Industrial Engineering and Management Sciences

Robert R. McCormick School of
Engineering and Applied Science
Northwestern University

FALL 2014

IEMS Announces New Department Chair
JORGE NOCEDAL PLANS TO STRENGTHEN ANALYTICS RESEARCH

The Department of Industrial Engineering and Management Sciences (IEMS) is delighted to announce that Jorge Nocedal, the David A. and Karen Richard Sachs Professor, became the department chair on Rice University in Houston, Texas. He has received numerous awards, including the George B. Danzig Prize from the Society for Industrial and Applied Mathematics and the Charles Broyden Prize from the *Optimization Methods and Software*
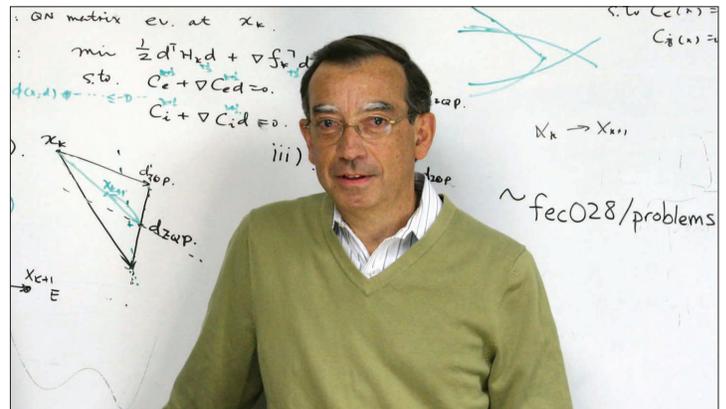
Jorge Nocedal

"Universities do things that companies cannot do. We examine problems that take so long to think about, and companies don't have the resources for that. I want our faculty members to be geared to long-lasting impact rather than to the moment." *Jorge Nocedal*

September 1. Nocedal succeeds Barry Nelson, the Walter P. Murphy Professor, who served as chair for six years.

As chair Nocedal plans to strengthen the area of analytics at the PhD level. In collaboration with the Department of Electrical Engineering and Computer Science (EECS), IEMS will establish a research center for advanced analytics and optimization. The center will strengthen PhD-level course offerings and research and will consolidate the analytics efforts of IEMS and EECS faculty.

"Our department research is moving in the direction of analytics," Nocedal said. "So this is a natural area of growth. We hope that IEMS and EECS will charge each other up and create synergy."

Nocedal received his bachelor's degree in physics from the National University of Mexico and his PhD in mathematical sciences from

editorial board. He has also served as editor-in-chief of SIAM's *Journal on Optimization* since 2010.

The director of McCormick's Optimization Center, Nocedal's research interests lie in the area of optimization and its applications in machine learning. He designs algorithms to help systems make predictions for search results, speech recognition, and recommendation systems. This work caught the attention of companies in the technology sector, and, in 2009, he received a phone call from a principal scientist at Google Research proposing a new collaboration.

"Because of that call, my research changed directions," Nocedal said. "I decided to design new algorithms to help solve the type of big data problems tackled by Google."

Nocedal embarked on a close collaboration with Google Research

and IBM. His former students have followed in this path, accepting jobs at Twitter, Google, IBM Research, and Amazon.

Even though these relationships have been satisfying, Nocedal said that there is more potential for long-lasting impact in academic research.

"Universities do things that companies cannot do," he said. "We examine problems that take so long to think about, and companies don't have the resources for that. I want our faculty members to be geared to long-lasting impact rather than to the moment."

Inside This Issue

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IEMS in the Community: An Optimal Race

IEMS STUDENTS WORK TO IMPROVE CHICAGO MARATHON LOGISTICS

Taut, eager faces at the starting line. Ninety thousand feet pounding the pavement. The exhausted winner breaking the tape at the finish. We've all seen those pictures.

What most of us don't see at the Bank of America Chicago Marathon: the logistics. With 45,000 runners from around the world, an estimated 1.7 million spectators, and dozens of stakeholders with a variety of expectations, running a seamless event becomes a tremendous organizational challenge. Now, the experts who have worked for years to make this event a world leader in emergency preparedness and public safety are partnering with Northwestern University to teach the next generation their tools of the trade. In return, they're getting access to the bright minds of faculty and students who just might provide a few new tools of their own.

As part of a new partnership, faculty and students from the Department of Industrial Engineering and Management Sciences and the Feinberg School of Medicine are working with marathon organizers to observe and analyze the race's logistics plan and propose suggestions to make a great event even greater.

The bar on event management is already high at the Chicago Marathon. Thanks to a unique organizational plan, the race is recognized as a global leader within the industry. Implemented in 2008 after 88-degree heat forced the cancellation of the 2007 marathon mid-race, the aptly named Chicago Model brings together dozens of interested parties, including race organizers, the mayor's office, the Office of Emergency Management, police, the fire department, state and federal agencies, medical staff, emergency workers, the Red Cross, and others in a central command center during the race. George Chiampas, assistant professor of emergency medicine at Feinberg and the Chicago Marathon's

medical director, has worked with the marathon on this model for the better part of a decade and has published his research on enhancing community disaster resilience during mass sporting events.

