

Operations Research Center

The [Operations Research Center \(ORC\)](#), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 66th year of operation in academic year 2020. The ORC administers its own graduate program and a varied research program of methodological and applied projects.

This report summarizes AY2020 activities and briefly reviews ORC's educational, research, and outreach programs.

Faculty, Students, and Staff

Professor Georgia Perakis from the MIT Sloan School of Management, and Professor Patrick Jaillet from the Department of Electrical Engineering and Computer Science (EECS), served as co-directors of the ORC.

During AY2020, the ORC had 59 affiliated faculty and three staff members, with faculty drawn from the MIT Sloan School of Management and the Departments of Electrical Engineering and Computer Science, Civil and Environmental Engineering, Economics, Mathematics, Aeronautics and Astronautics, Mechanical Engineering, Nuclear Science and Engineering, and Urban Studies and Planning.

The ORC offers two interdepartmental graduate degree programs: a PhD and a master's degree. During the past year, these programs enrolled 85 students—69 PhD candidates and 16 SM candidates. The ORC conferred eight master's degrees and 18 PhDs. Several other PhD theses were in the final stages of completion in summer 2020.

We had an outstanding year in terms of yield in admissions. We received 241 applications for the doctoral program, of which we made 22 admission offers, 14 of whom accepted. For the SM program, we received 165 applications of which we made 11 offers, 10 of whom accepted. We will have students who accepted their offer but will defer until fall 2021. In addition, we admitted two students to the Leaders for Global Operations/ORC joint master's program.

We continue to place our students exceptionally well in both academic and in industry jobs. This year, graduates were placed as assistant professors at the University of Illinois; the University of British Columbia; London Business School; the Naval Postgraduate School; New York University (Stern School of Business); and University of Southern California (Marshall School of Business). Other graduates found positions at Huawei, Amazon, and Google.

Academic Programs

The ORC's academic programs continue to be recognized as ranking among the very best nationally and internationally. Moreover, the programs are repeatedly cited as achieving an excellent balance between application and methodological domains.

The ORC recently joined the newly established Schwarzman College of Computing. The center will now report to both the Schwarzman College of Computing (SCC) and Sloan School of Management. The two ORC co-directors are sitting on the SCC Council and one of the co-directors at the Promotions Academic Council.

Research Activities

Research activities spanned a wide spectrum of methodological topics and applications, ranging from small, unsponsored projects involving one faculty member supervising a student's thesis to larger, sponsored programs involving several faculty, staff, and students.

There has been increasing emphasis on the interface between machine learning and optimization; data-driven optimization; and algorithms for convex, discrete, stochastic, and robust optimization on the methodological side. On the application side the emphasis has been on the interface between personalized medicine; operations management; and pricing. Moreover, ORC faculty continue to contribute to application domains as wide-ranging as manufacturing, communications, transportation, public services, logistics, marketing, financial services, and health care. With the unfortunate rise of the COVID-19 crisis, the ORC faculty rose to the task and together with students worked hard to develop predictive and prescriptive models that are used from MIT and the Centers for Disease Control and Prevention, among others.

Several organizations sponsored research projects at the ORC during AY2020, including the National Science Foundation, Draper Laboratory, Food and Drug Administration, Lincoln Laboratory, Office of Naval Research, Oracle, Sapient, Mitsubishi, Anheuser-Busch, InBev, CIBC, Singapore Alliance Program, Swiss Re, ISN Software, Beth Israel Deaconess Medical Center, Hartford Hospital, and Quest Diagnostics.

Outreach and Professional Service

Seminar Series

The ORC Weekly Seminar Series was privileged to have many distinguished speakers from industry and academia this year. The operations research professionals who made presentations included Carri Chan (Columbia University); John Birge (University of Chicago); Jorge Nocedal (Northwestern University); Brad Sturt (MIT); Garud Iyengar (Columbia University); Joann de Zegher (MIT); Guy Bresler (MIT); Margaret Brandeau (Stanford University); Les Servi (MITRE Corporation); Francis de Véricourt (European School of Management and Technology); Ben Moseley (Carnegie Mellon); Aaron Sidford (Stanford University); Cristian Tomasetti (Johns Hopkins University); Kuang Xu (Stanford University); and Tuomas Sandholm (Carnegie Mellon).

