

Symposium on Data Analytics for Advanced Manufacturing

Tuesday, December 12, 2017

Time	Event
8:45 – 9:45	Conference Keynote Speech: <i>Human-in-the-loop Applied Machine Learning</i> Prof. Carla E. Brodley, Northeastern University, USA
9:45 – 10:45	Conference Keynote Speech: <i>TextScope: Enhance Human Perception via Text Mining</i> Dr. ChengXiang Zhai, Professor, University of Illinois at Urbana-Champaign, USA
10:45 – 11:05	<i>Coffee Break</i>
11:05 – 11:15	Opening Remarks: Sudarsan Rachuri, DOE
11:15 – 12:00	Symposium Keynote Speech: <i>IoT: Opportunities and Challenges</i> Dr. Sanjay Sarma - Vice President for Open Learning, MIT
12:00 – 12:45	Symposium Keynote Speech: <i>Federal Internet of Things Initiatives for Industrie 4.0 (I4.0)</i> Dr. Regine Gernert and Matthias Kuom – Project Managers, German Aerospace Center (DLR-PT)
12:45– 14:00	<i>Lunch</i>
14:00 – 16:05	Tutorial: <i>Building and Deploying Predictive Analytics Models Using PMML Standard</i> Svetlana Levitan, Advisory Software Engineer, IBM Hybrid Cloud, IBM Corp
16:05 – 16:25	<i>Coffee Break</i>
16:25 – 18:05	Technical Paper Session 1 (Session Chair: Dr. Ronay Ak)
16:25 – 16:50	<i>Statistically-substantiated density characterizations of additively manufactured steel alloys through verification, validation, and uncertainty quantification</i> Heather Reed, Corbin Robeck, Richard P. Vinci, Trevor Verdonik, Christina Viau Haden, Michael Pires, Maria Castro, and Wojciech Misiolek
16:50 – 17:15	<i>A Data-Driven Approach for Improving Sustainability Assessment in Advanced Manufacturing</i> Yunpeng Li, Heng Zhang, Utpal Roy, and Yung-Tsun Tina Lee
17:15 – 17:40	<i>Issues in Synthetic Data Generation for Advanced Manufacturing</i> Don Libes, David Lechevalier, and Sanjay Jain
17:40	Adjourn

Wednesday, December 13, 2017

Time	
8:45 – 9:45	Conference Keynote Speech: <i>Large-scale Graph Representation Learning</i> Dr. Jure Leskovec, Associate Professor, Stanford University, Chief Scientist at Pinterest, USA
9:45 – 10:45	Conference Keynote Speech: <i>Contextual Reinforcement Learning</i> Dr. John Langford, Microsoft Research
10:45 – 11:05	<i>Coffee Break</i>
11:05	Technical Paper Session 2 (<i>Session Chair: Dr. Anantha Narayanan</i>)
11:05 – 11:30	<i>Hybrid Datafication of Maintenance Logs from AI-Assisted Human Tags</i> Thurston Sexton, Michael Brundage, Michael Hoffman, and KC Morris
11:30 – 11:55	<i>Automatic Localization of Casting Defects with Convolutional Neural Networks</i> Max Ferguson, Ronay Ak, Yung-Tsun Tina Lee, and Kincho Law
11:55 – 12:20	<i>Estimation of online tool wear in turning processes using recurrence quantification analysis (RQA)</i> Srinivasan Radhakrishnan, Yung-Tsun Tina Lee, and Sagar Kamarthi
12:20 – 12:45	<i>Manufacturing and Contract Service Networks: Composition, Optimization and Tradeoff Analysis based on a Reusable</i> Alexander Brodsky, Mohan Krishnamoorthy, M. Omar Nachawati, William Z. Bernstein, and Daniel A. Menasce
12:45 – 14:00	<i>Lunch</i>
14:00-14:05	<i>Session Chair: Y. Tina Lee</i>
14:05 – 14:45	Symposium Keynote Speech: <i>Guided Deep Reinforcement Learning for Additive Manufacturing Control Applications</i> Dr. Kishore K. Reddy – Research Scientist, United Technologies Research Center
14:45 – 15:25	Symposium Keynote Speech: <i>Creating Data-driven Advanced Manufacturing Collaborative Communities</i> Douglas Ramsey, Vice President, Business Development, Citrine Informatics
15:25 – 16:05	Symposium Keynote Speech: <i>Clean Energy Smart Manufacturing Innovation Institute-Vision and Roadmap</i> Jim Wetzel – CEO, CESMII
16:05 – 16:25	<i>Coffee Break</i>
16:25 – 17:30	Panel: Big Data Analytics and IoT for Advanced Manufacturing: Challenges and opportunities Panelists: Dr. Regine Gernert, Prof. Sagar Kamarthi, Prof. Kincho Law, Douglas Ramsey, Dr. Kishore K. Reddy, Jim Wetzel. Panel Moderator: Dr. Sudarsan Rachuri, Department of Energy
17:30	Adjourn

