

Workshop on Industrial AI for PHM

Industrial AI is a systematic discipline which focuses on developing, validating and deploying various machine learning algorithms for industrial applications with sustainable performance. Combined with the state-of-the-art sensing, communication and big data analytics platforms, a systematic Industrial AI methodology will allow integration of physical systems with computational models. The concept of Industrial AI is in infancy stage and may encompass the collective use of technologies such as Internet of Things, Cyber-Physical Systems and Big Data Analytics under the Industry 4.0 initiative where embedded computing devices, smart objects and the physical environment interact with each other to reach intended goals. Advanced Industries such as automotive, aerospace, health care, semiconductors, and industrial manufacturing could harness the power of Industrial AI to gain insight into the health condition and consistency of their machines and processes and use that insight to maximize their uptime, productivity and efficiency of their operations. In terms of predictive maintenance, Industrial AI can detect incipient changes in the system and determine the expected time to system failure; allowing them to optimize maintenance tasks in real time, maximizing the useful life of their equipment while still avoiding disruption to operations.

The workshop will introduce the advances in Industrial AI enabling technologies such as Big Data Analytics, Internet of Things, Cyber-Physical Systems under the Industry 4.0 architecture. The workshop will introduce system tools of Industrial AI such as Data technology, Analytic Technology, Platform Technology and Operation technology that can facilitate the realization of a fully functional smart industry. The workshop would cover the state of the art AI computation technologies and methodologies in Industrial applications such as Deep learning, SVM, SOM etc. In addition, industrial case studies will be provided to demonstrate the implementation of such technologies. The workshop is addressed to engineers, scientists, operations managers, educators, small business principals and system designers interested to learn how these emerging technologies can impact their work environment.

Topics

- 1) Introduction to Industrial AI
- 2) AI Foundry within the 5C CPS Architecture
- 3) System tools of Industrial AI
- 4) Overview of the state of the art AI technologies.
- 5) AI based PHM Technologies demonstrated via actual industrial case studies.
- 6) Challenges in implementation of AI in Industries.
- 7) Conclusions

Presenters

This workshop will be led by Dr. Jay Lee, Dr. Hossein Davari, and Dr. Jaskaran Singh. Each has outstanding qualifications in the fields of Industrial AI, PHM, Big Data Analytics, Internet of Things, and Cyber-Physical Systems.

PROFESSOR JAY LEE



Dr. Jay Lee is Ohio Eminent Scholar, L.W. Scott Alter Chair Professor, and Univ. Distinguished Professor at the Univ. of Cincinnati and is founding director of National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) on Intelligent Maintenance Systems (www.imscenter.net) which consists of the Univ. of Cincinnati (lead institution), the Univ. of Michigan, Missouri Univ. of S&T, and the Univ. of Texas-Austin. Since its inception in 2001, the Center has been supported by over 100 global companies. IMS was selected as the most economically impactful I/UCRC in the NSF Economic Impact Study Report in 2012 which reported that the Center has delivered to its members a combined benefit of \$847.6 million in cost savings, and that the Center returned \$238.30 of benefits for every \$1 invested by the National Science Foundation. Currently, he is leading a new Industrial AI Center. His current research focuses on predictive big data analytics and cyber physical systems for intelligent maintenance, prognostics and health management (PHM), and Industry 4.0 systems. He was selected to be one of the 30 Visionaries in Smart Manufacturing in U.S. by SME in Jan. 2016. In addition, he is co-Founder of Predictronics--a start-up company from NSF IMS Center of the Univ. of Cincinnati through NSF ICorp award in 2012. In addition, his

Team has won the 1st Place PHM Data Challenges five time out of nine competitions since 2008.

Currently he serves as a senior advisor to McKinsey & Company, S&T advisor to Plastic Omnium of France, Foxconn, etc. He also serves as a Member of Scientific Advisory Board of A*STAR SIMTech of Singapore, member of Board of Governors of the Manufacturing Executive Leadership Board of Frost Sullivan, and Board member of PHM Society etc. He also serves as on the Leadership Council of MForesight-a NSF/NIST funded Manufacturing Think Tank in Sept. 2015 as well as a member of Technical Advisory Committee (TAC) of Digital Manufacturing and Design Innovation (DMDI) in 2014. In 2013, he was invited to serve on the Advisory Committee member for White House Cyber Physical Systems (CPS) Workshop for American Challenge Initiative.

He also served as a honorary professor and visiting professor for a number of institutions including Cranfield Univ. in UK, Lulea Univ. of Technology in Sweden, Univ. of Lorraine in France, etc. In addition, he serves as editors and associate editor for a number of journals including IEEE Transaction on Industrial

Informatics, Int. Journal on Prognostics & Health Management (IJPHM), etc,

Previously, he served as director for product development and manufacturing at United Technologies Research Center (UTRC) as well as program directors for a number of programs at NSF including the Engineering Research Centers Program, the Industry/University Cooperative Research Centers Program, and Materials Processing, and Manufacturing Program, etc., etc. He also served on the NRC Board on Manufacturing and Engineering Design (BMAED) during 1999-2005 as well as a number of NRC Study and Assessment Panels since 1999.

He has authored/co-authored numerous highly influential articles and technical papers in the areas of machinery monitoring and prognostics, E-manufacturing, and intelligent maintenance systems. His papers have been listed as most cited paper in the most prestigious journals including Journal of Mechanical Systems and Signal Processing (MSSP), Journal of CIRP, as well as SME Manufacturing Letters, etc. He has over 20 patents and trademarks. He is a frequently invited speaker and has delivered over 250 keynote and plenary speeches at major international conferences. He is a Fellow of ASME, SME, as well as a founding fellow of International Society of Engineering Asset Management (ISEAM).

He has received a number of awards including the most recent Prognostics Innovation Award at NI Week by National Instruments in 2012 and NSF Alex Schwarzkopf Technological Innovation Prize and MFPT (Machinery Failure Prevention Technology Society) Jack Frarey Award in 2014, and PICMET Medal of Excellence in 2016. He is also an advisor to the Heifer International-a charity organization working to end hunger and poverty around the world by providing livestock and training to struggling communities.

JASKARAN SINGH

Dr. Jaskaran Singh is currently a post-doctoral fellow at the NSF I/UCRC for Intelligent Maintenance Systems (IMS) at the Dept. of Mechanical and Materials Engineering at the University of Cincinnati. His current role in the IMS center includes conducting research in the field of Prognostics and Health Management for rotating machinery, exploring novel research areas in this field, mentoring graduate students and formulating projects with IMS industry members. During his PhD studies, Dr. Singh worked at the Vibration Research Lab (IIT Delhi) as a Research Scholar with a research focus on the design of some novel approaches emphasizing on fault diagnosis, degradation assessment and life prediction of rolling element bearings.

HOSSEIN DAVARI



Dr. Hossein Davari is currently a post-doctoral fellow and the associate director of the NSF I/UCRC for Intelligent Maintenance Systems (IMS) at the Dept. of Mechanical and Materials Engineering at the University of Cincinnati. His current role in the IMS center includes conducting research in the field of Prognostics and Health Management (PHM) for rotating machinery, manufacturing and health care applications, along with exploring novel research areas in this field, mentoring graduate students and formulating projects with IMS industry members. During his PhD studies, Dr. Davari worked at the IMS Center as a Research Assistant and contributed in the development of PHM systems for wind turbines, gearboxes, induction motors and railway transportation systems.