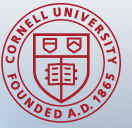


CornellEngineering

Operations Research and Information Engineering



ORIE

MAGAZINE 2024

**Looking Back,
Looking Forward**



Message from the director: Mark Lewis

I am writing for what will be my last ORIE Magazine as the director of the School of Operations Research & Information Engineering. I would like to take this opportunity to express what an honor it has been to serve as the director of this distinguished school for the last five years.

I joined ORIE in 2005 as a newly tenured associate professor. I was so excited about joining what I knew to be one of the preeminent operations research groups in the world. As I reflect, I had butterflies and was a bit intimidated by the Mike Todds, Jack Muckstadt, and Sid Resnicks of the world (to name just a few). After all, their reputation was beyond just being juggernauts in terms of research, they were known for being leaders in their respective areas of OR. To my surprise and utter delight I quickly found that Mike regularly played table tennis with the graduate students, Jack has a military background (he trained near my tiny hometown in the panhandle of Florida) and Sid...well, to know Sid is to know that he has the wit of George Carlin. This is all to say, they were all human beings who just happened to exhibit a kind of genius most aspire to. More than that, each had a maniacal dedication to ORIE in general and to the students in particular.

Fast forward 19 years later, and I could hardly expect that I would have had a five year stint in the dean's office followed by five years of leading this illustrious school. The same uneasy feelings that I had in 2005 are echoed in the butterflies I get in thinking of returning to the faculty, rekindling my research and reconnecting with the students in the classroom. I am looking forward to completing my cycle of researcher/teacher to administrator and back to research/teacher.

Somewhat similarly, the directorship gives you an opportunity to watch the cycles of ORIE. Sure we have navigated unprecedented challenges of a global pandemic, an internal financial crisis and a footprint at Cornell Tech that had not grown in several years. While doing so, almost in the background, the faculty continue to innovate, relay those innovations in the classroom or via publications and go back to find

new innovations. The students arrive neophytes, emerge global leaders and then are replaced by a new budding set of operations researchers. The ORIE machine keeps chugging along.

With all of this, some exciting new areas of research have emerged through the data science revolution. ORIE is meeting the challenge head on. Initially, we saw an uptick in applications of information engineering to pricing and placement of vehicles in ride sharing or in recommender systems for streaming services. We are now seeing the applications of machine learning in public policy, taking for example, refugee resettlement, resident crowdsourcing, ambulance placement and gerrymandering. All of this is done without losing sight of the classic areas of operations research like supply chain management, finance, and manufacturing, each of which has seen significant shifts as real-time data becomes more readily available.

As we hire new faculty, I see in them what some of the leaders of the past

hopefully saw in me. At the end of the day, the people of ORIE make the second floor of Rhodes Hall a vibrant place. Indeed, this issue should give you a snapshot of how we enable society to make better decisions that lead to increased efficiency, productivity, and prosperity. Whether it's developing more effective transportation systems, improving healthcare outcomes, or streamlining business operations, ORIE plays a crucial role in shaping our world for the better. I recommend reading the issue cover-to-cover. If you can, imagine yourself a new student, a new staff member or a new faculty member just joining ORIE. That is what I plan to do... after sabbatical.

Thank you and please do not be a stranger!

With warm regards and gratitude,
Mark Lewis



Table Of Contents Winter 2024

Operations Research & Information Engineering

- News 4
- Cover Story 8
- December Graduates 12
- Student Profile—Caroline He..... 13
- Meet the New ORIE M.Eng. Director..... 14
- Awards and Honors 16
- Alumni Profile—Radhika Kulkarni 18



Support ORIE's future with a gift to the Discretionary Fund

By combining the latest advances in optimization methods, stochastic analysis, and data science to develop impactful decision-making tools, ORIE enables society to make better decisions that lead to increased efficiency, productivity, and prosperity. Whether it's developing more effective transportation systems, improving healthcare outcomes, or streamlining business operations, ORIE plays a crucial role in shaping our world for the better.

ORIE alumni land in virtually every business sector and university imaginable, quite often ascending to leadership positions. We are proud of you and the things you have accomplished. The achievements of our alumni and our extended Cornell Engineering community are our greatest source of pride, and we thank you for your continued loyalty, engagement, and generosity.

You can help us create an innovative educational environment and spur research. Every gift helps us do the greatest good.

Please consider making a gift to ORIE today by scanning the QR code or by visiting tinyurl.com/giveorie



With gratitude,
Mark Lewis, Director

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THE ORIE Mission

The School of Operations Research and Information Engineering, on the forefront of Operations Research science, continues to influence and impact organizational and managerial process improvement, productivity, and performance through sophisticated mathematical and analytical techniques—quantitative methodologies applied to solving complex problems and reducing business risk.

Caggiano appointed Associate Dean of M.Eng. Programs

Kathryn Caggiano '98, professor of practice in the School of Operations Research and Information Engineering (ORIE), was appointed to a three-year term as associate dean of Master of Engineering Programs at Cornell Engineering, effective July 1, 2023.

Caggiano was the director of ORIE M.Eng. Studies for 16 years and "brings a unique combination of experience and proven success to this role," said Lynden Archer, the Joseph Silbert Dean of Engineering. Under her leadership, the ORIE M.Eng. program was repeatedly selected as a finalist for the INFORMS UPS George D. Smith Prize, the field's flagship award for effective and innovative preparation of students.

Caggiano received her master's and Ph.D. degrees in operations research at Cornell, and she served on the Cornell Engineering Alumni Association Board of Directors from 2009-2015. She is also a member of the ORIE Advisory Council and of the Graduate Studies Advisory Board at William & Mary, where she received her undergraduate degree.

