# The 37th Chinese Control Conference

# Pre-conference Workshop

**Speaker:** Vincenzo Loia, University of Salerno, Italy

**Title:** Visioning Safe and Smart Cities with Situational Awareness and Computational Intelligence

**Biography:** Professor Vincenzo Loia received B.S. degree in computer science from University of Salerno, Italy in 1985 and the M.S. and Ph.D. degrees in computer science from University of Paris VI, France, in 1987 and 1989, respectively. From 1989 he is Faculty member at the University of Salerno where he teaches Safe Systems, Situational Awareness, and IT Project & Service Management. His current position is as Chair and Professor of Computer Science at Department of Management and Innovation Systems. He is the coeditor-in-chief of Soft Computing and the editor-in-chief of Ambient Intelligence and Humanized Computing, both from Springer. He is also Co-Editor in Chief of Int. Journal of Information Processing Systems. He is an Associate Editor of various journals, including the IEEE Transactions on System, Man and Cybernetics: Systems; IEEE Transactions on Fuzzy Systems; IEEE Transactions on Industrial Informatics; IEEE Transactions on the IEEE Transactions on Cognitive and Developmental Systems. His research interests include soft computing, agent technology for technologically complex environments Web intelligence, Situational Awareness He was principal investigator in a number of industrial R&D projects and in academic research projects. He is author of over 390 original research papers in international journals, book chapters, and in international conference proceedings. He holds in the last years several roles in IEEE Society in particular for Computational Intelligence Society (Chair of Emergent Technologies Technical Committee, IEEE CIS European Representative, and Vice-Chair of Intelligent Systems Applications Technical Committee).

**Abstract:** It's not uncommon for large-scale enterprises to manage hundreds of

thousands of computers, networks with thousands of devices, and petabytes of data. What makes problems at this scale particularly difficult is that often there must be a human in the loop. Security is no exception. Security analysts suffer in automating problem solving duties because it's inherently difficult to capture the tacit knowledge and procedures that they use to arrive at a decision; in addition, integrating with all of the myriad tools and sources of information an analyst uses to make a decision and react is cost prohibitive.

Humans introduce significant delays in the time to mitigate a threat. Yet, security analysts are typically flooded with far more alerts than they can possibly handle. How these alerts should be prioritized is poorly understood. Humans make mistakes, so organizations typically establish processes and best practices for their labor force to ensure that problems are dealt with systematically and predictably. Although this doesn't guarantee that errors won't happen, these techniques can help manage these errors to a tolerable level. But policies and best practices are designed to address well-understood threats and often don't adequately address emerging threats, especially in a highly dynamic and changing environments.

Situation Awareness is usually defined in terms of what information is important for a particular job or goal.

Most of the problems with Situation Awareness occur at the level "Perception" and "Comprehension" because of missing information, information overload, information perceived in a wrong way (e.g., noise) or also information not pertinent with respect to the specific goal. Thus, the current situation must be identified, in general, in uncertainty conditions and within complex and critical environments. In this case, it is needed an effective hybridization of the human component with the technological (automatic) component to succeed in tasks related to Situation Awareness.

Situation Awareness oriented systems have to organize information around goals and provide a proper level of abstraction of meaningful information. To answer these issues, we propose a Cognitive Architecture, for defining Situation Awareness oriented systems, that is defined by starting from the well-known Endsley's Model and integrating a set of Computational Intelligence techniques (e.g., Fuzzy Cognitive Maps

and Formal Concept Analysis) to support the three main processes of the model (perception, comprehension and projection). One of these techniques is Granular Computing that makes information observable at different levels of granularity and approximation to allow humans to focus on specific details, overall picture or on any other level with respect to their specific goals, constraints, roles, characteristics and so on.

Furthermore, the proposed Cognitive Architecture considers some enabling technologies like multi-agents systems and semantic modeling to provide a solution to face the complexity and heterogeneity of the monitored environment and the capability to represent, in a machine-understandable way, procedural, factual and other kind of knowledge and all the memory facilities that could be required.

Practical experiences deriving from the realization of complex systems in the domain of Smart and Safe Cities will be presented during the talk.