"We've done a lot of great work, but we always strive to be better," Chiampas says. "That's what this partnership is all about. It's a great example of a university and an organization working together to share knowledge and ultimately improve a great Chicago event."

The significance of the project is not lost on the researchers involved in the new partnership, whose work began just months after the tragic 2013 Boston Marathon bombings. "People understandably are apprehensive about large public gatherings right now," said Karen Smilowitz, associate professor of industrial engineering and management sciences, who spearheaded the project with Chiampas, Sanjay Mehrotra, professor of industrial engineering and management sciences, and Jennifer Chan, assistant professor of emergency medicine at Feinberg. "Carefully planned logistics not only improve runners' experiences, but also make the marathon safer."

In October 2013, Smilowitz attended the marathon with a core group of five undergraduates, one master's student, and a PhD candidate. Their task: to learn everything possible about event operations from how organizers communicated, to the processes in place in first-aid tents, to how supplies were delivered.

"At first it was really hectic," said Christine Hsiao, a senior industrial engineering major. "But once I started looking closer, it was really interesting to see how things I had learned in class, like

Karen Smilowitz (center) works with students at the 2014 Bank of America Shamrock Shuffle 8k in March.

> "People understandably are apprehensive about large public gatherings right now. Carefully planned logistics not only improve runners' experiences, but also make the marathon safer." *Karen Smilowitz*

forecasting, could be applied, even with little things like replenishing ice and Gatorade."

Hsiao and her teammates focused on the marathon's 20 first-aid stations, particularly their system for tracking patients, which includes equipping each aid tent with a tablet computer to check injured runners in and out and monitor the care provided. The system connects all medical facilities in a shared network and provides critical data that organizers can analyze after the event to better understand what injuries to anticipate and where care is needed most.

Other McCormick students focused on central command, the event's nerve center. Currently, marathon officials use a variety of independent systems to stay alerted to conditions on the course with vital information, such as the current number of runners, weather conditions, and first-aid and police activity being relayed frequently.

What officials lack is a central platform that provides basic, need-to-know information in a consolidated view. McCormick students took the challenge and set out to design a solution: an online portal to provide a visual "home base" for the central command.

"It's really a macro-level view of the race, with weather, live updates, and a map of the course with indicators like the location of the front-runner and the capacity of the aid stations," said Alex Van Atta, a fourth-year co-op student studying industrial engineering.

The portal serves another important purpose: a virtual location for information in case of an emergency. "By creating a central information hub, we are training people to go to a specific place for their information," Van Atta said. "If something bad were to happen, God forbid, people would know where to look."

Letter from the Chair

It is my pleasure to write to you as the new chair of IEMS. After leading the department for six years, Barry Nelson will return to full-time teaching and research—and to enjoy a much-deserved sabbatical. Barry has placed the department in a very strong position in education, research, and outreach. We are extremely grateful to him for his outstanding contributions to IEMS and Northwestern.

This fall we welcomed two new faculty members, Dave Morton from the University of Texas, and Jing Dong from Columbia University. Dave joins us as a full professor; he is an expert in the area of stochastic optimization and enjoys a strong international reputation for his research. We will draw on his experience to strengthen IEMS's efforts in the areas of analytics and applied optimization. Jing, who joins as an assistant professor, adds depth to our stochastic systems and applied probability group. Her recently completed PhD dissertation focused on Monte Carlo methods and data-driven stochastic modeling, with applications in service engineering.

Karen Smilowitz will teach a University-wide course on humanitarian logistics. McCormick selected this course for its novelty and broad appeal, and it builds upon Karen's outstanding teaching abilities. The course explores the challenges and opportunities of achieving social good in the age of analytics. Juniors and seniors will work on interdisciplinary teams, focusing on case studies that range from advanced technology for disaster response to improved decision-making frameworks for health care providers.

The Master of Science in Analytics (MSiA) and the Master of Engineering Management (MEM) programs moved to the new building adjacent to the SPAC sports center this fall. The new space provides a collaborative environment where group work can flourish; it includes four breakout meeting rooms, two new lecture-style classrooms, and a central collaboration space for MSiA and MEM. The new facilities double the collaborative space available to MSiA students for industry project work.

Let me now return to Barry Nelson and his tenure as chair of the department. During his time, IEMS was able to improve its high ranking at both the undergraduate and graduate levels. This required work on all fronts: maintaining high teaching standards, renewing the curriculum, disseminating our accomplishments, supporting the

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>
> Jorge Nocedal

best scholarly research, and keeping students, staff and faculty working towards a common goal. Barry displayed an admirable ability to lead by example; he is among our finest teachers, best renowned researchers, and most dedicated faculty members. He is without doubt one of the most admired and beloved faculty members in McCormick.