Prior to joining the ORIE faculty in 2007, Caggiano was a faculty member in the Wisconsin School of Business at the University of Wisconsin-Madison. Outside of academia, she has held positions with Price Waterhouse Management Consulting Services (now PwC) and PeopleSoft (now Oracle) in technology and supply chain consulting.

Caggiano's research interests focus on developing practical mathematical models and solution approaches to enable better decision making in large-scale production and distribution systems. Her effectiveness as an educator has been recognized with multiple



By Chris Dawson

awards, including the Michael Tien '72 Sustained Excellence and Innovation in Engineering Education Award. Kathryn is the author of Spreadsheet Modeling, a four-part eCornell Certificate Program that launched in March 2022.

Caggiano succeeded Yong Joo, the BP Amoco/H. Laurance Fuller Professor in the Smith School of Chemical and Biomolecular Engineering.

International team develops new vaccine distribution model

This story appeared originally in the Cornell Chronicle in June, 2023 and features ORIE emeritus faculty members John Muckstadt and Peter Jackson.

By Jane Langille

Researchers from Weill Cornell Medicine, Cornell's Ithaca campus, Singapore University of Technology and Design, and San Jose State University in California have developed a model for optimizing the dispensing of vaccines during pandemics that uses a new measure of success for such efforts.

The new model – detailed in a paper published May 23, 2023 in the International Journal of Production Economics, expands the concept of vaccine coverage to include vaccinated person-days (VPDs), which prioritizes both the number of people vaccinated and the speed of getting shots into arms.

The primary goal of distributing vaccines in response to a pandemic is to protect the most people as quickly as possible. Shorter timeframes mean fewer infections, hospitalizations, deaths and opportunities for new strains to emerge compared with longer timeframes. During the COVID-19 pandemic, manufacturers produced the first two vaccine doses in record time – within 300 to 400 days of U.S. Food and Drug Administration approvals. Vaccines were distributed widely, with emphasis on pharmacies and other small venues, with the objective of making them easy to access.

The researchers found this distribution method was neither efficient nor effective.

"We were surprised to learn this distribution strategy led to extended times from production to people's arms," said senior author Dr. Nathaniel Hupert, associate professor of population health sciences and of medicine at Weill Cornell Medicine and an internal medicine physician at New York-Presbyterian/Weill Cornell Medical Center.

"So although the percentage of the population vaccinated – or coverage – is an important metric reported by public health authorities," Hupert said, "our work emphasizes that the timing of that coverage in relation to the unfolding outbreak is also critical."

The research team included lead author John Muckstadt, the Acheson-Laibe Emeritus Professor of Engineering in the School of Operations Research and Information Engineering and Stephen H. Weiss Presidential Fellow at Cornell Engineering. Muckstadt and Hupert are co-directors of the Cornell Institute for Disease and Disaster Preparedness (CIDDP).

Other co-authors included Dr. Robert Gougelet, an affiliate of the CIDDP; Michael Klein, professor of marketing and business analytics at San Jose State University, and Peter Jackson, professor of engineering systems and design at the Singapore University of Technology and Design.

The investigators developed a computer model that incorporated supply chain logistics for distributing vaccines from manufacturers to regionalized distribution warehouses and finally to more localized dispensing centers. It included two options for box sizes, the number and scale of dispensing locations, and the number of vaccines administered daily. Using Centers for Disease Control and Prevention data, they calculated how box size (number of doses per box) and the number and capacity of dispensing venues affected the goal of achieving maximum VPDs within larger population groups.

The model showed almost 20% more VPDs would have been achieved if COVID-19 vaccines had been delivered into arms within a week of availability in the community, using the maximized distribution strategy, rather than 81 days, as actually happened.

Looking at data from New York state, the number of VPDs achieved with the government's policy would have been 16% higher if the proposed optimized distribution strategy had been employed. These inefficiencies in distribution translated to a loss of more than 50 days of protection for the average vaccinated person in New York state, which is close to one-third of the duration of the omicron variant surge.

The model also showed that a smaller box size, an often-overlooked factor, was associated with higher VPDs in all scenarios.

"Lost VPDs were not recovered over the course of the vaccination campaign, and every single VPD matters," Gougelet said. "It would be useful to communicate this concept in future pandemics to raise awareness of the increased risk of disease transmission for unvaccinated individuals and encourage rapid vaccine distribution and uptake, especially in high-risk communities. Although difficult to accurately calculate considering the multiple variables in each event, we may find that most lives saved may be due to reduced transmission rather than individual protection."

Vaccine manufacturers and nongovernmental organizations such as the Coalition for Epidemic Preparedness Innovations have recently supported shortening vaccine development and manufacturing timelines to 100 days or fewer.

"Faster availability from manufacturers than what we saw with the first doses of the COVID-19 vaccine will magnify the urgency to have properly designed distribution supply chain systems in place," Hupert said.

"We recognize choosing dispensing locations is a complex decision, and we're not suggesting vaccinating everyone in stadiums," he said. "We also realize several factors determine the final 'form factor' of vaccines ranging from shipping box size to the use of prefilled syringes. Based on core principles of supply chain engineering, our findings support the use of larger venues and smaller box sizes whenever possible to achieve the overall goal of vaccinating more people sooner."

Using broad race categories in medicine hides true health risks

This story appeared originally in the Cornell Chronicle in August, 2023. ORIE assistant professor Nikhil Garg is a co-author of the study.

By Patricia Waldron

Many medical studies record a patient's race using only the broad categories from the U.S. Census, which may conceal racial health disparities, a new study reports.

Researchers evaluated the performance of clinical risk scores for people of different races in an emergency department (ED). A clinical risk score summarizes the severity of a patient's symptoms into a single number – the higher the score, the greater the risk of severe health outcomes. The researchers looked at broad race categories, like "Asian," and more specific subgroups, like "Chinese" and "Indian." The risk scores performed much better for some subgroups than others, but lumping groups together under broad race categories hid those differences.

