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Special Session on

“Biologically-Inspired Cognitive Architectures in Dependable Cyber-Physical Systems”

Organized by

Principal Organizers: Prof. Evgeny Osipov, Luleå University of Technology
Prof. Valeriy Vyatkin, Aalto University of Technology
Prof. Anatoly Shalyto, ITMO University

Call for Papers

Traditional computing architectures are designed to produce reliable systems with specifiable behaviours and properties. Their major strengths come from easiness of inspection, maintenance, interoperability, and reuse. However, all modern computing systems operate based on strict assumptions about their environments, thus are too inflexible to react to changing demands. In critical environments such as industrial automation, smart grids and dependable cyber-physical systems in general, this inflexibility results in serious in many cases life-critical errors. Alternative computing architectures, which greatly borrow their functionality from the versatility and efficiency of systems developed by nature, are known as biologically-inspired cognitive computing architectures (BICA). Traditionally these architectures find their applications in areas like natural language processing, image and speech processing. Very little attention so far was paid at exploring their applicability in the context of dependable industrial systems. This special session solicits contributions exploring diverse applications of BICA architectures for enriching intelligent functionality of industrial systems.

Topics of interest include, but are not limited to:

- Associative memory based reasoning
- Combined machine learning / BICA solutions
- Neural networks in cognitive computing architectures
- Cognitive architectures for continuous signal processing
- Cognitive fault detection and system identification
- Cognitive and hybrid automatic control
- Cognitive wireless communications
- Symbiosis of cognitive and Von-Neumann computing architectures
- Novel application areas and use-cases for BICA architectures in CPS and IoT.
- BICA empowered software engineering
- Spiking Neural Networks interfacing BICA architectures. Industrial usecases.

Information about organizers:

Evgeny Osipov (TCII Sub-Committee Chair on Bio-inspired industrial informatics)

Dr. Evgeny Osipov is a full professor at Luleå University of Technology. He received PhD in Computer Science from University of Basel, Switzerland in 2005, Licentiate of Engineering from KTH, Royal Institute of Technology, Sweden in 2003 and completed a pre-doctoral programme at EPFL, Swiss Federal Institute of Technology in 1999. His major research interests are in cognitive computing and communication architectures applied to various scenarios of future cyber-physical systems and Internet-of-Things. Prof. Osipov published 60+ research works on international conferences and in journals. He has raised external research funding in excess of 1 MEur. He is an experienced educator teaching and examining in several undergraduate and MSc-level courses.



Valeriy Vyatkin (TCII Co-Chair and Sub-Committee Chair on Distributed Systems)

Valeriy Vyatkin is on joint appointment as Chaired Professor of Dependable Computation and Communication Systems, Lulea University of Technology, Lulea, Sweden, and Professor of Information and Computer Engineering in Automation at Aalto University, Helsinki, Finland. Previously, he was a Visiting Scholar at Cambridge University, U.K., and had permanent academic appointments with the University of Auckland, Auckland, New Zealand; Martin Luther University of Halle-Wittenberg, Halle, Germany, as well as in Japan and Russia. He received Ph.D. degree from the State University of Radio Engineering, Taganrog, Russia, in 1992. His research interests include dependable distributed automation and industrial informatics; Industrial Internet concepts, such as Internet of Energy and Internet of Things, system and software engineering for industrial automation systems; and distributed architectures and multi-agent systems applied in various industry sectors, including smart grid, material handling, building management systems, data centres and reconfigurable manufacturing. Dr. Vyatkin is Associated Editor of IEEE Transactions on Industrial Informatics. He was awarded the Andrew P. Sage Award for the best IEEE Transactions paper in 2012.



Anatoly Shalyto (TCII Co-Chair and Sub-Committee Chair on Machine Learning in Industrial Informatics)

Anatoly Shalyto is a professor and a leading researcher at the department of computer technologies, faculty of IT and programming, ITMO University, St. Petersburg, Russia. His research mostly concerns automata-based programming. In particular, he introduced a methodology for automata-based programming called Switch-technology. In later years, his research is mostly dedicated to connection of automata-based programming to machine learning techniques for solving such problems as automata synthesis, automata testing and automata verification. The results of this research are currently used in a variety of Russian industrial companies. Professor Shalyto is also a coauthor of the UniMod tool that supports automata-based programming. The UniMod tool is currently used in educational process in several Russian and Italian universities. His results were published in many international conferences, including IEEE Integration of Knowledge Intensive Multiagent Systems (KIMAS), ACM Genetic and Evolutionary Computation Conference (GECCO), IEEE International Conference on Machine Learning and Applications (ICMLA), Language and Automata Theory and Applications (LATA). He is the author of a series of articles devoted to the problems of Computer Science and education in Russia. For his achievements in education, in 2008 he got a Russian State Government award.

