

Operations Research Center

The [Operations Research Center \(ORC\)](#), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 67th year of operation in academic year 2021. The ORC administers its own graduate program and a varied research program of methodological and applied projects.

This report summarizes AY2021 activities and briefly reviews its educational, research, and outreach programs.

Faculty, Students, and Staff

Georgia Perakis, the William F. Pounds Professor of Management, and Patrick Jaillet, the Dugald C. Jackson Professor in the Department of Electrical Engineering and Computer Science served as co-directors of the ORC.

During AY2021, the ORC had 56 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 (EECS), 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 83 students—65 PhD candidates and 18 SM candidates. The ORC conferred 10 master's degrees and 13 PhDs, and several other PhD theses were in the final stages of completion in summer 2021.

We had an outstanding year in terms of yield in admissions. We received 260 applications for the doctoral program and made 22 admission offers, with 17 accepting. For the SM program, we received 177 applications and made 11 offers, with six accepting; one SM student will defer their admission until fall 2022. We additionally admitted two students to the Leaders for Global Organizations/ORC joint masters program. We anticipate having 92 students in Operations Research programs for the upcoming year.

We continue to place our students exceptionally well in both academic and industry jobs. This year, graduates were placed as assistant professors at Harvard, New York University, University of California at Los Angeles, University of Pittsburgh, University of Oxford, University of British Columbia Sauder School of Business, Georgia Institute of Technology, and University of Southern California. Other graduates found positions at Amazon, Facebook, and Lyft.

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 Stephen A. Schwarzman College of Computing and reports to both the College of Computing and the Sloan School of

Management. The two ORC co-directors currently sit on the the College of Computing Council, with one of the co-directors at the Promotions Academic Council.

This past year, there was a significant change with regard to the Operations Research Qualifying Exam. At the end of summer 2020, the faculty voted to implement a new process. Instead of a written exam, students will now choose three courses to declare as qualifying courses, in which they must receive a GPA of 4.6. In addition, during the month of August, students will participate in a Common Experience project where they work in teams to solve a practical analytics challenge.

Research Activities

Research activities spanned a wide spectrum of methodological topics and applications, ranging from smaller 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 personalized medicine, operations management in the developing world, sustainability, and pricing. With the unfortunate continuation of the Covid-19 crisis, the ORC faculty have continued to rise to the task and together with students have worked hard to develop predictive and prescriptive models that are used at MIT, the Centers for Disease Control and Prevention, and elsewhere. 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.

Several organizations sponsored research projects at the ORC during AY2021, including the National Science Foundation, Draper Laboratory, the Food and Drug Administration, Lincoln Laboratory, Office of Naval Research, Oracle, Sapient, Mitsubishi, Anheuser-Bush, InBev, Canadian Imperial Bank of Commerce, 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 Itai Gurvich (Cornell University), Dick den Hertog (University of Amsterdam), Adam Elmachtoub (Columbia University), Alexandre d'Aspremont (École normale supérieure), Daniela Saban (Stanford University), Eran Segal (Weizmann Institute of Science), Alex Chouldechova (Carnegie Mellon University), Garrett Van Ryzin (Amazon), Dan Russo (Columbia), Guillermo Gallego (Hong Kong University of Science and Technology), Courtney Paquette (McGill University), Anatoli Juditsky (University of Grenoble), Andres Gomez (University of Southern California), Nika Haghtalab (University of California at Berkeley), Mihaela van der Schaar (University of Cambridge), Guillaume Roels (INSEAD), Susan Murphy (Harvard), and Jay Sethuraman (Columbia).

During the January independent activities period, the ORC also offered a two-day event called Policymaking in Operations Research, in which speakers from various fields gave talks focused on their work, research, and careers, and to discuss the future of operations research. The speakers included Mohammad Fazel Zarandi (MIT), Jonathan Mattingly (Duke University), Lawrence Wein (Stanford), Alexandre Jacquillat, Michael Lingzhi Li, Agni Orfanoudaki, and Holly Wiberg (MIT), Swati Gupta (Georgia Institute), Edward Kaplan (Yale University), and Susan Martonosi (Harvey Mudd College).

