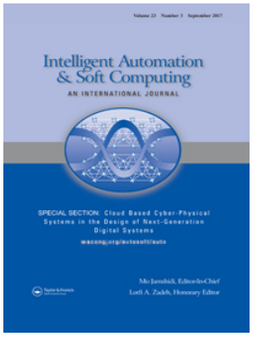

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EDITORIAL

Cloud based cyber-physical systems in the design of next-generation digital systems

Cyber-Physical Systems (CPS) has an antecedent generation of embedded systems integrating computational elements and physical environments, which are typically coupled by a communication infrastructure. The cyber-physical cloud computing systems consist of various services and applications that might be implemented across the computing platform based sensors, processing, control and data services. The next generation digital systems rely more on pervasive access to the internet via smart devices by the extension of cloud computing paradigm. Consequently, CPS are expected to play a significant role on the design of the next generation digital systems in numerous applications, e.g., healthcare, energy, environmental monitoring, consumer electronics, etc. Furthermore, standardization of (a) architectures that allow modular design and development, (b) new methodologies, algorithms, and tools, (c) dependable, highly reconfigurable, trustworthy hardware and software components is a more focused research area in the cloud based CPS. Subsequently, a number of design challenges are associated with the CPS, such as, heterogeneity in system and integration of different design disciplines. This special issue is to primarily bring together the contributions of the CPS research to support a better design of the next-generation systems and their digital parts.

The next generation industrial applications can now be rapidly composed by selecting and combining various platforms and capabilities offered (as services in the cloud) to achieve their goals. Similarly, Internet of things (IoT) and wireless network play a key role in the cloud based CPS. In addition, the design of the CPS and implementation of their applications need the IoT-enabled architectures, sensor network protocols, and actuation devices. Thus, this special issue is to address the research aspects associated to the cloud-based and IoT-based wireless sensor network towards large scale CPS. The synergy between the three different streams of the special issue is shown in Figure 1.

This special issue has the following six papers, each of which has been carefully reviewed during several rounds of review:

In the first paper entitled "Broker based Trust Architecture for Federated Healthcare Cloud System," the authors present a broker based federated cloud mechanism, which helps to resolve the difficulties of selecting the optimal cloud provider for the service based on regression tree. In addition, various trust mechanisms are proposed to ensure the believability of the cloud environment as well as characterize the importance of each Service Measurement Index (SMI) attributes suggested by the cloud consortium. Simulation results show that the performance of the proposed mechanism is better than the existing random provider and feedback-based selection mechanism reported in the related literature.

In the second paper entitled "Availability Modeling for Multi-Tier Cloud Environment," the authors propose a high-level performance analysis model that can predict the availability of multi-tier cloud environment. Moreover, the multi-tier cloud design is developed in the SHARPE tool, and the availability of this design has been verified with the proposed methodology. Similarly, the proposed availability model estimates the Quality of Service (QoS) for different models. It can be used in comparison of different models in order to estimate their performance level in all aspects. The dependability aspect, parallel pattern, and serial pattern are also considered in evaluating the performance of the cloud system.

In the third paper entitled "Design of an Improved PSO Algorithm for Workflow Scheduling in Cloud Computing Environment," the authors demonstrate how the Improved Particle Swarm Optimization (IPSO) is applied to schedule the applications in the cloud resources. The IPSO-based task resource mapping can achieve better results when compared with the standard PSO. As a matter of fact, two improvements are made here: (1) by introducing a new information sharing mechanism to make particles move on the contrary direction of the worst individual positions and worst global swarm positions, thus enlarging the global search space and reducing the possibility of the particles to be trapped into a local optimum; (2) by embedding the genetic selection strategy to decrease the possibility of being trapped into local optima.

In the fourth paper entitled "Region Based Find and Spray Scheme for Co-operative Data Communication in Vehicular Cyber-Physical Systems," the authors combine the single-copy routing and multiple replications in the intermittently connected vehicular CPS. Additionally, the developed scheme uses the single copy routing wherever possible, and does fuzzy controlled multiple replications. Subsequently, the results show that it can outperform the existing methods in terms of packet delivery ratio, packet delay, and protocol overhead.

In the fifth paper entitled "Activity Recognition Method Based on Weighted LDA Data Fusion," the authors present a novel activity recognition method based on missing data processing and multi-sensor data fusion, which can be employed to identify Activities of Daily Living (ADLs). An activity recognition method based on missing data processing and weighted Linear Discriminant Analysis (LDA) data fusion is further proposed. It is capable of enhancing the data quality and recognition accuracy. Experimental results illustrate that this method is more effective and more robust, and its performance is competitive against other *state-of-the-art* data fusion techniques in the Human Activity Recognition (HAR).

In the sixth paper entitled "An Intensive Study on Rule Acquisition in Formal Decision Contexts based on Minimal

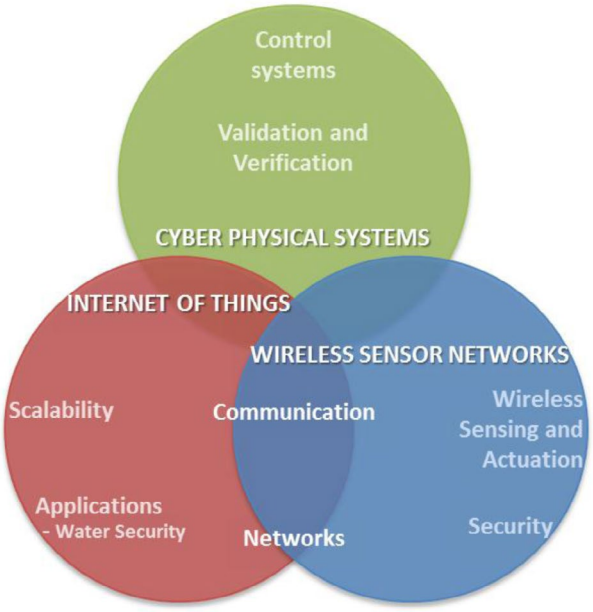

Figure 1. Research streams contributing to cloud-based CPS.

Closed Label Concept Lattices," the authors investigate an effective heuristic algorithm designed to find the optimal representative reduct of minimal closed label concept lattice, which has been used to extract non-redundant limitary decision implications from a formal decision context. Moreover, this paper also examines the pair-wise inclusion and inference relationships among limitary decision implications, decision implications, decision rules, and granular rules in order to make a better use of them in decision-making analysis.

Notes on contributors

Xiao-Zhi Gao received his B.Sc. and M.Sc. degrees from the Harbin Institute of Technology, China in 1993 and 1996, respectively. He earned a D.Sc. (Tech.) degree from the Helsinki University of Technology (now Aalto University), Finland in 1999. Since January 2004, he has been working as a Docent (Adjunct Professor) at the same university. He is also a Guest/Visiting Professor at the Harbin Institute of Technology, Beijing Normal University, and Shanghai Maritime University, China. Dr. Gao has published more than 300 technical papers in refereed journals and international conferences. His current research interests are nature-inspired computing methods (e.g., neural networks, fuzzy logic, evolutionary computing, swarm intelligence, and artificial immune systems) with their applications in optimization, data mining, control, signal processing, and industrial electronics. Dr. Gao is an Associate Editor of the *Applied Soft Computing*, *International Journal of Machine Learning and Cybernetics*, *Journal of Intelligent Automation and Soft Computing*, *International Journal of Innovative Computing, Information and Control*, and *International Journal of Swarm Intelligence and Evolutionary Computation*. He also serves on the editorial boards of numerous international journals.

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