"Any time you have a predictive risk score that works better for some groups than for other groups, that's potentially a problem, because it means that the errors in that risk score may have a bigger impact on some groups than on others," said senior author Emma Pierson, assistant professor of computer science in the Jacobs Technion-Cornell Institute at Cornell Tech, and in the Cornell Ann



S. Bowers College of Computing and Information Science.

Often, there were greater differences among subgroups within the same race category than between the broad race categories themselves. Clinical risk scores can influence what kind of care a patient receives, and so performance differences could cause some groups to be systematically denied care.

"To the best of our knowledge, we present the first analysis of disparities in risk scores in health care that looks at this granular level," said Rajiv Movva, a doctoral student in the field of computer science and co-first author on the study. "Optimistically, if you do this more granular analysis, you can better describe your population and also think more carefully about possible interventions."

Movva presented the study, "Coarse race data conceals disparities in clinical risk score model performance," on Aug. 11 at the Machine Learning for Healthcare 2023 meeting.

In the new study, researchers looked at two commonly used clinical risk scores for triaging the most at-risk patients. They also used patient demographic and health information to develop their own risk scores using machine learning to predict a patient's risk of hospitalization, death or transfer to the ICU, or a quick return to the emergency room after discharge. The data came from an existing dataset of about 418,000 emergency room visits to a Boston hospital.

When it came to risk score performance, some subgroups were consistently outliers. Brazilians and Russians in the white group; Africans, Caribbeans and Cape Verdeans in the Black group; and Koreans and Southeast Asians in the Asian group all had risk score results that often differed from the group averages.

The researchers also found evidence of the "healthy immigrant effect" – an observation that immigrants often have better

health than people with a similar background who were born in the U.S. For example, people who identified as "Black" had more health problems than people who identified as "Black-African" or "Black-Caribbean," and thus may have been more likely to be immigrants.

Disparities in how the risk scores performed for the subgroups could be traced to different patterns of symptoms and health outcomes. One reason for these differences may be social and environmental factors the subgroups share, the researchers said.

While this study focused on emergency visits, the researchers expect this phenomenon occurs across the field of algorithmic fairness – the study of understanding and correcting biases in computer models – which historically has used broad race categories.

"The findings suggest that there is much more work to be done in terms of examining performance disparities across groups when we have better descriptions of the groups themselves," said Divya Shanmugam, co-first author and doctoral student at the Massachusetts Institute of Technology.

Nikhil Garg, assistant professor of Operations Research and Information Engineering at Cornell Engineering and at the Jacobs Technion-Cornell Institute at Cornell Tech; Kaihua Hou, doctoral student at the University of California, Berkeley; Priya Pathak, assistant professor of pediatrics at Columbia University and John Guttag, professor of computer science and electrical engineering at MIT, contributed to the study. Pierson also has an appointment with Weill Cornell Medicine.

This research was supported by a Google Research Scholar award, an NSF CAREER award, a CIFAR Azrieli Global scholarship, a LinkedIn research award, Wistron Corporation, a Future Fund regrant, a Meta research award, a Cornell Tech Urban Tech Hub grant and an NSF Graduate Research Fellowship Program award.

Garg is senior author of "Quantifying Spatial Under-reporting Disparities in Resident Crowdsourcing," which published Dec. 5 in Nature Computational Science.

"We're optimistic that this method can be used to understand underreporting," he said, "not just in 311 (citizen "hotline") systems, but more broadly where these benchmark problems appear."

Garg's co-authors are Zhi Liu, lead student author and a doctoral student in ORIE, and Uma Bhandaram, deputy chief for data systems and analytics for the New York City Department of Parks and Recreation.

Crowdsourcing is an essential component of city management; crews can't be everywhere at the same time, and they rely on residents to report issues to the proper authorities so they can be addressed. Large cities – including New York, Chicago, Los Angeles and Houston, the four largest U.S. cities – have reporting systems that residents can log into to report problems.

"The 311 system is a big one," Garg said. "New York City, for instance, can't know where all the problems are all the time with something like 700,000 street trees – NYC gets over 3 million service requests a year from the public. For us, this started with a general question: Who is actually participating in all of these participatory mechanisms underlying government?"

"That's also one of the questions that city agencies are interested in – the fact that people behave differently," Liu said. "So how do they respond to these requests?"

Garg and Liu's model takes the available information – the occurrence of an incident, and the public's reporting behavior related to that incident – and converts it into a Poisson rate estimation task, which expresses the probability of a given number of events occurring in a fixed interval of time or space.

Without knowing exactly when the incident happened, the method uses the number of reports between the time of the first report (but not including it) and an estimated incident resolution time to quantify an incident's rate function. The method

could allow city managers to determine the reporting rates of different types of incidents in different neighborhoods, and address problems more equitably.

The researchers applied their method to more than 100,000 resident reports made to the New York City Department of Parks and Recreation, and to more than 900,000 reports made to the Chicago Department of Transportation and Department of Water Management. Even after controlling for incident characteristics, such as the level of emergency response needed, they found that some neighborhoods reported incidents three times faster than others.

The disparities corresponded to socioeconomic characteristics of the neighborhoods. In New York City, reporting rates were positively correlated with higher population density; the fraction of people with college degrees; income; and the fraction of the population that is white.

The researchers were able to further validate their method by testing it on incidents for which exact times were known.

"We find overwhelming evidence that people use 311 systems differently," Liu said. "And when we're thinking about the downstream response to those reports, this can serve as a very good reference point. Say no one reports an incident and it's been sitting there for a prolonged period: We might want to respond to it faster, so that the overall delay is similar across neighborhoods."