Townhalls, Social Events, and Meetings

Over the past year, the ORC has taken numerous steps to adjust to the ever-changing landscape that resulted from the COVID-19 pandemic. It was an unprecedented challenge for the staff, students, and faculty; however, we were able to pull together and make changes that allowed coursework and research to continue remotely. We put forth a concerted effort to maintain our close-knit community feeling by organizing online townhalls, social events, and meetings.

In order to keep our students informed of ongoing changes, the ORC began a series of monthly online townhall meetings. These meetings gave us the opportunity to listen to students' concerns and check on their overall wellbeing. In addition, we held townhall meetings with the operations research faculty to keep them up-to-date on ongoing matters.

The center held its annual open house event for prospective students remotely, which allowed us to interact with our newly admitted students through an entirely online program of events and meetings. Similarly, we planned an online commencement celebration for our graduates and their families. Both events were successful and very well attended, and many of the new ideas implemented will be carried forward when we are physically back on campus.

iPad Loaner Program

The ORC launched an iPad Loaner Program aimed at providing first-year students with an iPad and Apple Pencil in order to assist them in their remote learning and research collaboration. Working with MIT Information Systems & Technology and Sloan Technology Services, the ORC was able to purchase a number of iPads which we loaned to our students. This iPads were so well received that the center is planning to expand the program in the upcoming year to include students in their second year and beyond.

Student-Run Programs and Activities

The ORC is very supportive of activities organized by the student chapter of the Institute for Operations Research and the Management Sciences (INFORMS). The student chapter held social events which fostered a feeling of comradery amongst students and helped to improve life at the center. These events are often used as opportunities to meet students from other MIT programs. The ORC is proud of the friendly, inclusive environment we foster for our students. Events and activities this year included the following:

- Two Weeks Tournament of Wonder (online social activities with incoming students)
- ORC Trick "O.R." Treat Virtual Halloween Party

- ORC Online Happy Hour Mixers
- Virtual ORC Reunion (during the INFORMS annual conference)
- ORC Superlatives and Trivia Night
- ORC Online Holiday Party
- Social lunches, including Welcome Back and End-of-Semester events
- Chinese New Year Celebration
- Pi Day event

The ORC is also very proud of the work done by our student REFS (Resources for Easing Friction and Stress) volunteers. This program is run by student volunteers who complete training in conflict resolution and are familiar with other resources offered at MIT. They are an invaluable resource to our students and make themselves available both as moderators for conflicts and as confidants for students who may be experiencing difficulties. REFS also organize events centered on reducing stress and tension, including social events to increase awareness of the REFS program and to discuss student issues and concerns.

Fellowships

The ORC receives ongoing fellowship support from the Sloan School of Management for incoming doctoral students. We continue to have the Henry Gabbay 1976 Endowed Fellowship and the Vassilakis Fellowship, which are awarded to incoming doctoral students. In addition, the the Schwarzman College of Computing has provided funds to recruit one first-year female or an underrepresented minority doctoral student each year. This will be used to support incoming doctoral students already in fall 2021.

Future Plans

The ORC program has been expanding and increased its total number of enrolled students, while the new Master of Business Analytics (MBAn) program had its fourth class of 61 students. It is our hope that the interaction and collaboration between these new students and the current ORC students will be beneficial to all. 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 all of the capstone research for MBAn students is supervised by ORC faculty. In addition, the MBAn students are working with faculty and PhD students on research projects.

The ORC will keep working toward integrating as a new member of the Schwarzman College of Computing. In the next year, we will continue exploring how best to contribute to the college through potential educational and research synergies, such as developing new courses and creating research collaborations.

