

RTSI 2016

Tutorial Program

7- 9 September 2016

Scuola di Ingegneria e Architettura
Via Risorgimento 2, 40136 Bologna Italy

TUTORIAL 1: IBM Advanced Analytics: How to Leverage on Tacit Knowledge to Empower Clinical Decision Making

Date: Wednesday, September 7

Time: 10.45-12.15

Location: Room 4

Summary: The seminar will introduce the audience to approaches and applied research methods that, by leveraging on the IBM Advanced Analytics, are capable of identifying and mapping valuable implicit knowledge so to make it explicitly available to clinicians and case managers for better decision outcomes. International, as well, Italian use cases will be presented in details

Speaker: Marco Monti, IBM

Biography: Marco Monti is a senior consultant and research scientist at IBM Advanced Analytics Group. He is also an adjunct researcher at the Max Planck Institute for Human Development in Berlin within the Adaptive Behavior and Cognition Group, led by Professor Gerd Gigerenzer. Marco's research focuses on the role of heuristics in real-life decision-making processes, particularly in the medical and financial domains, and on the role of advanced analytic technology (e.g. IBM Watson) to support better decision outcomes. He collaborates with an interdisciplinary group of researchers investigating the concept of ecological rationality within the novice-expert relationships, such as patient-doctor and customer-financial advisor interactions. The group is presently exploring new ways to empower decision makers through the adoption of smart technology that conveys more transparent and cognitively suitable information. Marco holds a bachelor's degree and both a master's degree and Ph.D. in economics from the Bocconi University of Milan, Italy. He is a fellow of the Salzburg Global Seminar. IBM Advanced Analytics: How to Leverage on Tacit Knowledge to Empower Clinical Decision Making: The seminar will introduce the audience to approaches and applied research methods that, by leveraging on the IBM Advanced Analytics, are capable of identifying and mapping valuable implicit knowledge so to make it explicitly available to clinicians and case managers for better decision outcomes. International, as well, Italian use cases will be presented in details.

TUTORIAL 2: Modern Reliability and Maintenance Engineering for Modern Industry

Date: Thursday, September 8

Time: 8.30-10.15

Location: Room 4

Summary: The 4th industrial revolution, the internet of things and big data, the industrial internet, are changing the way we design, manufacture, provide products and services. This is providing opportunities to make productions systems more efficient and faster, and more flexible and resilient the complex supply chains and distribution networks that tie the global economy.

In this fast-pace changing environment, the attributes and activities related to the reliability and maintenance of components and systems continue to play a fundamental role for industry. The innovations that are being developed have high potential of increased wellbeing and benefits, but also generate new and unknown functional and structural dependencies, new and unknown failure mechanisms. On the other hand, the advancements in knowledge, methods and techniques, the increase in information sharing and data availability, offer new opportunities of analysis and assessment for reliability and maintenance engineering.

In this tutorial, we consider the above context and address it with reference to challenges and opportunities related to the increased availability of component and system monitoring data and the possibility of treating these data by intelligent algorithms for the assessment and prediction of their state. This opens the doors to Prognostics and Health Management (PHM) in many industrial sectors, for improved operation and maintenance. Some of the challenges discussed are:

- developing methods and models capable of dealing with the inevitable Evolving Environment (EE) that changes the conditions in which a component or system lives, and degradation and failure occur (PHM in EE);
- considering the information and data coming from a fleet of components and systems, for effectively informed PHM (Fleet PHM);
- evaluating the economic and safety value of a PHM approach for condition-based and/or predictive maintenance (PHM value).

Speakers: Piero Baraldi, Francesco Di Maio, Enrico Zio, Politecnico di Milano (Italy)

Biography: Piero Baraldi (PhD in nuclear engineering, Politecnico di Milano, 2006) is professor of Nuclear Engineering at the department of Energy at the Politecnico di Milano. He has been Technical Committee Co-chair of the European Safety and Reliability Conference, ESREL2014, and Technical Programme Chair of the 2013 Prognostics and System Health Management Conference (PHM-2013). He is co-author of 2 books and more than 100 papers on international journals and proceedings of international conferences

Biography: Francesco Di Maio (Double EU-China PhD in Nuclear Engineering, 2010, Politecnico di Milano and Tsinghua University) is Assistant Professor in Nuclear Power Plants at Politecnico di Milano (Milano, Italy) since 2011. He is Partner of Advanced Reliability, Availability and Maintainability of Industries and Services (ARAMIS) Srl since 2014. In 2009-2010 he has been Research Fellow of the Science and Technology Programme (STFP) in China, financed by the European Commission, and he has been appointed as Senior Researcher in City University of Hong Kong. He has been technical committee member for a number of international conferences. He has been Associate Editor of the International Journal of Performability Engineering (2011-2015). He has published more than 90 papers in peer-reviewed international journals and conferences. He is Co-Chair of the Technical Committee on Nuclear Industry of the European Safety and Reliability Association (ESRA) and Chair of the Italian IEEE Reliability Chapter.

