

INDUSTRIAL ENGINEERING AND MANAGEMENT SCIENCES

DEPARTMENT GROWS MANAGEMENT SCIENCES ARM OF UNDERGRADUATE PROGRAM

Gail Berger to lead the effort

As the department aims to strengthen and develop the management sciences arm of the IEMS undergraduate degree, Gail Berger is ready to lead the effort.

"I will focus on helping students to cultivate their leadership capability, build high-performing teams, negotiate deals, and manage conflict," said Berger, who was hired this year as an assistant professor of instruction.

The management sciences part of the degree trains students in the psychology of human interaction and growth. With this training, students will be better equipped to navigate the workplace.

"All of this content will be delivered with an emphasis on experiential learning and practical application of concepts in a work context," said Berger. "I view these courses as a critical complement to the analytical and problem solving skills that are developed in the IE courses."



Berger

With an emphasis on ethical behavior and choices, Berger believes students will learn how to build strong cultures, create an engaging and motivating work environment, influence others and mitigate the psychological biases that can adversely impact decision making so that they can harness the analytical skills that they develop in their other courses.

Berger holds a doctoral degree in management and organizations from Northwestern University's Kellogg School of Management, and a master's

"I WILL FOCUS ON HELPING STUDENTS TO CULTIVATE THEIR LEADERSHIP CAPABILITY, BUILD HIGH-PERFORMING TEAMS, NEGOTIATE DEALS, AND MANAGE CONFLICT."

GAIL BERGER

of education in administration and supervision from Loyola University. Berger's career history includes teaching roles in Northwestern's School of Education and Social Policy (SESP), Kellogg School of Management, and McCormick School of Engineering. She received the Instructor of the Year Award for the 2010-11 academic year from SESP, and was on the Associated Student Government Faculty Honor Roll for 2007-08, 2009-10, and 2015-16.

Dear friends and colleagues,

With major plans for expansion, Northwestern is in the midst of a season of change. Our department, too, is undergoing new growth and many exciting changes. We have developed a five-year strategic plan that calls for a significant increase in the size of our PhD program, a re-orientation and consolidation of research areas around our two signature centers — the Center for Optimization and Statistical Learning (OSL) and the Center for Engineering and Health (CEH) — and a reform of the undergraduate curriculum. IEMS aims to play a more central role in the mission of Northwestern Engineering through closer collaboration with other departments, most notably the Department of Electrical Engineering and Computer Science.

These changes will be implemented upon a strong foundation. Our department is currently one of the leaders in research and education nationwide. In the past 15 years, the department has improved its standing among its peers and has influenced the field through seminal research contributions and through the successes of its graduates in

business and academia. But as the field of industrial engineering is undergoing a substantial shift, we must respond by embarking on educational reform and by strengthening and re-envisioning our research areas. The main thrust behind our new research mission is the dramatic convergence of the fields of optimization, statistics, and computer science, which has important implications on the future of the field of operations research. The department will undertake novel research at the intersection of these disciplines, and will play a significant role in the University-wide computer science initiative, announced in 2016. The directors of our two signature centers, **Dave Morton** and **Sanjay Mehrotra**, have made a real impact at Northwestern with their vision, optimism, and unbounded energy.

I am delighted to share with you the news that Sanjay has been selected as an INFORMS fellow, Class of 2016. This is one of the highest recognitions in our field. INFORMS fellows are exemplars of outstanding lifetime achievement in operations research and the management sciences who have demonstrated exceptional accom-

plishments, and made significant contributions to the advancement of operations research and management science.

Professor **Charles Thompson** retired in December 2015. During his 43 years on our faculty, Charles influenced the lives of more than 3,500 undergraduate, master's, and PhD students. By combining his unique training and life experiences in education, law, business, and industrial engineering with a systems perspective and a quick wit, Charles taught generations of students about the theory and practice of organizational behavior and technology management. Many graduates point to the capstone systems management projects he directed as the pinnacle of their Northwestern education. Friends and colleagues from throughout Northwestern and alumni attended a dinner on April 1, 2016 to celebrate Charles' contributions, commitment, and passion for Northwestern.