And as Liu said, their system promotes equity in terms of responding to the most urgent problem first.

"One key finding is that equity and efficiency don't have to trade off," he said. "Sometimes they're in accordance – the most severe incidents should be addressed across the city at a faster rate, no matter where they are. So in that sense, equity and efficiency are actually aligned."

Said Garg: "There's so much work left to do, and that our team is continuing to do, to make these systems more efficient and equitable."

This work was funded in part by the Urban Tech Hub at Cornell Tech.

Method may improve cities' responses to resident service calls

This story appeared originally in the Cornell Chronicle in December, 2023.

By Tom Fleischman

M Researchers from Cornell Tech have developed a method to identify delays in the reporting of incidents such as downed trees and power lines, which could lead to practical insights and interventions for more equitable, efficient government service.

Their method, which works without knowing exactly when an incident occurred, uses the frequency of reports of the same incident by separate individuals to estimate how long it took for the incident to be first reported. The first report establishes that the incident occurred, and subsequent reports are used to establish the reporting rate.

Applying their method to more than 1 million incident reports in New York City and Chicago, the researchers also determined that a neighborhood's socioeconomic characteristics are correlated with reporting rates.

"We've devised a fairly general method that works for a large class of these problems, known as 'benchmark problems,' where you can get duplicate reports of an incident," said Nikhil Garg, assistant professor of operations research and information engineering (ORIE) at Cornell Tech, as part of the Jacobs Technion-Cornell Institute.

To keep up with all of the news from ORIE, visit the news section of the website:



<https://www.orie.cornell.edu/orie/news>

LOOKING BACK, LOOKING FORWARD

By Chris Dawson

Looking back

The field of operations research has been a part of Cornell Engineering since at least as far back as 1904, when Professor Dexter Kimball of Cornell's Sibley College created a new course he wanted to call "Economics of Production." He was talked out of using this title by someone who told him it sounded "too high-brow," so instead he called the class "Works Administration." In that class Kimball focused on, as you might guess, the economics of production.

This class was unique in all of American higher education. In 1913, after teaching the class for nine years, Kimball expanded his lectures into the book "Principals of Industrial Organization." A year later, the Sibley College created a Department of Industrial Engineering. Over the intervening years the names "administrative engineering," "operations analysis," and, eventually, "operations research" were all applied to the field.

No matter the name, the goals of the field have always been the same: To apply scientific and mathematical methods to influence and impact organizational and managerial process improvement, productivity, and performance. The purpose of ORIE today is the same: to use data and mathematical models to help organizations and people make better decisions.

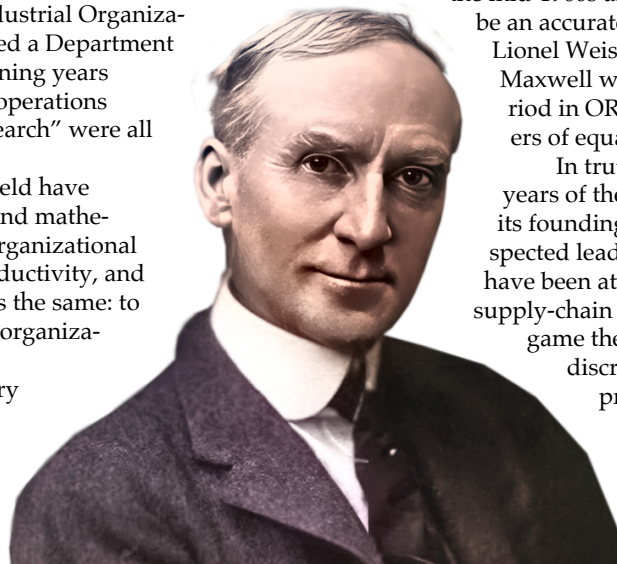
In the early twentieth century a primary

focus was making manufacturing processes more efficient. During and after World War II a major goal of the field was making supply chains function more reliably and economically.

Throughout the 1950s and 1960s computers became more common and more powerful and mathematics and the applications of statistics became an increasingly important part of operations research. At Cornell, courses in Operations Research were introduced in 1955. In 1961 the Department of Industrial Engineering and Administration and the graduate field of Industrial Engineering and Operations Research were established. In the 1965-66 academic year ORIE became an official school of the college.

It is tempting to paint those early years of the school starting in the mid-1960s as a golden age of Cornell ORIE, but that would not be an accurate assessment. Yes, Uma Prabhu, Robert Bechhofer, Lionel Weiss, Andrew Schultz, Richard Conway, and William Maxwell were all at Cornell. But if you pick any ten-year period in ORIE's history you will find another set of researchers of equal ability and stature.

In truth, and with all humility, we can say that all 58 years of the school's existence have been a golden age. Since its founding Cornell's School of ORIE has been a well-respected leader in both academia and industry. ORIE faculty have been at the leading edge of production scheduling, supply-chain management, applied statistics, optimization, game theory, stochastic processes, discrete optimization, discrete-event simulation, queueing models, applied probability, and financial engineering, to give an



Dexter Kimball



incomplete list. Our history makes us proud to look back.

In 1989 Cornell ORIE hosted the first ever academic meeting to focus on financial engineering. By 1995 the financial engineering program at Cornell became a formal offering. In 2005 ORIE opened an office in Manhattan's financial district and today Cornell Financial Engineering Manhattan (CFEM) is a wildly popular and successful Master of Engineering program. Cornell ORIE recognized the importance of having a presence in New York City almost twenty years ago and now roughly 20% of the ORIE faculty work on Roosevelt Island at CFEM or Cornell Tech. That number will only continue to grow.

