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ANALYTICS FOR RESILIENCE

Improving global security through real-time analysis of complex risks

SEATTLE, WA, AUGUST 10, 2015 – Statistical models are playing an increasingly important role in risk analysis and helping the United States and other countries around the globe mitigate the effects of natural and man-made disasters, said Siddhartha (Sid) Dalal during a presentation at the 2015 Joint Statistical Meetings (JSM 2015) yesterday in Seattle.

Dalal presented a talk titled "Challenges in Risk Analysis of Complex Systems: From Space Shuttle *Challenger* and Dirty Bombs to Medical Drugs and Chemicals" at a luncheon sponsored by the American Statistical Association's (ASA) Committee on Statistical Partnerships among Academe, Industry, and Government (SPAIG).

Dalal is chief data scientist and senior vice president at AIG, an international insurance organization with customers in more than 100 countries and jurisdictions. He also is an adjunct professor teaching data mining to graduate students at Columbia University.

While statistical models can provide insight into risks, the field is experiencing a sea change brought on by new advances in technology and data collection, including Big Data and the Internet of Things (IoT), said Dalal during his luncheon presentation. IoT describes the growing network of physical objects or "things" embedded with electronics, software, sensors and connectivity, enabling these objects to exchange data with their manufacturers, their operators and other connected devices.

With the increased ability to collect data through IoT and analyze this data in real time, the field of risk analysis is entering an exciting new phase based on real-time probabilistic risk analysis. This emerging paradigm can enable humans to better manage risks associated with complex systems, including space shuttles launching into orbit, illicit nuclear materials crossing national boundaries and the side effects of chemicals and even medical drugs, explained Dalal, who is an expert in the field of risk analysis and was appointed by the National Academy of Sciences to a panel commissioned to study the *Challenger* disaster. The panel's research demonstrated the ability of statistical science to predict risks to space shuttles and convinced the National Air and Space Administration (NASA) to establish a probabilistic risk assessment group.

The data sets that enable real-time risk analyses range from small sets to terabytes of data on the millions of shipping containers entering U.S. ports to medical information about new drug treatments.

While this data-driven age provides an abundance of data to enable real-time probabilistic risk analysis, this same abundance of data can make it challenging to create unified decision systems for risk analysis. Risk analysis depends on strong decision-making: Analysts seek to identify different kinds of risks, quantify risks and their consequences and invent interventions to increase the world's resilience.

Today, new methodologies and technologies enable smarter decision-making that improves global resilience. These methods include generating possible accident scenarios, combining the power of Big Data with cutting-edge analytical techniques to predict the probability of these accidents and working passively (e.g., observing accident data from videos) as well as actively (e.g., leveraging sensors and IoT to detect and prevent risks before they occur) to build a more resilient world, described Dalal.

Risk and resiliency analytics are already playing a key role in U.S. government public policy. Recent examples include the Department of Homeland Security's work on preventing dirty bomb material from entering the country and the identification of dangerous drug interactions by the U.S. Food and Drug Administration and National Institutes of Health.

"Global resilience depends upon society's ability to identify, quantify and understand the consequences of risks—from health risks, to natural events like floods, to accidents and others. To prepare for risks and recover from their consequences, we must analyze and understand data from our past, as well as elicit information about future events," Dalal told the audience.

"Big Data, the sophisticated modeling techniques of machine learning and Bayesian statistics, and sensor technologies will help us make society more resilient than ever before," he concluded.

JSM 2015 is being held August 8–13 at the Washington State Convention Center in Seattle. More than 6,000 statisticians—representing academia, business and industry, as well as national, state and local governments—from numerous countries are attending North America's largest statistical science gathering.

About JSM 2015

JSM, which has been held annually since 1974, is being conducted jointly this year by the American Statistical Association, International Biometric Society (ENAR and WNAR), Institute of Mathematical Statistics, Statistical Society of Canada, International Chinese Statistical Association, International Indian Statistical Association, Korean International Statistical Society, International Society for Bayesian Analysis, Royal Statistical Society, and International Statistical Institute. JSM activities include oral presentations, panel sessions, poster presentations, professional development courses, an exhibit hall, a career service, society and section business meetings, committee meetings, social activities, and networking opportunities. Click here for more information about JSM 2015.

About the American Statistical Association

The ASA is the world's largest community of statisticians and the second-oldest continuously operating professional society in the United States. Its members serve in industry, government and academia in more than 90 countries, advancing research and promoting sound statistical practice to inform public

policy and improve human welfare. For additional information, please visit the ASA website at www.amstat.org.

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