Barry arrived at Northwestern in 1995 from Ohio State University, where he started his academic career. He is an expert in the areas of simulation of stochastic systems, statistics, and stochastic processes, which have applications in manufacturing and supply chain management. He has written three textbooks and has lectured at leading universities and international conferences. He is known for the clarity of his ideas, his originality and rigor, and for his masterful communication skills.

Barry directed the MEM program from 1998 to 2007. He received numerous honors, including an appointment as Walter P. Murphy Professor and election into INFORMS and IEE Fellows.

On September 27, students, staff and faculty gathered at a dinner in his honor, where his famous bonhomie and sense of humor were in full display. We look forward to Barry's continued contributions to IEMS for many years to come.

Jorge Nocedal
David A. and Karen Richards Sachs Professor and Chair

2013-14 Gifts to the Department

IEMS is extremely grateful for the generous donations we continue to receive from our private and corporate donors. Below is a list of donations received from August 1, 2013 through July 31, 2014. Every dollar is used to support the academic, administrative, and research endeavors of our department. Please accept this acknowledgment with our deepest appreciation.

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Department News

PROGRAM RANKINGS ANNOUNCED

IEMS's undergraduate program jumped into the #5 spot in the recent *U.S. News & World Report* rankings. The graduate program held steady at #3.

FACULTY RECEIVES SPONSORED AWARDS

IEMS received a number of new external sponsored awards last year, including the following:

Noshir Contractor received an NSF subcontract for "Rocky Mountain Sustainability and Science Network: Enhancing Undergraduate Student Learning of Biological Concepts," and a grant from the Bill & Melinda Gates Foundation for his project "Knowledge Networks for Scaling Up Impact." (see page 8)

Seyed Iravani and *Sanjay Mehrotra* received an NSF award for "Managing Downstream Patient Flow Processes Using Improved Coordination and Staffing."

Diego Klabjan received funding from the New York State Energy Research and Development Authority for "Improving Operator Situation Awareness with Wide Area Geographic Data View Displays of the Electric Power Grid," a grant from CME Group Foundation for "Data Analytics and Maxeler's Technology," an award from Nemo Partners Innovation Consulting Group, Ltd. for "Establishing a Development Process of a Global New Vehicle in SL," and a grant from Semiconductor Research Corporation for "Knowledge Management via Document Classification and Ranking in Complex Technical Ecosystems."

Sanjay Mehrotra received an award from the Department of Energy for "Development of Distributionally Robust Optimization Methodologies for Electrical Transmission Operation Problems with Uncertainties."

Jorge Nocedal received an award from the Office of Naval Research for "Large Scale Optimization Methods for Data Science Applications."

Ohad Perry received a new award from NSF for "Service Systems and Outbound Work and Blending."

Karen Smilowitz received an award from NSF for "INSPIRE Track 1: Primary School Organizations as Open Systems: Strategic External Relationship Development to Promote Student Engagement in STEM Topics."

WASSERSTROM LECTURE AVAILABLE ONLINE

*Patrick Jaillet* of the Massachusetts Institute of Technology presented "Routing Optimization Under Uncertainty" in IEMS's 2014 Wasserstrom Distinguished Lecture Series. To watch the full video, visit www.iems.northwestern.edu/events/wasserstrom-lecture-series.

NEW FACULTY

David Morton, previously an Engineering Foundation Professor in the Cockrell School of Engineering at the University of Texas at Austin, joined the IEMS faculty in fall 2014. Morton received his PhD in operations research from Stanford University in 1993. After serving as a postdoctoral fellow at the Naval Postgraduate School he joined the OR & IE program at UT in 1995. Morton is a star in the area of stochastic optimization and its application to energy, security, and public health problems. He is widely known for providing the first sampling-based bounds on solution quality in stochastic optimization; such bounds are critical for understanding solution quality and managing risk.
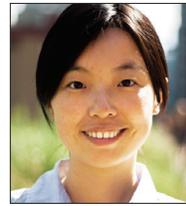
Jing Dong also joined the IEMS faculty this September. The second Columbia University hire in recent years, Dong received her PhD in 2014 in the Department of Industrial Engineering & Operations Research at Columbia University working under the direction of Professor Jose Blanchet. Dong's research interests lie at the interface of applied probability and operations management. She uses stochastic models to analyze complex service systems and develops efficient simulation algorithms for large-scale stochastic networks. Prior to Columbia, she received a BSc in actuarial science from Hong Kong University.

FACULTY NEWS

Sanjay Mehrotra and *Omid Nohadani* hosted the Health Systems Optimization Workshop in September, sponsored by the National Science Foundation SES program. This workshop aimed to accelerate the exchange of research ideas in a cross-disciplinary setting of the medical and industrial engineering, operations research, and management science community. The focus of the workshop was on health policies, operations, and delivery of care.

Vadim Linetsky was named co-editor-in-chief of the journal *Mathematical Finance*.