The ORC continues to play a large role in analytics and statistics within the Institute and 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

The ORC has always attempted to provide an environment that is responsive to the varied professional and personal needs of the operations research community at MIT. During AY2021, the staff of ORC consisted of two support staff member and one academic administrator. Two of our staff are women. In terms of the student population, 27 of our graduate students are women and one student is African American.

A number of ORC students participated on committees for the Schwarzman College of Computing on diversity, equity, and inclusion, for example in the search for MIT's assistant dean for diversity, equity, and inclusion.

Professional Activities

Charu Aggarwal received the highest prize that the Institute of Electrical and Electronics Engineers (IEEE) awards: the W. Wallace McDowell Award for outstanding theoretical, design, educational, practical, or related innovative contributions that fall within the scope of Computer Society interest.

Cynthia Barnhart was awarded the INFORMS President's Award.

Jackie Baek won honorable mention in the 2021 MIT Operations Research Center's Best Student Paper competition for her paper "A Group Fairness Framework for Apportioning the Burden of Exploration," co-authored with Vivek Farias.

Dimitris Bertsimas, Leonard Boussiou, Ryan Cory-Wright, Arthur Delarue, Vassilis Digalakis, Alexandre Jacquillat, Driss Lahlou Kitane, Galit Lukin, Michael Lingzhi Li, Luca Mingardi, Agni Orfanoudaki, Theodore Papalexopoulos, Ivan Paskov, Omar Skali Lami Hamza Tazi Bouardi, Kimberly Villalobos Carballo, Holly Wiberg, Cynthia Zeng, Omid Nohadani (Benefits Science Technologies), and Bartolomeo Stellano (Princeton University) won the 2020 INFORMS Pierskalla Best Paper Award for their paper "From Predictions to Prescriptions: A Data-driven Response to COVID-19."

Dimitris Bertsimas, Michael Lingzhi Li, Omar Skali Lami, and Hamza Tazi Bouardi; Najat Khan, Jennings Xu, Jose Zamalloa, Amir Hashemi, Ankit Lodha, Yuqi Shang, Kris Standish, Shi-hua Yu, Levon Demirdjian, Xiaoying Wu, and Sid Jain (Janssen Pharmaceuticals), and Ali Haddad-Sisakht (Dynamic Ideas LLC) won the 2021 Innovative Applications in Analytics Award for their work "Data-driven COVID-19 Vaccine Development for Janssen." Sponsored by the Analytics Society of INFORMS, Kinaxis, and Adelphi University, the award recognizes creative and unique application of a combination of analytical techniques in a new area.

Dimitris Bertsimas and Gina Mourtzinou, cofounders of Dynamic Ideas, are finalists for the 2021 INFORMS Edelman Award for their work regarding the impact of analytics on OCP.

Dimitris Bertsimas was named in the 2021 list of Leading Academic Data Leaders from *Chief Data Officer Magazine*.

Leonard Boussiou won the 2020 Robert B. Guenassia Award from MIT's Office of Graduate Education.

Leonard Boussioux won third prize in the 2021 MIT Generator's Research competition for his work "Holistic AI for Wildlife Analytics." Boussioux also won the 2020 first prize "Advancing Technology for Humanity" IEEE Student Branch Award for his paper "Large-scale monitoring of insect population using Deep Learning."

Ryan Cory-Wright and Jean Pauphilet won the 2020 INFORMS George E. Nicholson Student Paper Competition for their paper "Mixed-Projection Conic Optimization: A New Paradigm for Modeling Rank Constraints," coauthored with Dimitris Bertsimas.

Joseph Doyle won a 2021 Teaching with Digital Technology Award from MIT for his work teaching on campus and/or remotely. These student-nominated awards recognize faculty and instructors who have used digital technology to improve teaching and learning for MIT students.

Daniel Freund was a finalist for the 2020 INFORMS Daniel H. Wagner Prize for his paper "Driver Positioning and Incentive Budgeting with an Escrow Mechanism for Ridehailing Platforms."

