



ORIE

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Since July 2019, I have had the profound honor of serving as the Director of the School of ORIE. I assumed the reins from Professor Shane Henderson, who worked tirelessly to hire new faculty (both in Ithaca and New York City), increase the size of our Ph.D. program and create new educational programs.

I recall sitting in the director's office with Shane explaining many of the challenges of being director. How will we maintain close ties to Cornell Tech? How can we administer Master of Engineering programs across two cities? What might we magnify and what might we change in our undergraduate curriculum to ensure our students are prepared for the exciting, data rich environments of the future (or the present)? These were all challenges I felt prepared for. Quite obviously, none of us were ready for the COVID-19 pandemic. Aside from the horrific impact infection has had on some of the students, faculty, staff and their families, it has forced us all to perform our roles remotely. I am so proud of the work our faculty and staff have done to reimagine courses for virtual instruction. I am equally proud of our students for persevering through this unfortunate circumstance. Hearing story after story of Cornellians donating supplies to hospitals, lending their expertise, and helping those in need highlights what a caring, compassionate, and enduring community we are.

For those with questions about how Cornell is dealing with the pandemic, I encourage you to stay updated through the coronavirus links on cornell.edu and engineering.cornell.edu, respectively.

This issue's lead article profiles ORIE's presence in New York City—in Cornell Tech and in Cornell Financial Engineering Manhattan (CFEM). We are doing great things in the Big Apple. It is time to fill you in on what's been going on with our faculty and students.

ORIE continues to chalk up success after success. Assistant Professors Sid Banerjee and Nathan Kallus each won the prestigious CAREER award from the National Science Foundation last year. These research grants are highly sought after

and are a true badge of distinction. Well done, Sid and Nathan! Recent past winners of CAREER awards include Associate Professor Andreea Minca and Assistant Professor Jamol Pender.

This past year ORIE hired Professor Katya Scheinberg away from her chaired professorship at Lehigh University. She is a world leader in optimization and machine learning. In addition, we hired two highly distinguished Professors of Practice, Oktay Gunluk and Marco Lopez de Pardo, that will further strengthen ORIE's already formidable presence in the practice of operations research.

Speaking of practice in operations research, the winner of the "Silent Hoist and Crane" award in the College of Engineering is one of our Master of Engineering project teams. The team developed software tools, with built-in optimization (of course), to help with Women Swimmin'—an annual fundraiser that supports Hospicare here in Ithaca. It is gratifying to see projects of significant social value being recognized in this way.

Over the past year we bade farewell to three mainstays in the department; Professors Bob Bland (see page 14), Jack Muckstadt, and Sid Resnick. Their dedication to the educational mission of the department is undeniable. The good thing (for us) is that retirement does not mean they ride off into the sunset. Visit the department on any day, and you are just as likely to catch them in their offices talking to students and mentoring faculty (including me!).

ORIE is, in some ways, bursting at the seams. Our Ph.D. program currently has 54 students. At last year's graduation we hooded seven newly-minted Ph.D.s, and this fall we welcomed 12 new students, eight of whom are women! We also welcomed one of our largest Master of Engineering classes ever. That was not quite planned, but our yield went through the roof last year. I guess we are doing something right! Our undergraduate numbers are holding steady at around 80 students per year, with affiliations for next year still to be finalized.

Despite the challenges, it has been an exciting year of transition and growth. As always, we are up to it and optimistic for what comes next! Please take care of

yourself and those around you by practicing social distancing and following the recommendations of the Centers for Disease Control and Prevention.



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ON THE COVER

An aerial view of Cornell Tech on Roosevelt Island in New York City.

THE ORIE MISSION

The School of Operations Research and Information Engineering's mission is to host research programs, a full spectrum of educational programs, and industry outreach activities spanning its eponymous domain.

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CHECKING IN ON ORIE @ CORNELL TECH

When Huseyin Topaloglu, professor in Operations Research and Information Engineering (ORIE), moved from Ithaca to New York City in the summer of 2015, he brought with him 13 years of experience at Cornell and a big task: laying the foundation for ORIE programs at the nascent Cornell Tech campus.

Born out of a competition by then-Mayor Michael Bloomberg for a new applied-science institution, which Cornell won in 2011 with partner Technion-Israel Institute of Technology, and housed on Roosevelt Island since September 2017, Cornell Tech is charged with helping to diversify the city's economy after the financial crash of 2008.