Paul Leonardi's book *Car Crashes without Cars* won the Diamond Anniversary Book Award from the National Communication Association.

Irina Dolinskaya was featured on a national webinar broadcast to middle schools around the country, in which she answered questions and discussed her career in industrial engineering. To watch the webinar, visit: http://www.jason.org/live/stem-career-qa-irina-dolinskaya-industrial-engineer.

The paper by *Bruce Ankenman*, *Barry Nelson*, and *Jeremy Staum*, "Stochastic kriging for simulation metamodeling," *Operations Research*, received the 2013 Outstanding Publication Award from the Institute for Operations Research and the Management Sciences (INFORMS) Simulation Society. The award was presented at the 2013 Winter Simulation Conference in Washington, D.C.

Sanjay Mehrotra was featured on FoxNews.com in "Math saving lives: New models help address kidney organ donation shortages." He was also profiled in the spring issue of *Northwestern Medicine Magazine* in the article "Redesigning health care: Engineers apply unique skills to fix delivery problems." And he gave a plenary talk at the Mixed Integer Nonlinear Optimization Workshop at Carnegie Mellon University.

Mark Werwath was appointed associate editor for research and product/service development for the *IEEE Engineering Management Review*.

Ajit Tamhane gave the inaugural Satya Mishra Memorial Lecture at the University of South Alabama in March.

Gordon Hazen's book, "Probability: An Introduction With Applications," is now available as an e-book at: http://www.scribd.com/doc/127491210/Probability-an-Introduction-With-Applications. This text, which was developed for IEMS 202, employs innovative elements including Excel-based Monte Carlo simulation and the use of graphical tools for pedagogy.

In April 2014, *Barry Nelson* was honored as an Outstanding Industrial Engineer at Purdue University, a distinguished award given to alumni. Of more than 8,000 graduates, only 115 have received this award.

Noshir Contractor has been elected by a group of his peers to receive the National Communication Association 2014 Distinguished Scholar Award. This award recognizes a lifetime of scholarly achievement in the study of human communication. Contractor will be honored during a ceremony at the 2014 NCA convention held on November 22, 2014.

STUDENT NEWS

Alumnus **Bill Pun** received second place in the competition for the Anna Valicek Medal from the Airline Group of the International Federation of Operational Research Societies (AGIFORS). The medal recognizes original and innovative research in the application of operations research to airline problems.

Two project teams were chosen by IEMS faculty to receive the Charles Thompson Senior Design Award for best team projects in spring and winter quarters. The students are *Andrew Hoff*, *Nicole Jewell*, *Emily Kelly*, *Tianli Li*, *Graeme Murphy*, *Ambar Pankaj*, *Julia Sierks*, *Stephanie Staton* and *Chang H. Yoon*.

Seven undergraduate students received IEMS Academic Excellence Awards in the 2014 graduating class: *Jing Chen*, *Xiyao Di*, *David Erickson*, *Stephanie Staton*, *Severin Tsuji*, *Jessica Williams* and *Yi Zhan*g.

Undergraduate student *David Erickson* was awarded the Arthur P. Hurter Award for Outstanding Industrial Engineering and Management Sciences Graduating Senior at the Senior Ceremony in June. The criteria for the Hurter Award include academic excellence, independent project work, and leadership.

Two undergraduate students received the IEMS department award: *Ibrahim Bengali* and *Emily Kelly*. This award recognizes graduating seniors who have excelled in academics, leadership, or made other contributions to the department as nominated by the faculty.

First-year PhD student **Collin Erickson** received the Benjamin K. Sachs Graduate Fellowship in the area of statistics for enterprise engineering, an award offered to exceptional applicants that carry a stipend supplement and research funding. Erickson also won a Cabell Fellowship from McCormick, a prestigious award given to only 10 students across all of the McCormick engineering departments.

Incoming first-year PhD student **Gökçe Kahvecioğlu** won a Fulbright Scholarship.

Imry Rosenbaum received the Outstanding Teaching Assistant Award for 2013-14.

Co-recipients **Gillian Chin** and **Xi Chen** won the annual Nemhauser Dissertation Prize for best doctoral dissertation. Chin's thesis was titled "Nonlinear Optimization Algorithms for Large Scale Machine Learning," and Chen's was titled "Enhancing Stochastic Kriging Metamodels for Computer Simulation."

IEMS undergraduate *Tessa Swanson* and MSiA graduate student *Andrew Fox* have been selected as finalists in the INFORMS Doing Good with Good OR student paper competition, for their paper "Volunteer Engagement in the Age of Analytics: A Case Study with American Red Cross, Greater Chicago Region" with IEMS faculty member Karen Smilowitz and Jim McGowan of the American Red Cross, Greater Chicago Region. Tessa and Andy will present their paper at the 2014 INFORMS annual meeting in San Francisco in November.

Undergraduate student *David Harris* was selected by IEMS students to receive the Senior Leadership Award.