In September 2024 we will be hosting two separate 100th birthday celebrations to commemorate the lives and contributions of ORIE Professors Uma Prabhu and Ray Fulkerson. (You can find more information about these events on page 14 of this magazine.) Both men played an outsized role in the history of ORIE at Cornell as well as in the fields of large-scale linear programming, combinatorial optimization, applied probability, and queueing theory.

Looking forward

One of the hallmarks of the Cornell School of ORIE is the dual focus on theory and applications. Students learn how and when to apply sophisticated mathematical and analytical techniques and quantitative methodologies, but they also learn where these techniques come from and how and why they work. ORIE students graduate with not just a completely stocked toolbox of methods and techniques, but also a well-informed sense of when each particular tool should be used.

Cornell ORIE consistently ranks in the top ten schools for Operations Research year after year. We continue to attract gifted undergraduate and graduate students and powerhouse faculty who are drawn, certainly, by the reputation of the school but even more so by the opportunity to work with some of the brightest students and fellow faculty in the field.

In the 2023-24 academic year alone four new faculty members have started at ORIE, with another slated to start in July 2024. These five newest members of the ORIE faculty, Raaz Dwivedi, Kyra Gan, Paul Gözl, Ziv Scully, and Soroosh Shafiee, highlight the broad array of domains to which OR methods and techniques can be applied. Their work also spans the range from theoretical to practical.

Dwivedi's research involves a multi-disciplinary approach to data science and brings together ideas from computer science, electrical engineering, and statistics in collaboration with domain experts. His research develops statistical machine learning approaches for personalized decision-making and healthcare applications.



Gan's research interests include adaptive/online algorithm design in personalized treatment under constraint settings, computerized/automated inference methods, robust causal discovery in medical data, and fairness in organ transplants. More broadly, she is interested in bridging the gap between research and practice in healthcare.

Gözl, who will join the faculty in July of 2024, describes his research interests succinctly. "I think about new ways of doing democracy (for example, citizens' assemblies), and about how to fairly allocate resources (e.g. capacity to host refugees)."

Scully's focus is more theoretical, looking at decision making under uncertainty, including stochastic control, resource allocation, and performance evaluation. A particular emphasis of his work is scheduling and load balancing in queueing systems, as motivated by the needs of cloud computing data centers and service systems.

And Shafiee combines theory and applications. His research interests revolve around optimization under uncertainty, low-complexity decision-making and optimal transport. Most of his works falls into one of three categories: Designing new models and algorithms based on (distributionally) robust optimization, statistical and computational complexity analyses of data-driven optimization problems, or structured nonconvex optimization with application in machine learning and finance.

We have many reasons to look back with pride at where Cornell's School of ORIE has been and the leading role we have played all along in the broad field of operations research. But that has not stopped us from looking forward, as well. There is too great a legacy to stop now and rest on our laurels. The fall semester of 2025 will mark the start of ORIE's 60th year as a school and in many ways, it feels as if we are just getting started.



December ORIE Graduation Celebration

Each year there are some students that graduate in December, and 2023 was no exception. ORIE recognizes these December graduates with a ceremony and a reception that is open to the students themselves and their invited guests. This year's celebration was held on Saturday, December 16 in the first floor Upson Lounge and was led by the new ORIE M.Eng. Director Eric Gentsch (see profile on p 14.)

What's Next?

Graduation inevitably invites the question "So, what's next?"

We know that our graduates go on to do a wide variety of things for a wide array of companies, schools, and organizations. We wrote to some of ORIE's recent graduates to ask what they have been doing since getting their degree. This is what we heard:

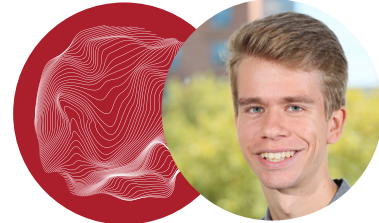


Julia VanPutte '23

I am at Cornell, working on my ORIE M.Eng. with a concentration in Data Analytics. After graduation, I will work as a Consultant Analyst at Sage Analysis Group doing Simulation Modeling and Data Science.

Favorite spot to study at Cornell?

Upson Mech.E. Lounge, Rhodes 4th floor ORIE Lounge, or the chairs on the 4th floor of Rhodes connecting it to Upson, while the sun sets.

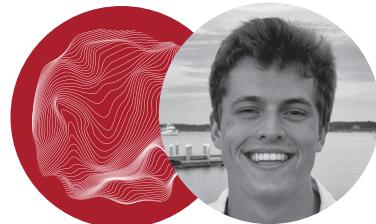


Hugo Mainguy, M.S. '23

I am currently doing a Ph.D. in Operations Management at the University of Maryland! This has allowed me to use all the knowledge and skills I learned at Cornell and apply them to prediction, routing and redistributing research problems.

Favorite spot to study at Cornell?

All the study spaces in Rhodes!



Henry Robbins '22

I live and work in New York as an Applied Scientist for Uber's shared rides matching team.

Favorite spot to study at Cornell?

Ithaca offered too many distractions, so I had to lock myself in my dorm to get anything done. Plus, that's where my sound system was.



Bonnie Akhavan '22

I am getting my Ph.D. in Operations Research from MIT! My research mainly focuses on analytics for healthcare.

Favorite spot to study at Cornell?

Olin Library, 7th floor

A Great Fit *By Chris Dawson*

When Caroline He '23 started at Cornell Engineering, she listed her area of academic interest as biomedical engineering. This is not surprising, as several of her grandparents and her father are doctors and her mother is a nurse. But even as a first-year student, He knew that mathematics would figure prominently in whatever major she eventually settled on.

"The middle school and high school versions of me both really enjoyed math," He said. "It was challenging, but not so challenging that I would get overly frustrated." There is some room for choices in the first-year general engineering curriculum at Cornell and He used that freedom to enroll in probability and computer science classes. She was not too surprised to find that she liked these classes a lot. Especially the probability class.