I am pleased to announce that **Gail Berger** has joined the department as professor of instruction and will be in charge of working with **Bill White** and **Mark Werwath** to revamp our undergraduate management sciences curriculum. To ensure that its educational programs continue

to be recognized as some of the best in the country, our industrial engineering curriculum must provide the computational skills necessary to work in data-driven fields, offer high-quality opportunities to apply analytical skills, and help instill the business acumen that will set graduates apart from students in other top IE departments. This will require an increase in computing expectations in many of our courses, and an increase in the rigor and quality of senior design projects. These educational improvements will be overseen by assistant chair **Jill Wilson**.

As we welcome this fall the largest industrial engineering class in the department's history, we look forward to all the work that lies ahead. As you can tell, the rewards will be great.



Jorge Nocedal

David A. and Karen Richards Sachs Professor and Chair

2015-16 Gifts to the Department

The Department of Industrial Engineering and Management Sciences is extremely grateful for the generous donations it continues to receive from private and corporate donors. Below are donations received this year through July 31, 2016. Every dollar is used to support the academic, administrative, and research endeavors of our department. Please accept this acknowledgement with our deepest appreciation.

Up to \$99

Cristina Alfonso
Grant Anderson
Bryan Cowan
Siddharth
Mayur Daftary
Marsha Foster
Michael Johnson
Joel Joseph
Veronika Koren
Jeffrey Lee
Network for Good
Bradley Winters

\$100-\$499

Thomas M. Brody
Thomas Dickenson
Grand Haven Area
Community
Foundation
Hina T. Jaffery
Carley J. Jurishica
Daniel L. Kegan
Molly K. Kelly
Daniel Ozu Kwon
George Z. Lannert
Scottie S. Lee

Tyler Mansfield
Eva M. McGoey
Rajeshkumar C. Oza
Donald E. Rome
Jason Edward Velkavrh
Sandra Lee Waters
May Weber

\$500-\$999

Morris A. Cohen
Jason Bryan Cohen
William H. Gates, III
Saba T. Jaffery
Bart M. Wenstrom

\$1000-\$9999

Chicago Parks District
Columbus
Jewish Foundation
Izak Duenyas
Jeffrey Richard
Lefebvre
Joseph S. Martinich
George Nemhauser
Jonathan H. Owen
Richards Sachs
Investment
Partners, LLC

Vicki L. Sauter
Schwab Fund for
Charitable Giving
\$10,000+
Burlington Northern
Santa Fe Corporation
Cars.com
Chicago Bears
Football Club, Inc.
CME Group
GN Partners
HERE, a Nokia business
Intel Corporation

Interactive Health Inc.
Teradata
TransUnion LLC
We Energies
Zurich American
Insurance Company

MORE COLLABORATION FOR MORE INTERCONNECTIVITY

Collaboration begets increased connectivity for big data and researchers alike

By David Morton

Big data is big news. According to computer technology titan IBM, approximately 2.5 billion gigabytes of data were generated every day of 2012, and that productivity has surely accelerated by 2016.

The result of a highly interconnected, Internet-driven world, much of that data is, paradoxically, disconnected from everything else around it. A major potential benefit of the drive to understand big data is the ability to discover useful connections among all of these nascent datasets around the globe.

Out of this potential, we created the Center for Optimization and Statistical Learning (OSL) at Northwestern University, an interdisciplinary collaboration between the Departments of Industrial Engineering and Management Sciences (IEMS) and Electrical Engineering and Computer Science (EECS) at the McCormick School of Engineering, which also draws faculty and expertise from Northwestern's Kellogg School of Management and Feinberg School of Medicine.