Letter from the Assistant Chair

Industrial engineering is popular. How do I know? Our IEMS courses and our undergraduate degree program are experiencing enrollment like we have not seen in recent memory. Some of this increase can be explained by the fact that our courses serve as prerequisites for the Kellogg Certificate Program for Undergraduates, but I can't help but think that part of our growth comes from students' realization that IE skills are invaluable in the Age of Big Data.

The recent changes in McCormick advising have helped us to deal effectively with the growth in our undergraduate degree program. In particular, four new freshmen advisers began working with students last summer and fall. We are especially excited that one of them, Janice Mejia, is an IEMS undergraduate alumna (BSIE '04). She has been working

Jill Wilson

designed to provide information about the cohesiveness of our curriculum, to alert instructors about concepts that need reinforcement at the beginning of a course, and to convey to students that prerequisite knowledge is relevant and important. IEMS faculty members are currently reviewing the results to determine what actions need to be taken in response to our most recent assessment. One of the unanticipated benefits is that

"Our IEMS courses and our undergraduate degree program are experiencing enrollment like we have not seen in recent memory." *Jill Wilson*

closely both with freshmen who are declared IEs, as well as with freshmen who are considering IE. Mejia has also assisted with group advising as those students transition to advising in IEMS, providing a more comfortable transition. This year also saw the implementation of the McCormick Advising System, the first step in moving undergraduate advising and degree audit documents online. Students and faculty alike have found this system to be user friendly and a great help in developing individual course plans.

This year also saw the full rollout of our new pretest assessment plan, which was piloted in 2012-2013. Pretests assess prerequisite material in any IEMS courses, which have IEMS prerequisites, allowing us to evaluate retention of concepts. Although this assessment plan was developed in response to our last ABET review, it was purposely

students are now able to self-assess their readiness for a course, especially in light of missing prerequisites.

In other program news, our approach to study abroad is being recommended to other departments by Global McCormick as an exemplar for promoting study abroad for engineers. We have also renovated the undergraduate computer lab with new paint and better lighting in response to a request by students, led by our student IIE officers. Continuing renovations this summer will include white board space and updated technology. We are also exploring improvements to our honors program and considering how we can encourage and facilitate more undergraduate research. Stay tuned for more details on these initiatives.

Jill Wilson
Assistant Department Chair for Undergraduate Studies

IEMS 2014 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 156th Commencement exercises at Ryan Field, Chicago Symphony Orchestra music director Riccardo Muti talked about the power of music to unite the world. In the 2013-14 academic year, IEMS graduated 7 PhDs: Weitao Duan, Yue Geng, Kibaek Kim, Dong Jae Lim, Peter Salemi, Sophia Sullivan, Wei Xie, and He Zhang. These graduates went on to academic and industry positions at places like Credit Suisse, LinkedIn, Rensselaer Polytechnic Institute, and the MITRE Corporation.
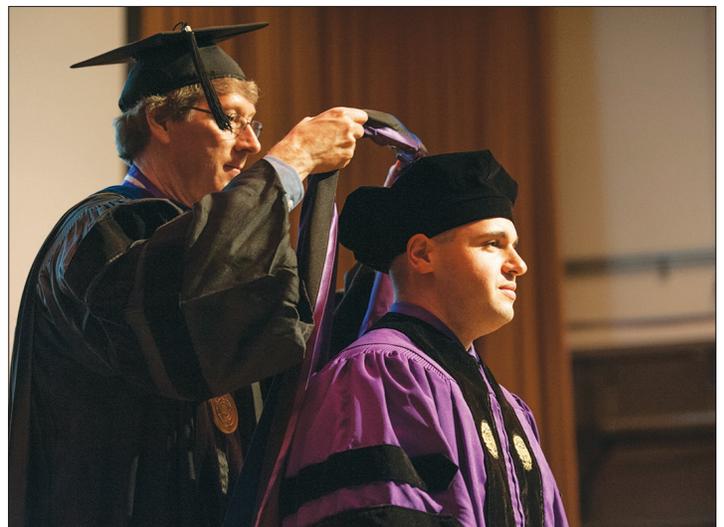
IEMS 2014 Senior Ceremony

On June 20, nearly 90 IEMS undergraduate students and their families celebrated graduation at the IEMS 2014 Senior Ceremony. In tribute to the graduating class, the event highlighted special student awards and achievements and provided time for students, faculty, and family to connect.

Data Analysis Shows Men More Likely to be Accused of Shaking Infants

McCORMICK AND JOURNALISM STUDENTS COLLABORATE ON INVESTIGATIVE PROJECT

Diego Klabjan

"This is not the kind of analytics problem you often encounter. The students had a fascinating opportunity to use their skills on an important public service project." *Diego Klabjan*

An analysis of thousands of police, court, and medical records conducted by Northwestern students has shown that men are nearly three times more likely than women to be accused of violently shaking an infant.

The study was conducted by The Medill Justice Project, a Northwestern investigative journalism enterprise, in partnership with graduate students from the McCormick School of Engineering's Master of Science in Analytics (MSiA) program.