Under the leadership of Laibe/Acheson Professor of Business Management and Leadership Studies David Shmoys, who served as school director at the time, and Kathryn Caggiano, Professor of Practice and director of the ORIE M.Eng. program in Ithaca, Topaloglu set to work on one of ORIE's key offerings in New York, the Master of Engineering (M.Eng.) in Operations Research and Information Engineering program. "We've had a lot of fun building a new academic program from scratch," Topaloglu said. "Usually you don't get this kind of luxury anywhere." Thinking about the right kind of OR program for the Tech Campus, they looked to the needs of industries working with big data. "The idea is that mathematical algorithms, large-scale computation, and heaps of data come together to solve business problems and drive business decisions," he said.

The first class of eight students arrived in the fall of 2016 to tackle such questions as how much stock a company such as



Cornell Tech fosters creativity and collaboration among students and faculty.

"Part of what we do in research directly translates into practice, and what we find in practice relates back to our research. This is a required part of being at Cornell Tech."

—Professor Huseyin Topaloglu

Amazon should keep, what types of ads Google might place next to a search, or what movies Netflix could recommend to a user.

Since then, the faculty has grown to comprise assistant professor Nathan Kallus, an expert in data-driven optimization, including decision making, causal inference, machine learning, and personalization; as well as professor Itai Gurvich, who specializes in performance analysis and optimization of human-operated processing networks, the theory of stochastic-process approximation and the application of operations research and statistical tools to healthcare processes. Charles H. Dyson Family Professor of Management Garret van Ryzin, who focuses on algorithmic pricing and marketplaces, is an ORIE field member at Cornell Tech.

"Being a small place, we're trying to cover a lot of ground with a small number of people," Topaloglu said. What they have in common is an interest in industry engagement, as well as methodological research and institution building. "Part of what we do in research directly translates into practice, and what we find in practice relates back to our research," Topaloglu explained. "This is a required part of being at Cornell Tech."

Another required part is attending ORIE faculty meetings on the main campus via teleconferences and participating in all department business, such as hiring decisions. "Intellectually, we're present in Ithaca all the time, though we may only physically visit a couple of times a semester," Topaloglu said. "We're one department."

People

M.Eng. students 2019/2020:	51
Ph.D. students:	7

Faculty

Huseyin Topaloglu, *Professor*
Itai Gurvich, *Professor*
Nathan Kallus, *Assistant Professor*
Garret van Ryzin, *Charles H. Dyson Family Professor of Management*

Our Programs

Master in Operations Research and Information Engineering

When Topaloglu and his colleagues the new Cornell Tech ORIE M.Eng. program, they knew it would have one important aspect in common with its Ithaca counterpart: “Like any other good master’s program in OR, we make sure the students understand the mathematical foundations of optimization, probabilistic modeling and machine learning extremely well,” he said. “These are our three technical pillars, and we do not sacrifice anything in terms of depth.”

But while the main campus degree focuses more heavily on building OR-related math and engineering skills and offers a third-semester option for the financial engineering concentration, Cornell Tech gives its two-semester ORIE master’s program a decidedly entrepreneurial bent, attracting individuals with an interest in very large-scale computation and learning how to use mathematical models to inform business decisions in uncertain environments. “This doesn’t mean the students have to be interested in starting their own companies, but they should have a natural inclination towards building products—whether an algorithm, software, or a process,” Topaloglu explained.

Students practice applying their skills in two of Cornell Tech’s signature Studio courses—cross-disciplinary team experiences with members from across the diverse campus. In the Product Studio in the fall, they solve a real-world challenge offered by a business or non-profit with a digital product, service, or strategy. Choosing between Startup Studio and BigCo Studio in the spring, students then create their own startup or lead innovation within a large, existing company under the guidance of C-suite or VP-level company advisor. In all three courses, the process of assembling work groups, hashing out plans, preparing pitches, and presenting products gives them a taste of how teamwork and leadership function in the real world.

Trained to help technology-driven businesses make sense of vast amounts of data, ORIE M.Eng. graduates have gone on to join major technology, consulting, and quantitative marketing companies and several hedge funds.

ORIE Ph.D. program

Unlike the Masters program—and like its overarching school—the ORIE Ph.D. program spans the Cornell Tech and Ithaca campuses, offering a unified curriculum in separate

locations. “At the Ph.D. level, there’s absolutely no distinction,” Topaloglu said. “It’s a research-based program, students are supposed to create new knowledge—their advisors just happen to be in New York.”