Tackling a wide range of disciplines, including healthcare, energy systems, manufacturing processes, and much, much more, OSL faculty and students harness their expertise to optimize complex systems for the most efficient operation and outcomes, analyze and deconstruct big data to enable actionable forecasting, and improve statistical



Morton



Waechter



Nohadani

"A MAJOR POTENTIAL BENEFIT OF THE DRIVE TO UNDERSTAND BIG DATA IS THE ABILITY TO DISCOVER USEFUL CONNECTIONS AMONG ALL NASCENT DATASETS AROUND THE GLOBE."

DAVID MORTON

models by understanding larger and larger datasets, coupled with better optimization algorithms.

Academic year 2015-16 for OSL has been not only an exciting undertaking into the interconnectedness of big data, but also a time of building connections and collaborations among researchers themselves, and the larger external community. IEMS associate professor **Andreas Waechter** has been leading the OSL Software User's Group, a highly collaborative community of research faculty that includes associate professor **Omid Nohadani**, several PhD students, and me.

Conducted over lunch hour meetings, students in the Software User's Group take turns presenting code they have written while developing their research, primarily so others may learn from their implementations, but also to receive feedback from colleagues and mentors on writing better code. While OSL researchers develop new models,

algorithms, and theory in their research, implementing those ideas in software is typically key to establishing that they actually work. Taking the next (big) step to develop software for public release is where students and faculty can often have the greatest impact.

Continuing in the collaboration out of which OSL was born, the Center hosted a number of faculty visitors over the 2015-16 academic year. In addition to giving a seminar on their research, three visiting faculty — Mark Schmidt from the University of British Columbia, Sham M. Kakade from the Washington University of Washington, and Peter Frazier from the Cornell University School of Operations Research and Information Engineering — graciously gave separate tutorials targeted to OSL PhD students and postdoctoral fellows. The tutorials brought together the larger OSL community, including IEMS and EECS faculty and students.

IEMS 2016 GRADUATION

Hundreds of purple-robed undergraduate, master's, and PhD students graduated from the McCormick School of Engineering and Applied Science in June as part of a weekend of festivities. At Northwestern University's 158th Commencement exercises at Ryan Field, School of Communication alumnus and comedian Seth Myers ('96) stressed to students the importance of maintaining personal relationships as they enter the workforce.

PhD GRADUATES

In the 2015-16 academic year, IEMS graduated five PhDs: **Liwen Ouyang** (American Express), **Ekkehard Beck** (Creativ-Ceutical), **Chen Jin** (Wharton Business School), **Imry Rosenbaum** (Goldman Sachs), and **Stefan Soltsev** (University of Wisconsin, Madison).



SENIOR CEREMONY

On June 17, a packed room of IEMS undergraduate students and their families celebrated graduation at the IEMS 2016 Senior Ceremony. The event highlighted special student awards and achievements and provided time for students, faculty, and family to connect.



FROM THE ASSISTANT CHAIR

Dear friends and colleagues,

As in years past, this academic year has seen great student achievements. In November 2015, **Tessa Swanson**, an IEMS undergraduate student, and **Andy Fox**, a student in the Master of Science in Analytics program, received a second-place award for their paper "Volunteer Engagement in the Age of Analytics: A Case Study with American Red Cross, Greater Chicago Region" at the Doing Good with Good O.R. student paper competition sponsored by INFORMS. Their research focused on creating more efficient and appropriate ARC deployments of volunteers during times of need.

This coming year, IEMS welcomes two new members to its administrative team: **Gail Berger**

and **Rachel Heyman**. As assistant professor of instruction, Berger will strengthen the management sciences arm of the student experience. You can read more about her and her goals on page 1. Heyman will act as a graduate advising intern in the 2016-17 academic year. She holds a doctoral degree and is currently in the Master of Higher Education Administration program at Northwestern. In the IEMS internship program, Heyman will work with me to design a meaningful, effective advising program for our students.