Robert Freund won MIT Sloan's 2020 Samuel M. Seegal Prize for "inspiring students to pursue and achieve excellence."

Emma Gibson won first place in the 2020 INFORMS Doing Good with Good OR Student Paper Competition for her paper "Redesigning Sample Transportation in Malawi Through Improved Data Sharing and Daily Route Optimization," coauthored with Jónas Jónasson, Sarang Deo (Indian School of Business), Kara Palamountain (Kellogg), and Mphatso Kachule (Riders For Health Malawi).

Emma Gibson, Jónas Jónasson, Sarang Deo (Indian School of Business), Kara Palamountain (Kellogg), and Mphatso Kachule (Riders For Health Malawi) won second place in the 2021 POMS Healthcare Best Paper Competition for their paper "Redesigning Sample Transportation in Malawi Through Improved Data Sharing and Daily Route Optimization."

Negin Golrezaei was the recipient of the 2021 Young Investigator Award at the Office of Naval Research for her paper "Finding a Needle in a Haystack: Utilizing Structures and Predictive Information in Online Optimization."

Hussein Hazimeh won Honorable Mention for the 2020 INFORMS Computing Society Best Student Paper competition for his paper "Sparse Regression at Scale: Branch-and-Bound rooted in First-Order Optimization," coauthored with Rahul Mazumder. Hazimeh also won the 2020 MIT Operations Research Best Student Paper Award.

Nuno Antunes Ribeiro, Alexandre Jacquillat, and António Pais Antunes won the 2020 INFORMS Aviation Applications Section Best Paper Prize for their paper "A Large-Scale Neighborhood Search Approach to Airport Slot Allocation."

Alexandre Jacquillat and K. Wang won the 2020 INFORMS Data Mining Section Best Applied Paper Competition for their paper "Scenario-based Robust Optimization for Data-driven Decision-making under Binary Uncertainty."

Alexandre Jacquillat was named in the 2021 list of Leading Academic Data Leaders from *Chief Data Officer Magazine*.

Patrick Jaillet was named in the 2021 list of Leading Academic Data Leaders from *Chief Data Officer Magazine*. In addition, Jaillet received the 2020 Burgess (1952) and Elizabeth Jamieson Award from the Department of Electrical Engineering and Computer Science.

Stefanie Jegelka won the 2020 Two Sigma Faculty Research Award in machine learning, and also won the 2021 Google Faculty Research Scholar Award in machine learning and data mining.

Nicholas Johnson won Honorable Mention in the 2020 INFORMS Undergraduate Operations Research Prize.

Jonas Jonasson, Emma Gibson, Sarang Deo (Indian School of Business), Kara Palamountain (Kellogg) and Mphatso Kachule (Riders For Health Malawi) won first place in the MSOM Practice Based Research Competition for their paper “Redesigning Sample Transportation in Malawi Through Improved Data Sharing and Daily Route Optimization.”

Retsef Levi was named in the 2021 list of Leading Academic Data Leaders from *Chief Data Officer Magazine*.

Andrew Lo won the 2020 MITx Prize for Teaching and Learning in MOOCs (massive open online courses) for his course “The Science and Business of Biotechnology.”

Andrew Lo won a 2021 Teaching with Digital Technology Award from MIT for his work teaching on campus and/or remotely. These student-nominated awards recognize faculty and instructors who have used digital technology to improve teaching and learning for MIT students.

Andrew Lo, Alexander Remorov, and Zied Ben Chaouch won the 2020 Special Distinction Award from the *Journal of Investment Management* for their paper “Measuring Risk Preferences and Asset-Allocation Decisions: A Global Survey Analysis.”

Susan Martonosi received the INFORMS Prize for Teaching of OR/MS Practice (operations research and the management sciences).