As an extracurricular project during the 2012-13 academic year, four MSiA graduate students worked with Medill undergraduates to identify and confirm 3,600 cases of shaken-baby syndrome. This required running defendant names and other identifiers through proprietary legal databases, cross-referencing them with police, appellate court and medical records, where available. The project will result in a national shaken-baby syndrome database that could help researchers, journalists, and the public gather insight into the crime.

Supervised by IEMS professor Diego Klabjan, the graduate students — David Cooperberg, Justin Kim, Qifan Wu, and Yan Xue — created a special query tool to enable the journalism students to mine thousands of PDF documents for keywords. They also developed ways to visualize the data on a searchable Internet database.

"This is not the kind of analytics problem you often encounter," said Klabjan, professor of industrial engineering and management sciences at McCormick and director of the MSiA program. "These students had a fascinating opportunity to use their skills on an important public service project."

Using Social Networks to Close the Science Gap

NOSHIR CONTRACTOR STUDIES HOW TO USE NETWORKS TO SPREAD MESSAGES ABOUT PUBLIC HEALTH

Scientists make discoveries everyday, but that doesn't mean the findings are put into common practice.

In India, for example, the neonatal mortality rate is 10 times higher than in the developed world. While clinical trials found that applying an inexpensive topical solution of chlorhexidine to cleanse a newborn's umbilical cord reduced the neonatal mortality rate by 24 percent, many Indian parents did not receive or follow this information.

"The challenge is not that we don't have solutions to solve major societal problems, but that we struggle with how to take a known solution and get a large number of people to use it," said Noshir Contractor, the Jane S. and William J. White Professor of Behavioral Sciences and professor of industrial engineering and management sciences. "There is a big gap between what science offers us and what gets applied."

To close this gap, Contractor and his collaborator Leslie A. DeChurch, a professor of psychology at the Georgia Institute of Technology, are combining social networks with knowledge about social motives to influence the adoption of family health innovations. Their work includes a survey of 14,000 family health workers in India.

In an earlier project funded by the Bill & Melinda Gates Foundation, Contractor surveyed government officials in India to determine which people were most influential both inside their district and among outside districts. By leveraging those influential people, Contractor found that networks could be used to

Noshir Contractor

spread valuable information about public health. In this Gates-funded follow-up project, Contractor is now exploring how to craft messages for these influential people to spread.

The team realized that for one person to persuade another person, it is important to have information about how their motives affect what information they believe. People tend to fall into one of two different categories: the need to be right or the need to be liked. People who want to be right respond more to scientific data and perspectives from well-respected opinion leaders. People who want to be liked respond more to the opinions of people they trust or to whom they feel an obligation.

To find out which people fall into each category, Contractor is leading a survey of 14,000 family health workers in India. "We are asking them about who they go to for advice on family health solutions as well as questions that will help us assess the extent to which these people are driven by the need to be right or the need to be liked," Contractor said. "Based on those characteristics, we can identify who is most likely to influence them and what message is most likely to influence them."

Analysis of Amazon Reviews Wins Hackathon

THE MSiA PROGRAM COLLABORATED WITH TERADATA ASTER DURING THE DAYLONG COMPETITION

At the bottom of each product review on Amazon.com, there is a simple question: "Was this review helpful?" Reviews that are voted most helpful are pushed to the top while less helpful reviews get buried at the bottom.

By analyzing data from 500,000 Amazon reviews, a student team found that a set of characteristics inherent in the review could predict whether or not readers determined it helpful. The review's length, keywords, and even punctuation served as predictive variables. This analysis received first place in McCormick's Master of Science in Analytics (MSiA) program's first-ever Hackathon.

"Students were able to find ways to analyze the data creatively by using their prior knowledge and additional external data sources," said Diego Klabjan, professor of industrial engineering and management sciences and director of the MSiA program. "By using one of the most user friendly—yet extremely sophisticated—systems provided by Teradata Aster, they were able to effectively analyze the data in a short time frame."

At the end of the day, the student teams presented their findings to a panel of judges and their peers. Students were evaluated based on their abilities to think creatively about data in a limited amount of time. The first and second

Northwestern's MSiA program teaches students skills that drive business success in today's hyper-competitive, data-driven world. Students learn to identify patterns and trends, derive optimized recommendations evaluated through simulations, interpret and gain insight from vast quantities of structures and unstructured data, and communicate findings in practical useful terms that help drive business management.

"Programs like Northwestern's Master of Science in Analytics are addressing a key skill set for business success," said Randy Lea, vice president of Teradata Big Data Practice. "Combining math, programming, visualization

Professor Diego Klabjan (above, right) observes as students participate in the MSiA program's first Hackathon; MSiA students apply analytics to compete in the Hackathon.

"Programs like Northwestern's Master of Science in Analytics are addressing a key skill set for business success. Combining math, programming, visualization techniques, and business concepts in a program like this is developing the future analytical groups that our customers are building out in their organizations."