This year, students can also expect to see changes to the undergraduate curriculum. In an effort to improve student computing proficiencies, incoming students will be required to

take two computing courses. Additionally, we plan to grow other computational competencies throughout various courses in the IE curriculum to address the growing need for modern graduates who can glean insights from available data and then design and implement custom solutions to capitalize on them. Students will also see the addition of new management sciences electives. In addition to our ever-popular course in organizational behavior taught by **Bill White** and **Kevin Murnane**, students can now choose from project management with **Mark Werwath**, Gail Berger's courses in negotiations, and leadership and teams.

Finally, we've made many changes to the senior design project sequence. We will develop a new website to showcase outstanding design projects. The site will also house a project

intake form to collect stronger information about potential new projects. In addition, the courses have moved from culminating in a poster session to culminating in a dynamic presentation session. We also plan to augment involvement from faculty project advisers so student groups make full use of their resources.



Jill Wilson
Assistant Department Chair
for Undergraduate Studies

ENGINEERS ASSIST CHICAGO MARATHON WITH TECHNOLOGY

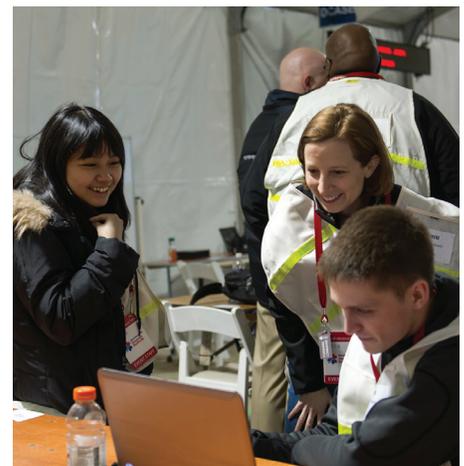
Data analytics team and its 'dashboard' was stationed in the race's Forward Command

Northwestern logistics expert **Karen Smilowitz** and her students custom-designed a data visualization system that provides a computer simulation of the Bank of American Chicago Marathon. Using data from the last seven races and from runners in this year's race, the system can forecast where large concentrations of participants will be 20 minutes later and help race officials to plan accordingly.

Two large one-stop "dashboards" in the busy forward command tent displayed

the race simulation and important course conditions onscreen at the same time: location of lead runners, runner density on the course, medical tent and aid station capacity, current temperature, alerts of any issues on the course, and much more. Desktop and mobile versions of the dashboard also were available, helping staff and volunteers on the course be more connected to the overall race.

Smilowitz's team includes **Sam Young**, **Rachel Lin**, and **Ryan Rose**, all undergraduate students, and **Bruno Peynetti Velazquez**, a master's degree student. These five were in forward command during the 2015 race, while team member **Mehmet Basdere**, a PhD student who is conducting research on course design, ran the marathon, his first.



Karen Smilowitz works with students in the Chicago Marathon's Forward Command.

MEM TEAM WEIGHS OPTIONS FOR CAMPUS MICROGRID

Microgrids address reliability, energy efficiency, and sustainability

By Monika Wnuk

Marked by the hum of research equipment and the buzz of construction on new buildings, daily operations on a university campus come with a growing demand for electricity.

Although that demand can be measured in kilowatt-hours, the reliability and resilience of the electricity system supplying power to campus, especially in the event of an outage, prove equally as important when developing and managing a campus energy plan.

Taking those factors into consideration, five Northwestern graduate students in the Master of Engineering Management (MEM) program will conduct a preliminary assessment of sites for distributed energy sources on Northwestern's Evanston campus, and make recommendations for the implementation of a microgrid.

Microgrids help address three main issues in electricity delivery — reliability, energy efficiency, and sustainability. Although microgrids carry high initial adoption costs, the Pew Charitable Trusts estimates that by 2020, the national microgrid capacity will increase 145 percent to 2,850 megawatts — almost 1.5 times the output of an average-sized nuclear power plant, and enough electricity to power more than 2 million households. Concurrently, the total market value of microgrids is expected to exceed \$3.5 billion.