During the January independent activities period, the ORC also offered a full-day session entitled Operations Research: From Theory to Practice, in which several talks focused on the presenter's work, research, careers, and discussions about the future of operations research (OR). The speakers included Vivek Farias (MIT); Emil Iantchev (Fidelity Investments); Ross Anderson (Google); and Martin Copenhaver (Massachusetts General Hospital).

Student-Run Programs and Activities

The ORC is very supportive of activities organized by the INFORMS student chapter. The student chapter held social events that fostered a feeling of comradery among students and helped to improve life at the center. Often, these events are used as opportunities to meet students from other MIT programs. The ORC is very proud of the friendly and inclusive environment we foster for our students. Student activities and events this year included the following:

- INFORMS several coffee and snack break events throughout the year
- INFORMS several social lunches throughout the year
- INFORMS Halloween Spook-a-lympics
- INFORMS ORC Happy Hour Mixers
- INFORMS Thanksgiving Lunch
- INFORMS End of Classes study break and gingerbread house competition
- INFORMS Chinese New Year Celebration
- INFORMS ORC Carnival Breakfast
- INFORMS π -Day event, pies and coffee served in the ORC lounge

The ORC is also very proud of the work done by our student Resources for Easing Friction and Stress (REFS) volunteers. This program is run by student volunteers who complete training in conflict resolution and are familiar with other resources offered at MIT. They make themselves available as moderators for conflicts and as confidants for students who may be experiencing difficulties. They have also begun meeting with each new student one-on-one to check in and make sure every ORC student knows they are there to help with any pressure or issues they may be experiencing. Additionally, they have organized small lunches where ORC students can meet with ORC faculty members. We think they are an invaluable resource for our students. They also organized events centered on reducing stress and tension, such as social events to increase awareness of the REFS program and to discuss student issues and concerns.

Fellowships

The ORC has continued to receive fellowship support from the Sloan School of Management for doctoral students. In addition, we continue to have the Henry Gabbay Endowed Fellowship. In addition, the center recently was the recipient of the Theodore Vassilakis Fellowship from four prominent Greek families and awarded a first fellowship to an OR doctoral student.

Future Plans

The ORC program has been expanding. The ORC has increased its total number of enrolled students and the new master of business analytics (MBAn) program had its fourth class of 60 students, who were provided shared desk space at the ORC. It is our hope that the interaction and collaboration between these new students and the

current ORC students will be beneficial to all. These MBAn students work closely with companies as part of their program, which should result in improved visibility for the ORC and encourage research collaboration. Almost the totality of the capstone research for MBAn students are supervised by ORC faculty. In addition, the MBAn students are working with faculty and PhD students on research projects.

We also plan to encourage our student INFORMS chapter and the REFS students to continue planning social events and opportunities for students to help each other in their pursuits.

The ORC continues to play a larger role in analytics and statistics within the Institute. In this context the ORC has offered the courses 15.071 The Analytics Edge, and 15.095 Machine Learning under a Modern Optimization Lens. The ORC also plans to offer a class on machine learning in health care.

Diversity

ORC has always attempted to provide an environment that is responsive to the varied professional and personal needs of the OR community at MIT, and that builds diversity.

During AY2020, the staff of ORC was composed of two support staff members and one academic administrator. Of these three staff, two are women. As for the student population, 28 of our graduate students are women.

Professional Activities

Michael Alley MBA '15, Max Biggs PhD '19, Rim Hariss PhD '19, Charles Herrmann MBAn '18, Michael Li, and Georgia Perakis were finalists in the 2019 MSOM Practice-Based Paper Competition for their paper, "Pricing for Heterogeneous Products: Analytics for Ticket Reselling."

Arielle Anderer, Hamsa Bastani, and John Silberholz PhD '15 won the 2019 Pierskalla Best Paper Award for their paper, "Adaptive Clinical Trial Designs with Surrogates: When Should We Bother."