Randy Lea, vice president of Teradata Corporation

A collaboration between the MSiA program and leading analytics software company Teradata Aster, the Hackathon was a day-long competition during which students applied Teradata Aster's technology to provided data sets. Student teams could choose from eight publically sourced data sets: NFL or MLB statistics, Amazon reviews, State of the Union addresses, airline flight data, and U.S. consumer bank complaints.

place teams will be sponsored by Teradata Aster to attend its Partners User Conference in Nashville at the end of October.

Peter Schmidt and Kyle Hundman made up the first place team. Second place was awarded to Bridget Hendricks and Alex Milut for their analysis of historical State of the Union addresses since 1790. Among other things, they found that former president Bill Clinton used the word "I" more than any other president in his address. Matt Yancey and Dixin Liu received third place, and Adrian Montero and Macario Lullo came in fourth.

"It was exciting to see the creativity of the teams in applying their technical skills to discover new insights in the data sets," said Lee Paries, regional vice president of Teradata Big Data Practice. "With minimal training and no prior hands-on experience with Aster, the teams were able to quickly engage and deliver the iterative discovery analytics process with the Aster platform."

techniques, and business concepts in a program like this is developing the future analytical groups that our customers are building out in their organizations."

Housed within IEMS, the MSiA program is a full-time, 15-month professional master's degree that immerses students in a comprehensive and applied curriculum exploring the underlying data science, information technology, and business of analytics. To learn more about the MSiA program, please visit www.analytics.northwestern.edu.

Optimizing Donor Kidney Distribution in the United States

AN INNOVATIVE MODEL COULD EASE KIDNEY DISTRIBUTION INEQUITIES IN THE UNITED STATES

Professor Sanjay Mehrotra has developed an innovative model that could help ease kidney distribution inequities among regions in the U.S. and ultimately help save hundreds of lives.

His mathematical model, which takes into account a number of different factors, simulates and optimizes donor kidney distribution.

Mehrotra discussed his research in a presentation titled "Addressing Allocation Inefficiencies and Geographic Disparities" at the American Association for the Advancement of Science (AAAS) annual meeting in Chicago in February. His presentation was part of the symposium "Transplant Organ Shortage: Informing National Policies Using Management Sciences."

Nearly 100,000 people in the United States are waiting for kidney transplants, but only 17,000 kidneys are available annually from both living and deceased donors. There are major regional inequalities in access to organs because of supply and demand disparities among different areas of the country. A person in one state might get a kidney within a year, while someone in another state might wait up to four years. As a consequence, nearly 5,000 people die each year waiting for a kidney transplant.

Logistically, organ allocation is a difficult problem. The country is divided into 11 transplant regions (which are themselves divided into 58 donor service areas). Because patients must provide biological samples to their specific transplant center beforehand, and because kidney donations must happen within 24 hours of harvesting, most kidneys are distributed within the same geographic zone in which they are donated. But regions vary in how many kidneys they receive a year, and centers differ in the quality of kidneys they accept for transplant.

Mehrotra, professor of industrial engineering and management sciences, provides a solution by combining each of these factors into a model that can optimize distribution. The model identifies areas for policy changes, including encouraging more sharing within states, encouraging transplant centers with long wait times to transplant lower-quality kidneys and encouraging insurance companies to weigh the cost-benefit analysis of dialysis versus transplanting lower-quality kidneys.

In addition to Mehrotra, two other Northwestern professors discussed issues related to organ shortage during both the symposium and press briefing. Michael Abecassis, M.D., chief of the division of organ transplantation and founding director of the Comprehensive Transplant Center at Northwestern University's Feinberg School of Medicine, offered a brief overview of the current issues facing organ allocation. John Friedewald, M.D., associate professor in medicine and surgery at Feinberg and director of clinical research at Northwestern University Feinberg School of Medicine Comprehensive Transplant Center and transplant nephrologist at Northwestern Memorial Hospital, spoke about policy changes in kidney allocation that were developed during his recent term as chair of the United Network for Organ Sharing Kidney Transplantation Committee.

(clockwise, from top) Sanjay Mehrotra, John Friedewald, M.D., and Michael Abecassis, M.D.

Logistically, organ allocation is a difficult problem. The country is divided into 11 transplant regions—which are then divided into 58 donor service areas. Regions vary in how many kidneys they receive per year, and centers differ in the quality of kidneys they accept for transplant.

Department News, continued

DEPARTMENT HAPPENINGS

Professor **Ohad Perry** welcomed the birth of his baby girl, Ori, in August.

Victoria Richmond joined IEMS as the program assistant of the MSiA program. She holds a BA in art history and English from Augustana College.

Stephen Tilley joined the Master of Engineering Management (MEM) program as associate director. Tilley recently worked as associate director of the McCormick Office of Career Development at Northwestern University. He holds a master's degree in management, with marketing and leadership concentrations, and a bachelor's in industrial engineering.