"I enjoyed probability and statistics and I found that I also felt comfortable with programming, so I decided to major in ORIE," He said. He used her time as an ORIE undergrad to explore the possibilities of the field by working with several professors on summer research projects. After her sophomore year, He worked with Professor Gennady Samorodnitsky using simulations to examine the topological features of a network. "That summer the work I did helped me see that I really like simulation," He said. "It allowed me to use a lot of the probability knowledge I learned in ORIE 3510 and it involved a lot of interesting CS techniques."

He also worked with Professor Shane Henderson on a simulation optimization project and with Professor David Shmoys on an optimization project focused on prelim scheduling. This project work helped He see that the work she liked most was a combination of the theoretical and the applied, with a healthy dose of coding thrown in.

The ORIE 3510 class He mentioned is called "Introduction to Stochastic Processes" and it was taught by Professor Jim Dai when He took it. He liked it so much that she has now been a TA for the class twice. "That class showed me the first really applicable uses of probability and statistics that I had come across and I found it very interesting," He said.

While the ORIE undergraduate program is demanding, He also found time to pursue other interests at Cornell as well. She plays guitar, takes voice lessons, and has even performed in stage productions. He likes to play squash and, (as seems to be the case with many ORIE students and faculty), He also likes to spend time on the Lindseth Climbing Wall.

He graduated in December 2023 with a B.S. in operations research and engineering, but rather than leave Ithaca, she has chosen to continue on and get an M.Eng. in financial engineering from Cornell ORIE. "The department here has been a great fit for me," He said. "It is just the right size. It's big enough to have all the resources and options I could want and at the same time small enough where you can make real connections with faculty and other students. I had so many good conversations with professors and got really valuable advice from them about what to do next academically and professionally."

One benefit offered by Cornell Engineering to undergraduates is the ability to start their M.Eng. program early, while in



Caroline He '23

I am currently working toward an M.Eng in Financial Engineering at Cornell

Favorite spot to study at Cornell?

CTB

the final semester of their bachelors studies. He chose this option and will graduate in December 2024 with an M.Eng. and a concentration in financial engineering. By starting early, she has turned a three-semester M.Eng. Program into a two-semester M.Eng. program.

He would like to find a position in quantitative finance upon graduation, but she is also open to the possibility of eventually returning to school for a doctorate. "No matter what I end up doing, I feel like my experiences at Cornell ORIE have given me the skills and the background I need to succeed," He said.

ORIE M.Eng. Director Eric Gentsch has been sailing since he was a child and he still likes to get out on the water whenever he gets the chance.



ment consultancy whose client list is almost exclusively from the Executive Branch of the federal government. It has retired civil service and military service members on its payroll, but also people with any kind of expertise a client might need, including supply chain management and operations, research, applied mathematics, computer science, and more.

"Whatever a client needed, we were able to put together a real blended package of capabilities for them," Gentsch said.

After 28 years with LMI, Gentsch started thinking about how he might be able to move back to Central New York to be closer to aging parents. At this point in the story you should know who is about to make another appearance: Jack Muckstadt.

Gentsch and Muckstadt had kept in touch over the years and Muckstadt floated the idea of coming to Cornell so Gentsch could teach a couple of ORIE M.Eng. classes that had been dormant. Gentsch had been teaching an eight-hour course for all of the new consultants who joined LMI for the previous six or seven years and knew that he enjoyed teaching. In his role with LMI he had also sponsored a number of M.Eng. projects and therefore had a good sense of what would make for a valuable project for both the student and the company.

The opportunity seemed like a good fit and the timing was right, so Gentsch said "yes."

That was 2018 and Gentsch has been teaching in the M.Eng. program ever since, bringing years of experience not only to the classes he teaches but also to the projects students work on. He knows firsthand what is demanded of OR practitioners in the work world. When longtime ORIE M.Eng. Director Kathryn Caggiano was named Cornell Engineering's Associate Dean for M.Eng. Programs, Gentsch was a natural fit for the role of ORIE M.Eng. Director and he has stepped right in seamlessly.

For his part, Gentsch credits the entire ORIE M.Eng. staff with the smoothness and success of his first year in the position. "There is a great team here and I am lucky they were already in place when I started," Gentsch said. "They made the transition easy on me. And the students here are just so strong. They really are a pleasure to work with."

Gentsch sees his role—and that of the M.Eng. program in general—as one of helping strong students become even stronger professionals. "As students, they learn about all of the powerful tools available to OR practitioners," Gentsch said. "And in classes they are told to open their toolbox and get out the Markov wrench or the optimization hammer to approach a problem." But Gentsch knows that in the work world the problems are often harder to define and the tools a person would use to solve the problems might not be so obvious. "The M.Eng. program is the bridge from the undergraduate experience—where you're learning the difference between a Phillips head screwdriver and a flat head screwdriver—to the messier 'real' world. The M.Eng. program is where you learn how to define a problem and how to design a solution, and how to select or build the tools to apply that solution."

Eric Gentsch's career has brought him full circle, back to where his interest in OR started all those years ago in those classes and conversations with Jack Muckstadt, but now he is the teacher instead of the student. Pop into his classroom on any given day and you'll find him blending OR tools with life lessons. And you'll never guess who frequently is joining him, either in person or by Zoom...

Helping strong students become even stronger professionals

By Chris Dawson

Eric Gentsch '80, M.Eng. '81, MBA '82 earned his BS from Cornell's School of ORIE in 1980 and, as his senior year was winding down, he was not certain about what to do next. He was walking through the halls of ORIE and saw that Professor Jack Muckstadt's office door was open. Gentsch knew Professor Muckstadt and they were on friendly terms (in spite of an earlier softball incident involving a line drive to the professor's stomach.)