Lennart Baardman PhD '19, Setareh Borjian SM '15, Tamar Cohen-Hillel, Kiran Panchangam, and Georgia Perakis received honorable mention (second place) in the 2019 MSOM Practice Based Best Paper competition for their paper, "Detecting Customer Trends for Optimal Promotion Targeting," which will appear in the journal *Manufacturing and Service Operations Management* (MSOM). The purpose of this award as listed by the MSOM Society is: "The objectives of the MSOM Practice-Based Research Competition are to motivate, help develop, reward and highlight high-quality OM research papers with significant practical relevance, and to publish these papers in the MSOM Journal." The same paper was also a finalist in the INFORMS Best Service Science Paper Award competition, as well as in the INFORMS Social Media Analytics Section Best Student Paper Award and in the Innovative Analytics Applications Award.

Lennart Baardman, Elaheh Fata PhD '20, Abhishek Pani, and Georgia Perakis were finalists in the INFORMS Best Service Science Paper Award competition for their paper, "Learning Optimal Online Advertising Portfolios with Periodic Budgets."

Hamsa Bastani, Pavithra Harsha PhD '09, Georgia Perakis, and Divya Singhvi PhD '20 won Second Place in INFORMS Best Service Science Paper Award competition for their paper, "Sequential Learning of Product Recommendations with Customer Disengagement."

Mohammed Amine Bennouna won École Polytechnique's Grand Prize of Research Internship in the category of Applied Mathematics.

Dimitris Bertsimas SM '87, PhD '88 received the 2019 INFORMS Presidents Award.

Dimitris Bertsimas won the 2019 John von Neumann Theory Prize.

Dimitris Bertsimas, Arthur Delarue '16, Patrick Jaillet, and Sebastien Martin PhD '19 were finalists in the 2019 INFORMS Data Mining Competition for their paper, "The Price of Interpretability: Optimal Explanations of Linear Model."

Dimitris Bertsimas, Arthur Delarue, and Sebastien Martin were finalists in the 2019 INFORMS Edelman Competition for their work with the Boston Public School system.

Dimitris Bertsimas, Ryan Cory-Wright, and Jean Pauphilet PhD '20 won first place in the 2019 INFORMS Computing Society, Best Student Paper Award for their paper, "A Unified Approach to Mixed-Integer Optimization: Nonlinear Formulations and Scalable Algorithms."

Maxime Cohen PhD '15, Ruben Lobel PhD '12, and Georgia Perakis won the Best OM Paper in Management Science award for their paper, "The Impact of Demand Uncertainty on Consumer Subsidies for Green Technology Adoption," published in *Management Science*, and received an honorable mention in the 2019 ENRE Best Publication Award in Environment and Sustainability.

Maxime Cohen was a finalist in the 2019 INFORMS Data Mining Section Best Paper Competition, along with Kevin Jiao, and Renyu Zhang for their working paper, "Data Aggregation and Demand Prediction."

Maxime Cohen, Gad Allon, and Wichinpong P. Sinchaisri were finalists in the 2019 INFORMS BOM Section Best Working Paper Competition for their working paper, "The Impact of Behavioral and Economic Drivers on Gig Economy Workers."

Maxime Cohen, Daniel Guetta, Kevin Jiao, and Foster Provost were finalists in the 2019 INFORMS Case Competition for their paper, "Data-Driven Investment Strategies for Peer-to-Peer Lending."

Peter Cohen and Colin Fogarty received a Young Investigator Award from the Section on Statistics in Epidemiology of the American Statistical Association for their paper titled, "Gaussian Prepivoting for Finite Population Causal Inference."

Louis Anthony Cox PhD '96 became an INFORMS fellow.

Richard de Neufville won the Robert Horonjeff Transportation Award, American Society of Civil Engineers, 2019, for his contribution to airport systems planning, design, and management.

Richard de Neufville won Gold Medal for contributions to development of master in construction technology management, Poznań University of Technology, 100th Anniversary in 2019.