Rahul Mazumder and Hussein Hazimeh won the 2020 INFORMS Optimization Society Young Researchers Award for their paper “Fast Best Subset Selection: Coordinate Descent and Local Combinatorial Optimization Algorithms” which appeared in *Operations Research*.

Rahul Mazumder became an associate editor for the journal *Annals of Statistics*.

James Orlin won the 2020 INFORMS Optimization Khachiyan Prize.

Dessislava Pachamanova won the INFORMS Case Competition.

Elisabeth Paulson received second prize in the 2021 College of Supply Chain Management Student Paper Competition with her paper “Reverse Information Sharing: Reducing Cost and Waste in Supply Chains with Yield Uncertainty,” co-authored with her advisors Retsef Levi, Georgia Perakis as well as Pavithra Harsha (IBM Research)

Jean Pauphilet received honorable mention in the 2020 INFORMS Doing Good with Good OR Student Paper Competition for his paper “Hospital-wide Inpatient Flow Optimization,” co-authored with Dimitris Bertsimas.

Jean Pauphilet received Honorable Mention in the 2020 INFORMS George B. Dantzig Dissertation Award for his dissertation “Algorithmic Advancements in Discrete Optimization: Applications to Machine Learning and Healthcare Operations.” In addition, Pauphilet won the 2020 MSOM Data-Driven Challenge for his paper “Robust and Heterogeneous Odds Ratio: Estimating Price Sensitivity for Unbought Items.”

Georgia Perakis won the 2021 Distinguished Fellow Award from INFORMS MSOM Society. Perakis was named the editor in chief of the journal *Manufacturing and Service Operations Management* in January 2021, and was named in the 2021 list of Leading Academic Data Leaders from *Chief Data Officer Magazine*.

Georgia Perakis, Divya Singhvi, Omar Skali Lami, Alison Borenstein, Ankit Mangal, Stefan Poninghaus, and Jiong Wei Lua received honorable mention (second place) in the MSOM Practice Based Research Competition for their work with Wayfair as described in their paper “Ancillary Services in Targeted Advertising: from Prediction to Prescription.”

David Simchi-Levi was awarded the 2020 INFORMS Impact Prize for playing a leading role in developing and disseminating a new highly impactful paradigm for the identification and mitigation of risks in global supply chains.

David Simchi-Levi, Nikos Trichakis, and Peter Yun Zhang received the 2020 Koopman Award given to an outstanding publication in military operations research for their paper “Designing Response Supply Chain Against Bioattacks.”

Jinzhi Bu, David Simchi-Levi, and Yunzong Xu received the 2020 INFORMS Data Mining Best Theoretical Paper Award for their paper “Online Pricing with Offline Data: Phase Transition and Inverse Square Law.”

Eric Anderson, Song Lin, Duncan Simester, and Catherine Tucker won the 2020 Weitz-Winer-O’Dell Award from the American Marketing Association for their article “Harbingers of Failure,” which has made the most significant, long-term contribution to marketing theory, methodology, and/or practice.

Omar Skali Lami won the MIT Operations Research Center’s Best Student Paper Award for his paper “XSTrees: Extended Sampled Tree Ensembles for Classification and Regression” co-authored with Georgia Perakis and Divya Singhvi.

Nikos Trichakis won a 2021 Teaching with Digital Technology Award for his work teaching on campus and/or remotely. These student-nominated awards recognize faculty and instructors who have used digital technology to improve teaching and learning for MIT students.

Yanchong “Karen” Zheng, Retsef Levi, Somya Singhvi, and field partner Manoj Rajan (ReMS, Karnataka, India) won the 2020 MSOM Responsible Research Award, the 2020 INFORMS Public Sector Operations Research Section Best Paper Award, and the 2020 POMS Applied Research Challenge for their paper “Improving Farmers’ Income on Online Agri-platforms: Theory and Field Implementation of a Two-stage Auction.”

Patrick Jaillet

Co-director

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Georgia Perakis

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William F. Pounds Professor of Management Science