Gentsch popped in to say hi and before he knew it Professor Muckstadt said "I want you to sign up for the six-year M.Eng./MBA program. In fact, I put your name on the list this morning. I hope that's okay..."

As he relates the story now, more than 40 years later, Gentsch still smiles at the situation. "It's hard to say no to something like that," he says with a shake of the head. At the time, Gentsch had not even known that such a program was an option, but he trusted Jack Muckstadt, took his advice, and never looked back.

This past fall, Gentsch was named Director of ORIE's M.Eng. program, coming full circle from that day in 1980 when he first decided to pursue his own ORIE M.Eng. degree. In the intervening years Gentsch did indeed earn both his M.Eng. and his MBA from Cornell and then spent almost seven years with the Chicago Pneumatic Tool Company and twenty-eight years with the Logistics Management Institute (LMI).

It might not surprise you that Gentsch's first position with Chicago Pneumatic grew out of a consulting engagement none other than Jack Muckstadt had with the company. Muckstadt saw that the company could benefit over the long term by setting up its own internal Operations Research division. The company's CEO (Tom Latimer, '48) agreed, and hired Gentsch and two Cornell M.Eng./MBA classmates to be the OR division.

In his years with Chicago Pneumatic Tool Company Gentsch learned a lot about all aspects of the manufacturing process. For three years he settled at the company's Utica manufacturing plant where he and his colleagues created the company's first international planning system to manage their supply chain. They did this at a time before universal instant connectivity and communications became ubiquitous. It involved getting daily and weekly information from ten sales locations spread throughout the world as well as from the company's two main manufacturing facilities, processing the information on the relatively new technology of desktop computers, and then making inventory and distribution decisions based on the reports.

They did all of this pre-Internet, which was quite an accomplishment.

Once the system was in place and operational Gentsch spent more time on the actual production floor of the factory and had to learn a whole new set of skills that included reading blueprints and becoming deeply familiar with the details of business operations, manufacturing operations, and (probably most challenging of all) managing people. "I learned so many valuable skills in my time with CPT," Gentsch said. "But then one day I was in the Utica factory and I got a call from a vice president at Logistics Management Institute in the Washington, D.C. area."

That call, at the recommendation of Jack Muckstadt (of course) led to a job offer and in the spring of 1989 Gentsch started work with LMI as a consultant. By 1999 he was a program manager and by 2004 he was a program director. LMI is a manage-

ORIE 2024 Awards and Honors



J. Massey Cashore



Peter Frazier



Nikhil Garg



David Goldberg



Dave Goldsman



Paul Gözl



Shane Henderson



Billy Jin



Henry Lam



Mark Lewis



Andrea Lodi



Pierre Patie



Jamol Pender



Gennady Samorodnitsky



David Shmoys



Ziv Scully



Éva Tardos



Miaolan Xie



Tinghan (Joe) Ye



Christina Lee Yu

Ph.D. alumni **J. Massey Cashore '22** (advised by Peter Frazier) won the Auction and Market Design section's Michael H. Rothkopf Junior Researcher Paper Prize for a paper with **Peter Frazier** and **Éva Tardos**, "Dynamic Pricing Provides Robust Equilibria in Stochastic Ride-Sharing Networks."

Assistant Professor **Nikhil Garg** was a finalist in the JFIG paper competition.

Associate Professor **David Goldberg** received a 2023 Cornell Engineering Teaching Award for his role in designing and implementing undergraduate student projects in ORIE.

Ph.D. alumni **Dave Goldsman '84** received a Lifetime Achievement Award at the 2023 INFORMS winter simulation Conference.

Paul Gözl was a finalist for the INFORMS Dantzig Dissertation Prize. Gözl will start at ORIE as an Assistant professor in July of 2024.

Professor **Shane Henderson** won a 2023 Cornell Engineering Teaching Award for his "excellence in every facet of teaching."

Ph.D. student **Billy Jin** (advised by David Williamson) had his paper "Online Bipartite Matching with Advice: Tight Robustness-Consistency Tradeoffs for the Two-Stage Model" selected as one of the two winners of the 2023 Decision Analysis Society Student Paper Award.

Henry Lam, Director's Assistant and Accounts Representative, received a Cornell Engineering EPICC Award in recognition of his consistently demonstrated outstanding leadership skills.

ORIE Director **Mark Lewis** was honored with the William H. Kadel Alumni Medal for Outstanding Career Achievement from Eckerd College.

Andrea Lodi, the Andrew H. and Ann R. Tisch Professor (ORIE, Jacobs Technion-Cornell Institute), was named an INFORMS Fellow in their Class of 2023.

Associate Professor **Pierre Patie** has been awarded a grant by the National Science Foundation's Division of Mathematical Sciences to support his proposal entitled "Intertwining ideas for some problems in probability."

Jamol Pender, associate professor and associate director of graduate studies in ORIE, received a Cornell Engineering EPICC Award for the way in which he builds and supports the community of ORIE.

Professor **Gennady Samorodnitsky** has been awarded a grant by the National Science Foundation's Directorate for Mathematical and Physical Sciences to support his proposal entitled "Collaborative Research: Learning and forecasting high-dimensional extremes: sparsity, causality, privacy," (collaborative research with M. Aveila Medina and R. Davis of Columbia University). Also, Samorodnitsky has been elected the Charles W. Lake, Jr. Professor in Productivity effective February 1, 2024.

David Shmoys, the Laibe/Acheson Professor of Business Management and Leadership Studies at Cornell, was awarded the Philip McCord Morse Lectureship at the 2023 INFORMS Annual Meeting in Phoenix in October.