The Northwestern team, which includes MEM students **Abhi Chitlange** ('16), **Hemant Disale** ('16), **Sachin Gaekwad** ('16), **Swapnil Latad** ('16), and



The microgrid research team (from left to right): Abhi Chitlange, Vignesh Ramasamy, Swapnil Latad, Hemant Disale, and Sachin Gaekwad.

Vignesh Ramasamy ('16), will assess quantitative benchmarks, such as energy use, efficiency, and carbon footprint, at three locations on Northwestern's Evanston campus: the visitor's center, the North campus parking garage, and the Technological Institute. They will use a combination of private and open-source energy management software to assess the feasibility of installing a solar array for electricity generation, combined with a scalable battery, for storage. The team will also consider the project's qualitative potential for making the University a living laboratory for green technologies.

On August 4, the team presented a recommended site for the project, as well their financial analysis of next steps for installation — ranging from outright purchase of the microgrid system to options for leasing from a third-party owner. Their recommendations will be heard by sponsors and mentors on the project, which include the Institute for Sustainability and Energy at Northwestern (ISEN); Northwestern Facilities Management; the Master of Engineering Management program at Northwestern;

THE TEAM WILL CONSIDER THE PROJECT'S POTENTIAL FOR MAKING THE UNIVERSITY A LIVING LABORATORY FOR GREEN TECHNOLOGIES.

Schneider Electric, a multinational energy management and automation company; Viridity Energy, provider of energy management software; and ViZn Energy, a zinc-iron flow battery company. Additional funding for the project came from the Northwestern Sustainability Fund, a \$50,000 pool established to spark Northwestern student engagement in energy and sustainability.

Pending a decision on next steps, a solar installation at any of these locations would join the 16.8-kilowatt panel array situated on top of the Ford Motor Company Engineering Design Center, the first LEED-certified building on campus.

HOSPITAL DATA ANALYSIS WINS MSIA HACKATHON

Northwestern Engineering's MSiA program collaborated with Teradata Aster to host the third annual competition



Mengshan Jin and Balamurali Natarajan analyze flight data during the hackathon.

With nearly half of its expenses coming from managing inpatient care, US hospitals wrestle with a never-ending challenge: find new ways

to lower costs while maintaining a high standard of care. Master of Science in Analytics (MSiA) graduate students **Jamie Green** and **Kapil Bhatt** believe a solution could lie in the data.

Winners of the MSiA's third annual Hackathon on May 5, Green and Bhatt sought to gain insights into the dilemma by using analytics software to study inpatient discharge data from Texas hospitals over a six-month period in 2007. The duo created a linear model that codified and analyzed variables like length of stay, reason for admittance, and patient demographics.

The team determined that the patients' admitting diagnosis was the most accurate

predictor of their length of stay. Patients grouped with "mental health-related illness" as an initial diagnosis required the longest hospital stay. Conversely, diagnoses categorized by "pregnancy and child-birth" reflected relatively short visits, likely due to the brief nature of ultrasound and check-up screenings.

"To be able to predict length of stay based on patient data could help staff more accurately set schedules, order and maintain supplies, and prepare for new patients," said Green. "The cost savings from those changes could eventually be passed on to the consumer."

IT'S IN OUR GENES

Baseball and the Traveling Salesman Problem

By Eric Lundquist, from the MSiA blog

What better way to explore America than to make a pilgrimage to our nation's green cathedrals: all 30 Major League Baseball stadiums. This is a difficult proposition, however, because the size of the league and the geography of the country it spans. For someone seeking to complete the journey in a single, epic, cross-country road trip, planning an efficient route is of paramount importance.

The task at hand can be conceptualized as an instance of the Traveling Salesman Problem (TSP). Easy to understand but hard to solve, the TSP is one of the most studied problems in optimization and theoretical computer science. It's often used as a benchmark to test new algorithms and optimization techniques developed over time. With even a modest list of cities to visit, the number of possible route permutations, or tours, becomes enormous.

