to the National Academy of Engineering (NAE). Election to the NAE is among the highest professional distinctions awarded to an engineer. In announcing Shi's election to the prestigious organization, the NAE commended him "for development of data fusion-based quality methods and their implementation in multistage manufacturing systems."

Shi is an early pioneer in the development and application of data-enabled manufacturing. His methodologies integrate system informatics, advanced statistics, and control theory for the design and operational improvements of manufacturing and service systems by fusing engineering systems models with data science methods.

John Hunter Chair and Professor Arkadi Nemirovski was elected to the American Academy of Arts and Sciences (AAAS). Founded during the American Revolution, AAAS is one of the oldest learned societies and independent policy research centers in the U.S. Selection by the academy is a high honor, and Nemirovksi's cohort includes former president Barack Obama and the actor Tom Hanks.

Nemirovski's research interests focus on optimization theory and algorithms, with emphasis on investigating complexity and developing efficient algorithms for nonlinear convex programs, optimization under uncertainty, applications of convex optimization in engineering, and nonparametric statistics.

A. Russell Chandler III Professor Alexander Shapiro received the 2018 George B. Dantzig Prize. This award, given jointly every three years by the Mathematical Optimization Society and the Society for Industrial and Applied Mathematics, honors original research that has had a major impact on the field of mathematical optimization.

Shapiro's research interests are focused on stochastic programming, risk analysis, simulation-based optimization, nondifferentiable optimization and nonsmooth analysis, sensitivity analysis and optimization of queueing networks, sensitivity analysis of nonlinear programs, and multivariate statistical analysis.

This page, from top: Jianjun "Jan" Shi, Arkadi Nemirovski, Alexander Shapiro
Opposite page, from top: Shabbir Ahmed, Eva Lee

DEMOCRATIC
REPUBLIC
OF CONGO

Malaba: Educating Congo's Future

My name is Ségolène Muderhwa, and I am from the Democratic Republic of Congo (DRC). Ironically, one of the poorest and most "underdeveloped" countries in the world has proven to be one of the world's richest in mineral resources, and it is propitiously situated (the DRC covers most of central Africa). These advantages could provide the key to the creation and proliferation of industries essential to my country's emergence as a global presence. Such enterprise development could subsequently lead to a decrease in some of the most important issues hindering Congo's progress: high unemployment rates and a high rate of brain drain.

From a young age, I knew that my country faced many challenges. Likewise, I also knew that we had the potential to address them. As I grew older, and the end of my high school education drew near, I made it my mission to stop complaining about DRC's problems and instead to become proactive in fixing them.

In order to achieve my goals, I knew I would need to learn how to solve problems on a large scale effectively and efficiently. This realization

> **"With Malaba, we want to focus on the quality of education that these girls will receive, as it is the only way to make a real impact for their future."**
>
> Ségolène Muderhwa

led me to pursue a degree in industrial engineering. If I wanted to be the best, I would need to learn from the best. Ultimately, I was accepted into Georgia Tech's No. 1-ranked industrial engineering program. Matriculating to a highly competitive Institute with a strong emphasis on technology, the learning curve I faced was steep. Nevertheless, I pushed myself harder than ever before to make the most out of my time at a school I had painstakingly worked to attend. My experience at Tech — from group projects to extracurricular activities — always led me to ask myself, "Ségolène, comment peux-tu optimiser ca?" ("Ségolène, how can you optimize this?")

When I remember the knowledge gap I had to bridge on my own, I think of the millions of kids back home who are not fortunate enough to receive the education I did. Education is not free in Congo, and there is considerable variance in education quality from school to school.

Consequently, four years ago, I co-founded a non-profit organization called Soeur, lève-toi (Sister, rise up). We aim to ameliorate the conditions of underprivileged girls in Congo through increased education, as well as to provide social support to orphans and abandoned children. One of the organization's core priorities is the Malaba — or "future" in the Congolese Tshiluba language — scholarship project, which I currently direct.

The scholarship is based on meritocracy. Candidates have to pass a math, French, and general knowledge test, as well as give a small presentation about themselves and their goals. We select the recipient based on these criteria, along with her past academic history. The scholarship covers all school-related fees, ranging from tuition and uniforms to daily lunches and transportation costs.

Many of the orphans we support have been through emotional and sometimes physical hardships, which can cause low self-esteem. Through Malaba, we want not only to finance the girls' basic education but also to work with them so their confidence recovers as they succeed academically and relationally.

With Malaba, we want to focus on the quality of education that these girls will receive, as it is the only way to make a real impact for their future. Currently, the main roadblock is the lack of sustainable financial resources to fund the program. We can only sustain and expand the Malaba scholarship project by receiving as much support and advice as possible. As a famous African proverb says, "If you want to go quickly, go alone. If you want to go far, go together." ▪

Ségolène Muderhwa (BSIE 17) is currently a student in the Master of Science in Analytics program, an interdisciplinary degree housed in ISyE. For more information on or to support Soeur, lève-toi, visit the organization's website: **http://soeurlevetoi.org** *or reach out by email: contact@soeurlevetoi.org.*

ISyE 2018 Distinguished Scholarship Lecture: Compressed Sensing – from Blackboard to Bedside

In September, ISyE hosted Stanford University's David Donoho for its 2018 Distinguished Scholarship Lecture. Donoho is the Anne T. and Robert M. Bass Professor of Humanities and Sciences and professor of statistics at Stanford University. He is also the 2018 recipient of the Carl Friedrich Gauss Prize for his fundamental contributions to the mathematical, statistical, and computational analysis of important problems in signal processing.

During the lecture, Donoho discussed his most well-known work, titled simply "Compressed Sensing," which is reflected in a new generation of magnetic resonance imaging (MRI) scanners. These next-generation scanners have recently been approved by the Food and Drug Administration to enter the U.S. health care market. The manufacturers of these machines claim that using compressed sensing (CS) technology dramatically decreases the amount of time patients have to be immobilized compared to traditional scans.

The talk also covered the mathematical ideas paving the way for the advent of CS and some of the ideas that have developed in its aftermath, including the practical work in MRI before and after compressed sensing appeared. According to Donoho, early researchers created a solid foundation — both in MRI research and in mathematics — that made it possible for such a rapid transition from blackboard to bedside.

The ISyE Distinguished Lecture program promotes discussion on critical issues in the field of industrial and systems engineering by bringing in leading scholars and industry experts who engage and share their expertise with ISyE's faculty, students, and alumni. This year's distinguished lecture committee included Coca-Cola Chair in Engineering Statistics and Professor Jeff Wu, A. Russell Chandler III Professor Xiaoming Huo, and Associate Professor Santanu Dey. ▪

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 as collaborators on a variety of research and 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 research issues that improve quality of life for all.

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Students from ISyE and Vietnam's International University learned how to hand-catch catfish in mudbanks during a tour of the Mekong Delta as part of the ISyE Summer Program in Asia.