Assistant Professor **Ziv Scully** has been awarded a grant from the National Science Foundation's Directorate for Engineering to support his proposal entitled "New Approaches to Multiserver Schedule."

Éva Tardos, the Jacob Gould Shurman Professor, has been awarded the Donald E. Knuth Prize, which recognizes visionaries in computer science whose work has had foundational, long-term impact.

Ph.D. student **Miaolan Xie** (advised by Katya Scheinberg) was awarded second-place in the INFORMS Optimization Society's 2023 Student Paper Prize for her paper "Sample Complexity Analysis for Adaptive Optimization Algorithms with Stochastic Oracles," co-authored by Billy Jin and Katya Scheinberg.

Tinghan (Joe) Ye was a finalist for the INFORMS Undergraduate Research Prize.

Christina Lee Yu has been awarded a grant from the Air Force Office of Scientific Research for her project "Efficiently Exploiting Structure for Causal Inference in the Presence of Network Interference." Yu was also awarded a grant from the NSF to fund her proposal "CAREER: CCF: CIF: Randomized Experimentation for Systems with Time-varying Dynamics and Network Interference."

Save the Dates

ORIE is hosting two special events in September, 2024. One will honor the life and career of longtime ORIE faculty member Uma Prabhu and the other will celebrate the legacy of ORIE faculty member Ray Fulkerson. 2024 marks 100 years since the birth of both men and the School is bringing together family, students, colleagues, and friends for talks, food, and reminiscences.

The Uma Prabhu Centennial Conference will take place **September 13-14, 2024**.

The Fulkerson100@Cornell Celebration will happen **September 20-21, 2024**.

Both events will be on Cornell's Ithaca campus. You can learn more here: <https://www.orie.cornell.edu/orie-events>



To keep up with all of the news, awards, and honors from ORIE as well as from Cornell Engineering, visit the Cornell Engineering News page.

<https://www.engineering.cornell.edu/cornell-engineering-news>

After successful career in analytics, Radhika Kulkarni '81 sees the big picture

By Chris Dawson



Radhika Kulkarni '81 Ph.D. has scaled some of the most impressive heights of the advanced analytics universe: for 10 years she was Vice President of Advanced Analytics R&D at industry leader SAS Institute, Inc.; she is a Fellow and Past President of the Institute of Operations Research and Management Science (INFORMS); and she has won the WORMS Award for the Advancement of Women in Operations Research and Management Science for her contributions to the advancement and recognition of women in the field.

Kulkarni has also experienced much happiness and success in her family life, with a marriage of more than 40 years (and counting) to fellow Cornell ORIE Ph.D. alumni Vidyadhar Kulkarni '80 and three sons who have all graduated from Cornell.

It is likely Radhika Kulkarni would have risen to the top of the advanced analytics world whether or not she came to Cornell in 1977. But life truly is a stochastic process, and it is hard to say with certainty how a change in one variable early in a process affects the eventual outcome. For Kulkarni, there is one variable she can look back at and state with certainty “that—that event right there—dictated so much of my life that followed.”

After earning her B.Sc. in mathematics at Presidency College in Madras and her M.S. in mathematics at the Indian Institute of Technology in Delhi, Kulkarni knew she wanted to earn a Ph.D. in the United States. She wrote to several of the top universities in America requesting a temporary waiver of the \$20 application fee. She made it clear in her letters that, if admitted, she would pay the fee when she got to campus.

Cornell was the only university to agree to this deal. As a result, Cornell was the only place Kulkarni applied near the end of 1976. By the fall of 1977 she was in Ithaca, starting her doctoral studies in mathematics. And by the fall of 1978 she had switched to operations research and was working with her advisor Professor Robert Bechhofer.

“The kindness of Cornell has made a real difference in my life,” Kulkarni said. “They were willing to waive the application fee and then when I switched departments, Mathematics was willing to fund my second year, even though by then I was in OR. And then they made it possible for me to complete the final year of my doctoral program after I had moved to Georgia with my husband.” Much later, Kulkarni discovered even one more

way Cornell’s kindness had played a role in her life: her husband Vidyadhar applied to Cornell for his doctoral studies because the university had been willing to waive his \$20 application fee, as well. If Cornell had not waived those \$20 fees, the couple never would have met.

After earning their doctorates in successive years, Radhika and Vidyadhar had to solve the well-known academic two body problem. For them, this eventually meant a professorship in operations research at the University of North Carolina for Vidyadhar and a position with SAS as an individual contributor in the operations research department for Radhika. Before she was hired, SAS’s OR department consisted of only one person.

Over time, Kulkarni’s role at SAS expanded. She was given responsibility for growing the OR department and for rewriting SAS’s optimization software from scratch. She became senior director of advanced analytics R&D and then vice president of advanced analytics R&D—a position she held for ten years until her retirement from SAS in 2018.

Kulkarni has been active since her retirement. In fact, she said her husband jokes that the only way he knows she is retired

is that she no longer gets a paycheck, even though she is as busy as ever. She served as president of INFORMS in 2022 and has also been active in efforts to increase data science literacy and expertise in college students. Kulkarni serves on the Cornell ORIE Advisory Council, where her biography notes, “She also seeks to have a large impact across many different departments, schools, and colleges and to inspire inter-disciplinary collaboration. Such collaboration is a key requirement for success in finding the right solution for critical business problems.”

In keeping with the ideas of collaboration and having a wide impact, Kulkarni’s advice to current ORIE students and recent graduates is a distillation of something she has practiced her entire career: “Make sure you understand the big picture. Don’t be focused on just what you want to do or what your job is. Understand where it fits into the whole landscape, because that will help you explain what you’re doing to everybody, and it’ll help you to understand perspectives from others so that you can incorporate them into what you’re trying to do.”

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