In an attempt to tackle difficult problems like the TSP, researchers over the years have developed a wide variety of heuristic approaches. While not guaranteed to reach a global optimum, these techniques will return a near-optimal result with

a limited amount of available time and resources. One of these heuristics, genetic algorithms, models problems as a biological evolutionary process. The algorithm iteratively generates new candidate solutions using the principals of natural selection, crossover/recombination, and genetic mutation first identified by Charles Darwin back in 1859.

As a powerful problem-solving technique and a fascinating blend of real life and artificial intelligence, I wanted to see whether I could successfully implement a genetic algorithm to solve my own personal TSP: an efficient road trip to all of the MLB stadiums.

To read the complete blog entry, visit <http://sites.northwestern.edu/msia>

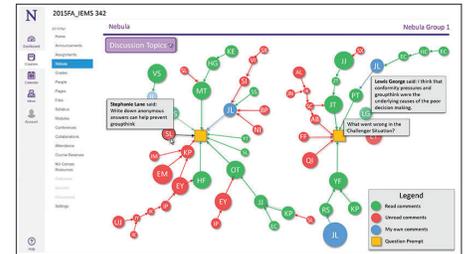
ONLINE DISCUSSIONS AS INTERACTIVE GRAPHS

Nebula encourages students to discuss work outside of class

After struggling to motivate students to participate in online conversations, Professor **Seyed Iravani** and his teaching assistant **Jackie Ng** developed Nebula, a visual graphical interface to the traditional discussion board. The new tool presents discussions as a network graph, in which posts are the nodes and replies are the links among nodes.

Having done research in complex systems, Iravani and Ng decided to visualize discussion boards as social network graphs, where the nodes are people and links are the replies to posts. The pair then approached Bill Parod and Jacob Collins in Northwestern Information Technology. Several conversations later, Nebula was born.

Although the networks are a simple way to convey discussions at a glance, the nodes communicate complex information. They are color-coded to help users distinguish between read and unread messages and are bigger relative to the length of the post. They are also marked with the contributor's initials,



Nebula depicts people as nodes in a network graph.

so participants can see who is talking and who is not. This can spur game-like competitions that motivate participation. But, more importantly, it helps students feel more prepared and excited about class.

ALUMNUS RESEARCHES TWO-WAY RATING SYSTEM

Chen Jin will study how the system helps match supply and demand



Jin

Chen Jin took a postdoctoral research appointment at the Wharton School of the University of Pennsylvania after receiving his doctoral degree from IEMS in 2016. In collaboration with

professors Kartik Hosanagar and Senthil Veeraraghavan, Jin will study the role of the two-way rating system in the online marketplace.

With the rapid development of information technology and digital innovations, the way that supply and demand are put together and deployed has fundamentally changed. Examples like Uber and Airbnb help match decentralized surplus capacity with pent-up demand.

"In marketplaces like these, the reputation and feedback system — or the rating system — plays a crucial role in building up trust and facilitating the transaction between customers and service providers," said Jin.

Traditionally, users rate providers in a one-way rating system. More and more platforms, however, have started adopting a two-way rating system. In this system, service providers can also rate back to customers and use the customers' reputation score to select which customers to serve or not serve. At Wharton, Jin will study how this two-way rating system helps to better match between supply and demand.

While at Northwestern, Jin studied under Professor **Seyed Iravani**. His research focuses on the observational learning behavior of decision makers — both rational and human subjects — in systems with information asymmetry.

PROFESSOR CHARLES THOMPSON RETIRES

Thompson spent nearly 50 years at Northwestern

After nearly 50 years at Northwestern Engineering, Charles Thompson retired from his position as a professor of industrial engineering and management sciences in December 2015.

During his time at Northwestern, Thompson contributed greatly to his field and the University through research, teaching, mentorship, and by promoting diversity.