Biography: Enrico Zio (Nuclear Engineer Politecnico di Milano (1991); MSc in mechanical engineering, University of California, Los Angeles, UCLA (1995); PhD in nuclear engineering, Politecnico di Milano (1995); PhD in Probabilistic Risk Assessment, Massachusetts Institute of Technology, MIT (1998); Full professor, Politecnico di Milano (2005-); Director of the Chair on Complex Systems and the Energy Challenge at Ecole Centrale Paris and Supelec, Fondation Européenne pour l’Energie Nouvelle – EdF (2010-present); Chairman of the European Safety and Reliability Association-ESRA (2010- present. He is co-author of seven books and more than 250 papers on international journals

TUTORIAL 3:

2.1 A Smart Manufacturing vs Smart Innovation: what should come first?

2.2 The (Smart) Cyber-physical Revolution: Challenges and Opportunities

Date: Thursday, September 8

Time: 10.45-12.30

Location: Room 4

Summary:

2.1 Smart Manufacturing vs Smart Innovation: what should come first?

Industry 4.0 and its world-wide declinations are generating a growing interest, also in the general public. This is for sure a good news for scientists and practitioners interested in making the world a bit “smarter”, with their technologies and solutions.

But, beyond the adjective, what is there? And, are we sure that manufacturing should be the first industrial process to be transformed in a “smart” way? Or other basis of the industrial competitive should be also involved? It has been already widely demonstrated that the main long time competitive factor is the ability to innovate, not only to produce better. So, maybe also a Smart Innovation should be considered, no?

Without aiming to be too much provocative, the presentation aims to bring to the attention of the audience some thoughts, also starting from some empirical data on the “smart” phenomenon.

2.2 The (Smart) Cyber-physical Revolution: Challenges and Opportunities Cyber-Physical Systems (CPSs) are gaining more and more relevance in many scientific and engineering applications and are becoming the reference technological solution for the monitoring and control of industry systems, critical infrastructures, smart grids, water distribution networks, natural or physical environments, just to name few scenarios. Such systems are generally composed by a possibly large and heterogeneous set of units endowed with sensing/actuating, processing and communication abilities so as to be able to interact proactively with the environment/system under inspection. Interestingly, in the recent years, the pervasive dissemination of such CPSs and the need to satisfy their increasing demands for autonomy, energy-awareness and reliability have led embedded designers and users to move towards smart solutions providing CPS units with self-adaptation, management and healing functionalities, e.g., to autonomously adapt the application behavior of units in response to changes affecting the mounted sensors (e.g., faults, ageing effects) or the environment the CPS is deployed in (e.g., time-variant scenarios). This tutorial will present some fundamental intelligent technological solutions and mechanisms and show how they represent the key ingredients needed to design the current and future generation of smart cyber-physical systems and derived applications, where Industry 4.0 represents one of most relevant and valuable scenarios. In particular, aspects related to the study and design of smart cyber-physical systems, the investigation and design of adaptive computational-intelligence techniques able to learn and operate in nonstationary/evolving environments and the deployment of credible networked intelligent cyber-physical systems able to operate in harsh environments will be introduced.

Speakers: Sergio Terzi, Politecnico di Milano; Manuel Roveri, Politecnico di Milano

Biography: Sergio Terzi (male) is Associate Professor of Product Lifecycle Management at Politecnico di Milano, Department of Economics, Management and Industrial Engineering. He got his degree in Industrial Engineering in 1999, his Master in Business Administration in 2001 and finally his PhD in 2005 (on the topic of product lifecycle management). He is author of 4 books and more than 150 papers at national and international level in the field of lifecycle management. Member of the Editorial Board of the International Journal on Product Lifecycle Management

and member of the IFIP WG 5.1 and 5.7. He is one of the founders of the International Conference on Product Lifecycle Management. He is used to work on international (IMS NoE, IMS 2020, LeanPPD, Linked Design, ELICIT, Pathfinder, etc.) and national research projects, generally with Dissemination and Exploitation responsibilities. sergio.terzi@polimi.it>

Biography: received the Dr.Eng. degree in Computer Science Engineering from the Politecnico di Milano (Italy) in June 2003, the MS in Computer Science from the University of Illinois at Chicago (U.S.A.) in December 2003 and the Ph.D. degree in Computer Engineering from Politecnico di Milano (Italy) in May 2007.

Currently, he is an Associate Professor at Dipartimento di Elettronica, Informazione e Bioingegneria of the Politecnico di Milano (Italy). He has been visiting researcher at Imperial College London (UK).