Keynote Speeches

Keynote 1:

Title: IoT: Opportunities and Challenges

Speaker: Dr. Sanjay Sarma - Vice President for Open Learning, MIT

Abstract:

The Internet of Things has garnered a lot of attention recently in terms of its potential. However, many questions remain: how does one start? What will its eventual impact be? What are the deeper research questions? Do we need more fundamental science and math to deal with it? What to do with all the data? Where do adjacent technologies such as machine learning and big data fit? I will present a view that IoT and cyber-physical systems require a fundamental rethinking of how we build, secure, manage, operate and monetize these systems ranging from factories to cars to homes, and that the incremental approach of adding IoT capabilities without thinking the issues may lead to irreparable problems in the future. In particular, I will describe concepts such as the cognitive firewall, data proxies, the use of the cloud, and the underlying concepts from control theoretic, computing architecture, networking and security perspectives.

Bio:

Sanjay Sarma is the Vice President for Open Learning. He also leads the Office of Digital Learning, which oversees MIT OpenCourseWare and supports the development and use of digital technology for on-campus teaching and massive open online courses (MOOCs). He is also the Fred Fort Flowers (1941) and Daniel Fort Flowers (1941) Professor of Mechanical Engineering at MIT.

A co-founder of the Auto-ID Center at MIT, Sarma developed many of the key technologies behind the EPC suite of RFID standards now used worldwide. Currently, Sarma serves on the boards of GS1, EPCglobal, several startup companies including Senaya and ESSESS, and edX, the not-for-profit company set up by MIT and Harvard to create and promulgate an open-source platform for the distribution of free online education worldwide.

Author of more than 75 academic papers in computational geometry, sensing, RFID, automation, and CAD, Sarma is the recipient of numerous awards for teaching and research, including the MacVicar Fellowship, the Business Week eBiz Award, and InformationWeek's Innovators and Influencers Award. He received his bachelor's degree from the Indian Institute of Technology, his master's degree from Carnegie Mellon University, and his PhD from the University of California at Berkeley.

Keynote 2:

Title: Federal Internet of Things Initiatives for Industrie 4.0 (I4.0)

Speakers: Dr. Regine Gernert and Matthias Kuom – Project Managers, German Aerospace Center (DLR-PT)

Abstract:

The presentation gives an insight about the Federal Industrial Internet of Things initiatives of Germany including Platform Industrie 4.0 (I4.0). The talk will also integrate a European and global perspective with respect to collaboration and standardization aspects. For instance, the Alliance for the Internet of Things Innovation and the Industrial Internet Consortium are of interest. If companies want to provide their data for digital services in a distributed and decentralized manner, the upcoming reference architecture of the Industrial Data Space will be of interest to them. The Platform Industrie 4.0 is in the process of standardizing its reference architecture RAMI at a European and international level.

There is a long tradition in the digitization of industry in Germany, also in supporting this with national funding programs. With the launch of the “Smart Data” initiative four projects in the industrial application area started to develop and elaborate new technologies that enable big data to be used in a secure and legally compliant manner and they will give an impact to data analytics in manufacturing, mainly in post-production maintenance. In manufacturing, there was a special initiative called “Autonomics” oriented on exploring the Internet of Things. In the subsequent initiative “PAiCE” IIoT pioneering technology fields, such as secure industrial communication, are addressed. The flagship project “Industrial Communication for Factories” specifically targets future industrial applications and, accordingly, a communication reference architecture and an easy-to-use modular technology toolkit will be developed. In particular, the goal is a modular approach to enable a flexible composition of components including key technologies like 5G or Edge Cloud Computing. Thus, starting with the networking of smart objects for industrial applications (the Internet of Things), organizing the data management and using analytics platforms (the Internet of Data), new web-based knowledge infrastructures are possible that pave the way for new electronic services (the Internet of Services). With the initiative “Smart Service World” all these levels are addressed. In a “Smart Services World” different digital user areas are connected using a targeted, secure combination of open service platforms, data management technologies, and Internet of Things. The presentation shows best practice examples as well as new approaches.

Bios:

Regine Gernert is employed at the Project Management Agency at German Aerospace Center (DLR-PT). She supports with her working group at DLR-PT in Berlin the European and internationalization strategy of the Unit "Digital Technologies" of the German Federal Ministry for Economic Affairs and Energy (BMWi). In addition to the monitoring of international developments and the initiation of collaborations, one of the objectives of the last years was the support of innovations in electronic services and out of data (Internet of Services, Internet of Data).

Previously Mrs. Gernert worked from 2006 to 2013 as project manager for research funding activities in the field of information and communication technologies (ICT) in the BMWi. Dr. Gernert studied computer science and received her degree Dr.-Ing. from the Technical University of Berlin in the field of Industrial Information Technology.