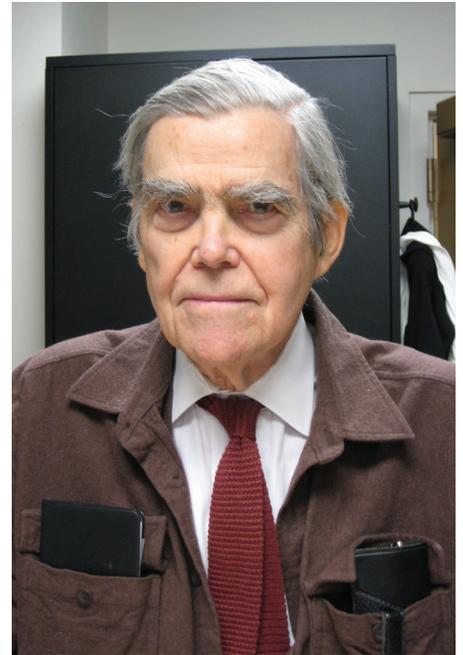
Thompson received his PhD from Northwestern in 1968 and accepted a faculty position at the University shortly thereafter. Prior to entering academia, he experienced a varied career. He served as an Air Force engineer in World War II and the Korean War. Once his military commitment ended, he continued living on the Wright-Patterson Air Force Base in Dayton, Ohio as a civilian consultant. Then he attended graduate school, followed by law school, and, at some point, even worked as a spy.

According to his colleagues, Thompson has never shied away from trying something new. While at Northwestern, he became a pioneer in the “field of research methods,” the process of improving organizations and systems by observing and surveying them as opposed to running experiments on them. He also taught all levels of students — from undergraduate to graduate.

Thompson also developed new courses for his students in order to keep up with the evolving field of industrial engineering. His popular courses include Methods, Standards, and Work Design (IEMS 210),

which teaches students about the foundations of industrial engineering practices, and Systems Project Management (IEMS 392), which challenges students to apply project management methods to outside systems.

In addition to his academic accomplishments, Thompson is known for his commitment to promoting women in science and engineering. When he joined Northwestern in the late '60s, women were scarce among both faculty and PhD students, which was characteristic of



Thompson

WHILE AT NORTHWESTERN, HE BECAME A PIONEER IN THE “FIELD OF RESEARCH METHODS,” THE PROCESS OF IMPROVING ORGANIZATIONS AND SYSTEMS BY OBSERVING AND SURVEYING THEM AS OPPOSED TO RUNNING EXPERIMENTS ON THEM.

the times but troubling to Thompson. He spent his career working to improve those numbers. Half of the PhD candidates to graduate from his laboratory were women. At one point, a National Science Foundation researcher remarked that Thompson was among the top engineering professors in the country in terms of the number of female PhDs he produced.

DEPARTMENT NEWS

Recently released rankings from *US News and World Report* place the IEMS graduate program number four.

SPONSORED AWARDS

Dan Apley received an NSF grant titled, "Collaborative Research: Model-Based Multidisciplinary Dynamic Decisions in Design."

Diego Klabjan received a grant from AbbVie Inc. titled, "RQS Safety Text Analytics," and a grant from Allstate Insurance Company titled, "Automatic Extraction of Real Estate Attributes: The Value of Image Recognition."

Sanjay Mehrotra received a grant from the National Institute of Biomedical Imaging and Bioengineering titled, "Unassisted Blood Pressure Monitoring Using Arterial Tonometry and Photoplethysmography" and a grant from the Department of Veterans Affairs titled, "Veterans Engineering Resource Center (VERC)."

David Morton received an award from the Alliance for Sustainable Energy, LLC, National Renewable Energy Laboratory and the Department of Energy titled, "Concurrent Optimization of Component Capital Cost and Expected O&M."

Barry Nelson received a GOALI award from NSF titled, "GOALI: Computer Simulation Analytics," and a General Motors Corporation grant titled, "Quantifying the Uncertainty Propagation in Vehicle Content Packaging and Pricing Optimization."

Jorge Nocedal received two awards: an Intel Corporation grant titled, "Scalable Learning Methods for Deep Neural Networks," and an NSF award titled, "Collaborative Research: Algorithms for Large-Scale Stochastic and Nonlinear Optimization."