Manuel Roveri is an Associate Editor of the IEEE Transactions on Neural Networks and Learning Systems and served as chair and member in many IEEE subcommittees. He is co-organizer of the IEEE Symposium on "Intelligent Embedded Systems" in 2014 and the IEEE Symposium on "Intelligence for Embedded and Cyber-physical Systems" in 2015 and 2016. Moreover, he is organizer and co-organizer of workshops and special sessions at IEEE-sponsored conferences. He is the lecturer of the Course "Intelligence for Embedded Systems" and "Cognitive Cyber-physical Systems: from theory to practice" at the Politecnico di Milano and the Coordinator at Politecnico di Milano of the CINI Smart Cities & Communities National Lab.

Current research activity addresses adaptation and learning in non-stationary environments and intelligence for embedded and cyber-physical systems and cognitive fault diagnosis.

TUTORIAL 4: Decentralized Computing in Smart Grids by Self-Organizing Sensor Networks

Date: Thursday September 8

Time: 16.45-18.30

Location: Room 4

Summary: The deployment of Smart Grid paradigms could play a strategic role in supporting the evolution of traditional electrical power systems toward active, flexible and self-healing web Energy networks composed by distributed and cooperative resources. In this context a large volume of raw data is collected by distributed and pervasive sensors networks, and sent to central servers for post processing activities. The large-scale deployment of this hierarchical paradigm in a Smart Grid is causing designers of high performance monitoring systems to revisit numerous design issues and assumptions pertaining to scale, reliability, heterogeneity, manageability, and system evolution over time. Therefore advanced computing paradigms aimed at supporting rapid decision in a data rich, but information limited environment are highly required for an effective smart grid operation. Armed with such a vision in this Tutorial a decentralized and self-organizing architecture for synchronized wide area smart grids monitoring and control will be introduced. The insight principle is to start from the information spreading theory for coordinating a networks of cooperative dynamic agents equipped by built-in mutually coupled oscillators. Thanks to this feature the time synchronization, the control, and the monitoring functions can be performed according to a decentralized, non hierarchical processing architecture which is alternative to the traditional client server based paradigms.

Speaker: Alfredo Vaccaro, University of Sannio, Benevento (Italy)

Biography: ALFREDO VACCARO (M'01, SM'09) received the M.Sc. degree with honors in electronic engineering from the University of Salerno, Salerno, Italy, and the Ph.D degree in electrical and computer engineering from the University of Waterloo, Ontario, Canada. From 1999 to 2002, he was an Assistant Researcher at the University of Salerno, Department of Electrical and Electronic Engineering. From March 2002 to October 2015, he was an Assistant Professor in electric power systems at the Department of Engineering of the University of Sannio, Benevento, Italy, where he is currently an Associate Professor of electrical Power System. His special fields of interest include soft computing and interval---based method applied to power system analysis, and advanced control architectures for diagnostic and protection of distribution networks. Prof. Vaccaro is a member of the Editorial Boards of IET Renewable Power Generation, and the International Journal of Reliability and Safety, and he is the Executive Editor of The International Journal of Renewable Energy.

TUTORIAL 5: Big Data 2.0 Processing Systems: Technologies, Challenges and Opportunities

Date: Friday September 9

Time: 11.15-13.00

Location: Room 4

Summary: For a decade, the MapReduce framework, and its open source realization, Hadoop, has emerged as a highly successful framework that has created a lot of momentum such that it has become the defacto standard of big data processing platforms. However, in recent years, academia and industry have started to recognize the limitations of the Hadoop framework in several application domains and big data processing scenarios such as large scale processing of structured data, graph data and streaming data. Thus, we have witnessed an unprecedented interest to tackle these challenges with new solutions which constituted a new wave of mostly domain-specific, optimized big data processing engines. In this tutorial, we refer to this new wave of systems as “Big Data 2.0 processing systems”. We provide a taxonomy and analysis of the state-of-the-art in this domain. In addition, we identify a set of the current open research challenges and discuss some promising directions for future research.

Speaker: Sherif Sakr, University of New South Wales, Sydney, Australia

Biography: Dr. Sherif Sakr is also a Senior Lecturer in The School of Computer Science and Engineering (CSE) at University of New SouthWales (UNSW) and a Senior Researcher at DATA 61|CSIRO (Formerly NICTA). In 2012, Sherif held a Research MTS position in Alcatel-Lucent Bell Labs. In 2011, Dr. Sakr held a Visiting Researcher with the eXtreme Computing Group (XCG), Microsoft Research Laboratories, USA. He has published more than 90 refereed research publications in international journals and conferences such as: VLDB, SIGMOD, WWW, CIKM, ISWC, DASFAA, ER, BPM, ICWS, JCSS, IEEE TSC, IEEE COMST, JCST, JDM and ACM Computing Surveys. Dr. Sakr (co-)authored 3 books and co-edited 3 other books, the most recent of them are "Big Data 2.0 Processing Systems" which is currently in press by Springer and to be available on the shelves by September 2016.