Gregory Raphael joined MSiA as the senior computer specialist. He holds a bachelor's in communications and has a long history in data management, teaching and IT.

Improvements to Chicago's Energy Efficiency Wins Accenture Competition

A TEAM OF THREE McCORMICK GRADUATE STUDENTS USED ANALYTICS TO INCREASE CITY'S EFFICIENCY

Teams of McCormick graduate students competing in the annual Accenture Analytics Case Competition designed new ways for the City of Chicago to use analytics to increase its efficiency and improve constituent service.

The students analyzed data from the city's data portal, which provides public access to information on city departments, services, facilities, and performance. The teams looked for patterns and trends in electric power and natural gas usage based on building type and location, and in other civic services, ranging from reports of potholes to requests for graffiti removal. This type of data mining is used to derive business intelligence from large volumes of unrelated data, and the contest encouraged students to take innovative approaches to this task.

The winning team—comprising McCormick graduate students Andy Fox, Kyle Hundman, and Monsu Mathew—designed a program that analyzed fluctuations in energy use in residential buildings to further refine the city's energy efficiency initiatives. The winners, who will share a $1,000 prize, were chosen from three teams of finalists that recently presented their proposals to a panel of Accenture and City of Chicago executives.

"Seizing the potential of big data is essential as organizations strive to transform data into insights that enhance customer relationships, drive competitive differentiation, and streamline operations," said Shahid Ahmed, managing director of Accenture's Communications Industry group for North America. "The challenge these students faced was to apply their knowledge and theories to real-world scenarios and then think creatively about what other insights the data might provide."

"This competition highlights some of the incredible research done by Northwestern's finest engineers in using the power of big data to make our city services more efficient and our government more effective," said Brenna Berman, commissioner and chief

Mark Werwath

information officer of the Chicago Department of Innovation and Technology. "By increasing our data transparency, we can provide a platform for our brightest minds to showcase their skills and innovative spirit to make the City of Chicago a 21st century economy."

The competition was open to two- or three-member graduate student teams from McCormick's Master of Engineering Management program, Master in Science of Analytics program, and students enrolled in the managerial analytics course.

"Innovative examples of using analytics are appearing in many different industries and, of course, government agencies as organizations unlock the promise of big data to drive new analytic insights and act on them," said Mark Werwath, a clinical associate professor in industrial engineering and management sciences and director of the Master of Engineering Management program. "As analytics expand, so do the opportunities to design compelling, useful programs."

> "This competition highlights some of the incredible research done by Northwestern's finest engineers in using the power of big data to make our city services more efficient and our government more effective."
>
> *Brenna Berman, Chicago Department of Innovation and Technology*

(left to right) Ben Rhodes and Shahid Ahmed of Accenture Communications; Charles Nebolsky of Cisco Business Group; McCormick graduate students Kyle Hundman, Andy Fox, and Monsu Mathew; Andy Fano of Accenture Technology; Josh Sommer of Accenture's CMT network offerings group; and Tom Schenk, the City of Chicago's director of analytics.

MOOC Offers Lessons for Transitioning into New Jobs

IEMS PROFESSOR WILLIAM WHITE SAYS PREPARATION HELPS NEW EMPLOYEES REACH JOB EFFICIENCY MUCH FASTER

When people accept new jobs, they often spruce up. They might buy new clothes and maybe get a haircut. But that's typically where the "preparation" ends.

According to William White, professor of industrial engineering and management sciences, new employees should take more time to prepare before entering a job. If they do, they will reach job efficiency and exceed workplace expectations at a much faster rate. This fall he will offer a massive open online course (MOOC) called "Power Onboarding," which is designed to help people start new jobs more effectively.

Hosted by Coursera, Power Onboarding will provide practical, easy-to-use tools to help individuals transition into new jobs. The six-week course is free and begins October 12. Throughout the course, participants will learn how to create their own personalized onboarding plans. Weekly content will include lecture videos, reading, quizzes, and personal reflection.

"Between accepting a new job and starting a new job, a person might have days, weeks, or even months," White said. "There is always time to get ready."

White recently published a new book on the topic called *Get Ready. Get Set. Go!: A Personal Onboarding Plan to Launch Your Extraordinary Career*. Before joining Northwestern, he spent 30 years as a manager in the business world, including time as

William White

CEO and chairman at Bell & Howell. When transitioning into a new job, White said workers should reflect on previous jobs, meet with their new bosses, and learn more about the company and industry.

"In a mid-manager job, reaching 70 percent efficiency usually takes 21 months," he said. "With preparation, you can take 21 months down to 12 months. Your employers will be thrilled, and you'll feel more confident."

White said the course applies to people at all stages in their careers. It also can be helpful for promotions, lateral transfers, changing companies, and those who are happy in their current jobs but who want to be prepared for future moves.

For more information or to sign-up for the course, visit www.coursera.org/course/poweronboarding.

"Between accepting a new job and starting a new job, there is always time to get ready." *William White*