All students begin their studies in Ithaca with a year of foundation courses and may opt to spend the following summer in the city to test out working with a Cornell Tech faculty member. “If the relationship is good, if they like it here, I usually like to send them back to Ithaca to take a second year’s worth of courses, and we keep the relationship alive through long-distance research and regular visits to the city,” Topaloglu explained. “If at the end of the year they’re really interested in working with an advisor in New York, we ask them to relocate here full-time.”

Once at Cornell Tech, doctoral students continue to engage with their colleagues in classes that are broadcast from the main campus and vice versa, and they may even access courses at Columbia and New York University through an informal arrangement with individual faculty members.

While there is no requirement that doctoral research have an entrepreneurial angle, some students tap into Cornell Tech’s wealth of resources and their proximity to New York’s wealth of businesses. Topaloglu’s Ph.D. advisee Mika Sumida, for example, took her work on dynamic resource allocation to food delivery company Homer Logistics (later acquired by Waitr) for a summer, spending a day a week at its offices. “She got field data, and she made an impact in the company,” Topaloglu said. “Things like this certainly happen here.”



Students study, mingle and head to classes at the Cornell Tech campus in New York City.

CFEM CONTINUES STEADY GROWTH AT CORNELL TECH

The discipline of financial engineering owes its beginnings to Cornell. Pioneered in Ithaca in 1989, it became formalized as the Master in Engineering with Financial Concentration (MFE) degree within ORIE in 1995—and has only grown since.

Expanded to three semesters in 2007 and moved to the Cornell Tech campus a decade later, the program now complements a year of broad theoretical foundation in quantitative finance on the Ithaca campus with an optional summer internship in the city, and a final semester at Cornell Financial Engineering Manhattan (CFEM).

“The Master of Engineering is effectively a professional degree, not a theoretical degree,” said Victoria Averbukh Ph.D. ’97, Professor of Practice in ORIE and director of CFEM since its inception. “We are committed to giving our students tools and skills that can make them useful from the first day that they’re on the job.”

To that end, CFEM places its students as close as possible to the pulse of the finance industry through internships, hands-on projects, and close interactions with experts in the field. All courses are led by practitioners, including those taught by in-house faculty. Averbukh spent the decade after earning her Ph.D. in ORIE on Wall Street, working as a fixed income strategist for Salomon Brothers (later Citi) and Deutsche Bank, while her colleague Sasha Stoikov, senior research associate and head of research in the program, has worked as a consultant for the Galleon Group and Morgan Stanley and as a VP at Cantor Fitzgerald.

“This semester we’re offering five

courses that are taught by people that actually work during the day and then come to teach in the evening on what they do during the day,” Averbukh said. “They’re all fairly senior experts in their respective fields.”

The program’s specific offerings change dynamically with the needs of the financial industry. “In the last 10 years, our focus has shifted from modeling of complex financial derivatives with limited financial data to the study of more liquid assets at a higher frequency, using data science and machine learning tools,” Stoikov explained.

As a result, students attracted to CFEM now are more likely to be motivated by programming and statistics than the aspiring traders of the past. The majority of this year’s incoming class (38 of 53) chose to opt into the program’s Financial Data Science certificate, launched in spring 2016.

Wherever students’ interests lie, “we have made our curriculum extremely flexible to allow them to tailor their coursework to fit their background and career goals,” Averbukh said. Only two courses are required: Like other M.Eng. students in ORIE, CFEM aspirants complete a project, working in teams of six to solve a real-world problem posed to them by a company. “They are advised by faculty like myself, produce a final report and present their work to the sponsor,” said Stoikov. “It is a big part of their grade, and sometimes sponsors hire some of the student.”

The more traditional route to a job is through the mandatory professional development course and associated workshops and boot camps. “Our students understand that having strong technical skills, while extremely important, is not enough to be successful in the industry,” said Liz Drummond, associate director



Professor of Practice Victoria Averbukh

of career development. “Effective communication and networking are essential components to their success. Our programming helps to foster these abilities, so that our graduates are able to jump-start their careers.”

Indeed, CFEM’s statistics speak for themselves: the program consistently places 100 percent of students in summer internships and 95 percent or more of freshly minted financial engineers in jobs—mostly in New York City or the United States—within six months of earning their degree. (Career support continues even after graduation.)

Networking through happy hours, the annual Quant Finance Forum, an advisory council, Women FIRE Chat, or the recently started ambassador program keeps alumni involved in CFEM. Perhaps some of them will be recruited by Averbukh to teach courses in the future, keeping the curriculum current and completing the circle.

By Olivia M. Hal