THE 4TH IEEE INTERNATIONAL CONFERENCE ON INDUSTRIAL CYBER-PHYSICAL SYSTEMS

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Special Session on

"Operational Safety Verification of Cyber Physical Industry 4.0 Applications"

Organized by

Principal Organizer 1: Dr. Sandeep K.S. Gupta
Affiliation: Arizona State University
Institutional Email: sandeep.gupta@asu.edu

Organizer 2: Dr. Ayan Banerjee
Affiliation: Arizona State University
Institutional Email: abanerj3@asu.edu

Organizer 3: Dr. Imane Lamrani
Affiliation: Arizona State University
Institutional Email: ilamrani@asu.edu

Call for Papers

Theme: Industry 4.0 Cyber-physical systems (CPS) which rely on inputs from various IoT devices are increasingly using Artificial Intelligence (AI) techniques to operate at various level of autonomy. Combination of AI and human-CPS interaction can result in unforeseen use cases (not predicted during design and development) potentially jeopardizing operational safety. For example, human-robot collaboration in Amazon fulfillment center does not consider the varying health status of the human participant and can result in unreasonable expectations causing physical injury. Another example is uncertain action of a pilot of an aircraft (e.g. Boeing 787 Max) while interacting with an intelligent flight control system resulting in potential deadly consequences. There is need for operational safety analysis that considers operational data and verifies whether an AI-enabled CPS is preserving safety. This is significantly different from design time safety analysis, which is typically performed before deployment. This special session seeks original ideas on verification of

Accepted papers will be published in an IEEE proceedings volume and will be also submitted for the International Publication in *IEEE xplore*

operational safety of AI enabled CPS with focus on: a) the status of existing informal and formal approaches in ensuring CPS/AI safety and what are the gaps? b) How can we engineer trustable CPS/AI software architectures c) what are the engineering techniques are required to develop sage human-CPS/AI interactions? Industrial large scale manufacturing domains such as aircrafts, autonomous vehicles, medical devices are the focus application areas.

Topics of interest include, but are not limited to:

- Runtime Monitoring to enhance operational safety
- Effect of Self-adaptation on operational safety
- Accountability, responsibility, and liability of CPS-AI systems
- Runtime Human-CPS-AI interaction safety
- Regulation of CPS-AI systems: operational safety standards and re-certification
- Runtime Evaluation platforms for CPS-AI systems
- Operational safety in autonomous vehicles, aircrafts, medical devices and other large scale manufactured systems

CVs of the proposers

Sandeep K.S. Gupta, has over two decades of experience in model based design and development of safety critical systems and has successfully conducted research on medical control systems through two NSF funded projects NSF IIS 1116385 and an NSF SIR project in collaboration with Food and Drug Administration (FDA). He has published a book on Body Sensor Networks-safety, security, and sustainability and has several significant contributions in the domain of safety verification of medical CPS. He has recently published several journal and conference articles on model mining and fault explanations.
Website: https://impact.asu.edu/

Ayan Banerjee has worked with the FDA and the Mayo clinic for several years to analyze the safety and effectiveness of medical control systems in specific the artificial pancreas. He along with Dr. Gupta were pioneers in the area of spatio-temporal hybrid modeling and verification with applications concentrated in the medical control system domain. Recently, they have collaborated to contribute to the emerging domain of testing of AI enabled CPS.

Imane Lamrani works on model-based verification techniques of AI-enabled Cyber-physical systems (CPS) that characterize their behavior before deployment using predictive models may be inaccurate and often result in incorrect safety analysis results. Typically, good environment models are often unavailable because of the high nonlinear variations present in the physical system due to different physiological conditions and operating conditions. Given the unsupervised nature of operation of intelligent systems, the operating conditions changes that are unaccounted for can guide towards misleading conclusions about the safe operation of these systems. Her

work consists of learning a formal specifications model using historical operational data of an AI-enabled CPS out in the field. The learned model is used to detect dissonance between the actual system's operation and the certified specifications model of the system. The dissonance between the work as designed and the work as performed is one of the compounding factors leading to fatal accidents of AI-enabled CPS.