Matthias Kuom joined the DLR-PT in 2002. Mr. Kuom is responsible for the implementation of ICT R&D funding programmes, including the evaluation of funding concepts, professional project tracking and financial control. Currently he supports the German Federal Ministry for Economic Affairs and Energy (BMWi) in the conceptual and organisational design of cross-border research funding as well as in the internationalisation of programme activities (esp. Industrie 4.0 and Autonomous Systems).

Prior to joining DLR, Mr. Kuom managed the implementation of e-health solutions at T-Systems – including portal technologies, interfaces with an electronic health record and pervasive end-user assistance systems. He designed an R&D project (in cooperation with well-known hospitals and clinics in Germany) for a tele-medicine solution which provided support for stroke sufferers during their rehabilitation process. Earlier in his career, Mr. Kuom was a scientist in the ICT Media and Communication Group at the Institute for Futures Studies and Technology Assessment.

Keynote 3:

Title: Guided Deep Reinforcement Learning for Additive Manufacturing Control Applications

Speaker: Dr. Kishore K. Reddy, United Technologies Research Center

Abstract:

Additive manufacturing (e.g., 3D printing, cold spray and powder bed manufacturing) encompasses a wide range of tasks that commonly involve complex trajectory traversal by a robotic agent to meet multifaceted objectives such as surface

quality, material properties etc. Traditional control or reinforcement learning can be inefficient in handling such a rich motion range with limited scalability to perception in a natural environment. In this talk, we will present a deep neural network based guided policy search (GPS) framework for optimizing trajectory policy of nozzle dynamics in cold spray application.

Bio:

Kishore K. Reddy is a Research Scientist at the United Technologies Research Center (UTRC) working in the area of computer vision, human machine interaction (HMI) and machine learning. He is currently leading the Digital Initiative at UTRC, primarily focusing on Deep Learning application in aerospace and building systems to perform anomaly detection, multi-modal sensor fusion, data compression, and design space exploration. He has published over 20 papers, and he is the co-author on 7 pending patents. Kishore earned his Ph.D. in 2012 from University of Central Florida, where he developed advanced video and image analysis algorithms for multiple contracts funded by DARPA, IARPA and NIH.

Keynote 4:

Title: Creating Data-driven Advanced Manufacturing Collaborative Communities

Speaker: Douglas Ramsey, Citrine Informatics

Abstract:

There are several key technologies that are driving a revolution in manufacturing across the world that will reshape how we source, design, and manufacturing everything from aircraft to mobile phones. These four drivers are artificial intelligence (AI), additive manufacturing (AM), collaborative robotics, and smart manufacturing. These technologies are not isolated geographically and will require increased levels of industrial cooperation. The challenge before industry today is how to best coordinate coalitions of innovators that include industry, academia, and government organizations. The US, Germany, China, Japan, and South Korea are all leaders in organizing their technology and innovations ecosystems domestically. However, there are challenges to establishing industrial collaborations due to IP, trade secret, and competitive intelligence concerns. New multisided platforms are allowing for these ecosystems to cross borders and build collaborative partnerships that balance between sharing innovation and developing competitive advantage. International collaborations in all four areas have been successfully demonstrated in North America, Asia, and Europe. However, there continue to be pitfalls and challenges related to conflicting patent regulations and concerns for protecting intellectual property. Coalitions of corporate collaborators can generally navigate these challenges, but that tends to exclude participation of federal research organizations that often have much to offer in terms of technical expertise and pre-competitive research and innovation. Commercially driven multi-sided platforms have the power and promise to act as honest brokers between these parties and creative collaborative test-beds that best leverage the full range of available partners and expertise. The 4th Industrial Revolution is eliminating traditional borders and driving changes that will force changes across both traditional manufacturers and new market entrants. A failure to think broadly about borderless collaboration models will harm not only individual sectors, but also more widely confound the next wave of manufacturing innovation.

Bio:

Douglas Ramsey is the Vice President for Business Development with Citrine Informatics. Citrine is the world leader in Artificial Intelligence (AI) and Materials Informatics (MI) for materials discovery, product design, and manufacturing. Mr. Ramsey has over 25 years of experience working across many manufacturing industries including primary metals, automotive, aerospace, energy, defense, and consumer products. Mr. Ramsey served as the Chairman of the Industrial Control Board for LIFT in Detroit and as a manufacturing technology contributor to the White House as part of the Advanced Manufacturing Partnership (AMP 2.0). He has also held advisory roles with many manufacturing institutes including America Makes, CESMII, and IACME. Mr. Ramsey also served as the Alcoa-Oak Ridge National Laboratory Technologist-In-Resident (TIR) with a focus on innovations in metals manufacturing technology. More recently, Mr.