Richard de Neufville won Silver Medal for Effective Teaching, Division of Construction Technology, Poznań University of Technology, 2019.

Celia Escribe won École Polytechnique's Best Research Internship Award in the category of Statistical and Probabilistic Modelling.

Hamza Fawzi, Pablo A. Parrilo, and James Saunderson PhD '15 have been selected to receive the 2020 SIAM Activity Group on Optimization Best Paper Prize for their paper, "Semidefinite Approximations of the Matrix Logarithm," published in *Foundations of Computational Mathematics* in April 2019.

Chong Yang Goh PhD '18, Chiwei Yan PhD '17, and Patrick Jaillet were finalists in the POMS-JD 2019 Best Data-Driven Research Paper Competition for their paper, "Estimating Primary Demand in Bike-Sharing Systems."

Bruce L. Golden PhD '76 received the 2019 INFORMS Robert Herman Lifetime Achievement Award. This award is presented to individuals who throughout their professional career have made fundamental and sustained contributions to transportation science and logistics, and have influenced the field through their writings, teaching, service, and nurturing of younger professionals.

Negin Golrezaei, Hamid Nazerzadeh, and Ramandeep S. Randhawa were finalists for their paper, entitled "Dynamic Pricing for Heterogeneous Time-Sensitive Customer," in the 2019 Best Service Science Paper Award. The paper will appear in the journal *Manufacturing and Service Operations Management* in the May–June 2020 issue.

Hussein Hazimeh and Rahul Mazumder were runners up in the 2019 Mixed Integer Programming Workshop Student poster competition for their poster, "Learning Sparse Hierarchical Interactions at Scale."

John Hull, Andrew Lo, and Roger Stein received the 2019 Harry M. Markowitz Award from the *Journal of Investment Management* for their paper, "Funding Long Shots."

Alexandre Jacquillat and Vikrant Vaze PhD '13 won the 2019 INFORMS Transportation Science and Logistics Society prize for Outstanding Paper in Air Transportation for their paper, "Interairline Equity in Airport Scheduling Interventions," published in *Transportation Science* in 2018.

Retsef Levi, Elisabeth Paulson, and Georgia Perakis were finalists in the INFORMS Best Service Science Paper Award competition for their paper, “Optimal Interventions for Increasing Healthy Food Consumption among Low-Income Populations.”

Retsef Levi, Manoj Rajan, Somya Singhvi, and Yanchong “Karen” Zheng won the best student paper award in the INFORMS competition Doing Good with Good OR for their paper, “Improving Farmers’ Income on Online Agri-platforms: Theory and Field Implementation of a Two-stage Auction”; as well as First Place in the 2020 POMS College of Supply Chain Management Student Paper Competition; the People’s choice Award, Early Career Sustainable OM Workshop; and finally, First Place in the 2020 POMS College of Sustainable Operations Student Paper Competition.

Meghna Lowalekar, Pradeep Varakantham, and Patrick Jaillet won the Best Applications Paper Award ICAPS 2019 for their paper, “ZAC: A Zone pAth Construction Approach for Effective Real Time Ride Sharing.”

Sebastien Martin won the 2019 George B. Dantzig Dissertation Award.

Sebastien Martin won the 2019 Transportation Science Dissertation Award.

Eytan H. Modiano won the Infocom Achievement Award for 2020.

Liangyuan “Irra” Na received an Honorable Mention for the 2019 INFORMS Undergraduate Operations Research Prize.

Milashini Nambiar PhD ’19, David Simchi-Levi, and He Wang PhD ’16 won the Best Student Paper award in the MSOM Student Paper Competition for their paper, “Dynamic Learning and Pricing with Model Misspecification.”

Chung-Piaw Teo PhD ’96 became an INFORMS fellow.

Caroline Uhler was awarded a 2019 Simons Investigator in Mathematical Modeling of Living Systems.

Patrick Jaillet

co-director

Dugald C. Jackson Professor of Electrical Engineering and Computer Science

Georgia Perakis

co-director

William F. Pounds Professor of Management Science