Omid Nohadani received a grant from NSF titled, "Robust Multi-Criteria Optimization with Application to Radiation Therapy."

Mark Werwath received three awards this past year from the National Collegiate Inventors and Innovators Alliance, Inc.: "Hazel Technologies," "Amper," and LiOnSafe."

FACULTY NEWS

Professors **Noshir Contractor** and **Seyed Iravani**, along with PhD student Jacqueline Ng, received a grant from the Office of the Provost for digital and online technology. The grant will be used to research how students use and learn from the new discussion board, Nebula.

The INFORMS Simulation Society awarded IEMS PhD alumni **Wei Xie** and Professor **Barry Nelson** with its 2015 Outstanding Publication Award.

STUDENT NEWS

IEMS INFORMS Student Chapter won Magna Cum Laude recognition at the INFORMS annual conference.

IEMS undergraduates **Paige von Achen** and **Andy Zheng** received recognition for their submissions to the 2015 INFORMS Undergraduate O.R. Paper Competition.

Anabel Buckfire, Katherine Cirulli, Jacob Friedrich, Veronika Koren, Ross Laird, Thomas Lewis, Adam Lim, David Olodort, Alejandro Rincon, Alex Rinholm, and Roy Yu received Charles Thompson Senior Design Awards, honoring the best team projects during winter and spring quarters.

Undergraduate student **Nicholas George Paras** received the Arthur P. Hurter Award for Outstanding Industrial Engineering and Management Sciences Graduating Senior at the Senior Ceremony.

Eight undergraduate students received the IEMS Academic Excellence Award in the 2016 graduating class: **Adam Michael Ashkenazi, James John Hsien Chung Bien, Evan Martin Gray, Luis Michael Johnston, Karan Paresh Kapashi, Neel Harshadkumar Patel, Nicholas George Paras, and Jason Shiou.**

Undergraduates **Veronika Koren** and **Tessa Louise Swanson** received the IEMS department award, which recognizes graduating seniors who have excelled in academics, leadership, or made other contributions to the department as nominated by the faculty.

PhD student **Sina Ansari** received the Outstanding Teaching Assistant Award for 2015-16.

Alvaro Maggjar won the annual Nemhauser dissertation prize for best doctoral dissertation. His thesis was titled "Optimization of Smoothed Functionals and Applications of Nonlinear Programming to Fastest Path Finding for Vehicles in Anisotropic Media."

Mehmet Basdere won the annual Nemhauser Best Paper Award for "The Lock-Free Arc Tour Problem with an Application to Marathon Course Design."

DEPARTMENT HAPPENINGS

Heather Gawronski-Salerno resigned after four years as business administrator to the department. We wish her all the best.

Eunae Jo joined the IEMS department staff this past summer as the business administrator. She holds a bachelor's in English literature and art theory from Northwestern.

Optimization Featured in Wasserstrom Lecture

Dimitri Bertsekas of MIT presented, "Incremental Proximal and Augmented Lagrangian Methods for Convex Optimization: A Survey," as part of IEMS's 2016 Wasserstrom Distinguished Lecture Series. Bertsekas is currently MIT's McAfee Professor of Engineering. His research spans several fields, including optimization, control, large-scale computation, and data communication networks. He has received numerous awards, including the SIAM/MOS 2015 George B. Dantzig Prize and the 2014 Khachiyan Prize for Life-Time Accomplishments in Optimization.

Logistics on the Run

At this year's Bank of America Chicago Marathon on October 9, Professor Karen Smilowitz and her students were among the race's 1.7 million fans lining the route. For the second year in a row, Smilowitz's team monitored the event with a data-visualization system that displayed a detailed breakdown of the race as it unfolded.

The system visualizes information, such as the location of lead runners and capacity of medical tents, on a computer dashboard in the Marathon's central command center. Smilowitz's dashboard helps race officials to oversee the marathon and better respond to emergencies.

Read more about Smilowitz's work with the Chicago Marathon on page 6.