Ramsey helped lead the team that secured a \$250m award from the US Department of Defense to establish a new national robotics institute (ARM Institute) in Pittsburgh, PA. Mr. Ramsey holds a MScEcon in Strategic Studies from the National University of Wales, Aberystwyth.

Keynote 5:

Title: Clean Energy Smart Manufacturing Innovation Institute- Transforming Manufacturing, the vision and roadmap

Speaker: Jim Wetzel, CESMII

Abstract:

This session will introduce the efforts of the Clean Energy Smart Manufacturing Innovation Institute (CESMII) operated by the Smart Manufacturing Leadership Coalition sponsored by the Department of Energy. The institute brings together industry, academia and government partners within a growing network of advanced manufacturing institutes, called Manufacturing USA, to increase U.S. manufacturing competitiveness. Smart Manufacturing (SM) is the business, technology, infrastructure, and workforce practice of optimizing manufacturing using engineered systems that integrate operational technologies and information technologies (OT/IT). The CESMII Roadmap will address R&D challenges and knowledge gaps related to the integration of manufacturing OT/IT, including: hardware, software, and security requirements; sensor technologies, multi-sensor data fusion, and sensor-actuator-human interfaces; process model (e.g., physics-based, empirical, data-driven, cognitive, and quantitative) verification, validation, and uncertainty quantification; data structures, contextualization, configuration, and management; and reference architectures and platform for process technology digitization.

Bio:

Jim Wetzel is currently the interim CEO of the Clean Energy Smart Manufacturing Innovation Institute (CESMII). This is a National Institute sponsored by the Department of Energy, and is one of 14 Institutes of Manufacturing USA. CESMII aims to radically accelerate the development and adoption of Smart Manufacturing—including advanced sensors, controls, platforms, and models—to help companies of all sizes across a variety of manufacturing industries to realize the benefits of Smart Manufacturing.

After 32 years at General Mills Inc, Mr. Wetzel retired in August 2017 as Director Engineering–Global Reliability. In this role, he was responsible for improving the existing asset base in GMI Manufacturing Plants across the Globe. This function was responsible for technology, standardization, reliability and maintenance and energy reduction. In addition, he was responsible for the technical mastery, learning and development for all of engineering.

Mr. Wetzel holds a BS Mechanical Engineering and MBA, both from the University of Minnesota.

PANEL- Big Data Analytics and IoT for Advanced Manufacturing: Challenges and opportunities

Moderator: Dr. Sudarsan Rachuri, Federal Program Officer and Technology Manager, Advanced Manufacturing Office, Department of Energy

Panelists:

Dr. Regine Gernert, German Aerospace Center (DLR-PT)

Prof. Sagar Kamarthi, Northeastern University

Prof. Kincho Law, Stanford University

Douglas Ramsey, Citrine Informatics

Dr. Kishore K. Reddy, United Technologies Research Center

Jim Wetzel, CESMII

Bios:

Sagar Kamarthi is Professor in the Dept. of Industrial and Mechanical Engineering at Northeastern University, Boston. He is the founding director of MS in Data Analytics Engineering program at Northeastern. He teaches courses in manufacturing, data mining, and machine learning. Prof. Kamarthi received his PhD and MS degrees in Industrial Engineering from The Pennsylvania State University and a BS in Chemical Engineering from Sri Venkateswara University, India.

His research interests are in smart and sustainable manufacturing, predictive analytics for engineering and healthcare applications, and engineering education research. He has published more than 190 articles in internationally reputed journal and conference proceedings and has secured several grants from the National Science Foundation (NSF) and other federal agencies. Through his NSF funded education research grants he co-pioneered Engineering Based Learning (EBL) model (a structured version of project based learning), "Transform" curriculum model to train non-STEM graduates for manufacturing careers, and Mass Customized Instruction (MCI) model to enable personalized learning. Data analytics in engineering education is one of his current interests.

Kincho H. Law is currently Professor of Civil and Environmental Engineering at Stanford University. He obtained his BS in Civil Engineering and BA in Mathematics from University of Hawaii in 1976, and his MS and PhD in Civil Engineering in 1979 and 1981, respectively, from Carnegie Mellon University. Prof. Law's research has been focused on innovative use of computational and information science in engineering. His work has dealt with various aspects of data analytics and machine learning, smart infrastructures, smart manufacturing, wireless sensing, monitoring and control, high performance computing, engineering and legal information management, Internet and cloud computing. He has authored and co-authored over 400 articles in journals and conference proceedings and has received best research paper awards from ASCE, ASME, IEEE and Digital Government Society. He was the recipient of the ASCE Computing in Civil Engineering Award in 2011. Prof. Law has been elected as a Distinguished Member of the American Society of Civil Engineers and as a Fellow of the American Society of Mechanical Engineering in 2017.