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## EDITORIAL

# IEEE ACCESS SPECIAL SESSION EDITORIAL: BIG DATA SERVICES AND COMPUTATIONAL INTELLIGENCE FOR INDUSTRIAL SYSTEMS

The pervasive nature of big data technologies as witnessed in industry services and everyday life has given rise to an emergent, data-focused economy stemming from many aspects of industrial applications. The richness and vastness of these services are creating unprecedented research opportunities in a number of industrial fields including public health, urban studies, economics, finance, social science, and geography. We are moving towards the era of *Big Data Services*, which are deployed in a multi-scale complex distributed architecture. These services can be formed a high-level computational intelligence based on emerging analytical techniques such as big data analytics and web analytics. In this context, computational intelligence employs software tools from advanced analytics disciplines such as data mining, predictive analytics, and machine learning. At the same time, it becomes increasingly important to anticipate technical and practical challenges and to identify best practices learned through experience. This special session has included nine papers, and a brief summary about each paper is presented as follows.

Limited memory bandwidth is considered as the major bottleneck in multimedia cloud computing for more and more virtual machines (VMs) of multimedia processing requiring high memory bandwidth simultaneously. Contending memory bandwidth among parallel running VMs leads to poor quality of service (QoS) of the multimedia applications, missing the deadlines of these soft real-time multimedia applications. In the paper by Han et al. (An adaptive framework for improving quality of service in industrial systems), the authors present an adaptive framework, Service Maximization Optimization, which is designed to improve the QoS of the soft real-time multimedia applications in multimedia cloud computing. The framework consists of an automatic detection mechanism and an adaptive memory bandwidth control mechanism. With the automatic detection mechanism, the critical section to the multimedia application performance in VMs is detected. This adaptive memory bandwidth control mechanism adjusts the memory access rates of all the parallel running VMs to protect the QoS of the soft real-time multimedia applications.

Network survivability is an attribute that network is continually available even if a communication failure occurs, and is regarded as one of the most important concepts to design dependable computer networks. In the existing work, a power-aware mobile ad hoc network (MANET) is described by a Markov regenerative process, and takes account of the variability in power level, which is caused by the possible low-battery state in each communication node. However, it implicitly ignores effects by the so-called border effects, and lacks the reality in modeling. In the paper by Dohi et al. (Towards highly dependable power-aware mobile ad hoc network – Survivability evaluation framework), the authors revisit a power-aware MANET model taking account of border effects and quantify the network survivability more accurately.

Following the two trends of computerization and informatization, another emerging trend is cyberization in which numerous and various cyber entities in cyberspace will exist in cyber-enabled worlds, including the cyber world and cyber-conjugated physical, social, and mental worlds. Computer science and information science, as holistic fields, have, respectively, played important roles in computerization and informatization. Similarly, it is necessary for there to be a corresponding field for cyberization. In the paper by Ning et al. (Cybermatics: A holistic field for systematic study of cyber-enabled new worlds), the authors propose Cybermatics, which is a holistic field for the systematic study of cyber entities in cyberspace and cyber world, and their properties, functions, and conjugations with entities in conventional spaces/worlds. This paper sets out to explain the necessity and rationale for, and significance of, the proposed field of Cybermatics, what it is and what it encompasses, and how it is related to other fields.

The development of informationization and intelligentization prompts Internet developing toward a new era. A deep fusion among cyber space, physical space, social space, and thinking space brings a quaternionic cyber-physical-social-thinking hyperspace, based on which an embryo of smart world is being established through heterogeneous spaces. The smart world is expected to be an attractive perspective

involving ubiquitous sensing, computing, and communication to achieve comprehensive interconnections of physical perception, cyber interaction, social correlation, and cognitive thinking. In the paper by Ning et al. (From Internet to smart world), the authors introduce the evolution of the smart world. Physical-based coordination, social-inspired interactivity, brain-abstracted cooperativity, and cyber-enabled homogeneity are, respectively, discussed as the characteristics of the smart world.

With the further adoption of the Internet of Things and sensor technology, all kinds of intelligent transportation system (ITS) applications based on a wide range of traffic sensor data have had rapid development. Traffic sensor data gathered by large amounts of sensors show some new features, such as massiveness, continuity, streaming, and spatio-temporality. ITS applications utilizing traffic sensor data can be divided into three main types: 1) offline processing of historical data; 2) online processing of streaming data; and 3) hybrid processing of both. Current research tends to solve these problems in separate solutions, such as stream computing and batch processing. In the paper by Zhao et al. (A hybrid processing system for large-scale traffic sensor data), the authors propose a hybrid processing approach and present corresponding system implementation for both streaming and historical traffic sensor data, which combines spatio-temporal data partitioning, pipelined parallel processing, and stream computing techniques to support hybrid processing of traffic sensor data in real-time.

Smart worlds begin with smart things, such as smart objects, smart cities, smart manufacturing, and smart systems, are overlaid with sensing and actuation, many embedded in things, and eventually encompass all aspects of the cyber, physical, social, and thinking hyperspace. In the future, human beings will live in a smart environment where both life and work are well addressed by technology, whereas humans will be responsible only for providing creativity. In the paper by Ning et al. (Top challenges for smart worlds - A report on the Top10Cs forum), the authors organize the 2015 Smart World Congress, including five IEEE International Conferences. Specifically, a variety of challenges are presented in the field of smart world. An open forum on the top ten challenges (Top10Cs) for smart worlds is held under the congress to identify the main challenges through collecting the intelligence existing particularly in crowd wisdom. Top10Cs and related works, as a crowdsourcing approach, discuss and analyze the top challenges for smart worlds based on the selective results of the crowd and experts via an online platform.

In an industrial system, wireless sensor networks (WSNs) are usually adapted to industrial applications. Industrial system are novel scenario to apply WSNs. Industrial WSNs are the base to establish supervisory control and data acquisition system with the benefits of extending the network boundaries and enhancing the network scalability of the WSNs. The integration of industrial systems, such as smart grids and social networks, is an important trend for new network

technologies. In many application scenarios of industrial systems, WSNs are controlled by different authorities. The network nodes that belong to different domains can share the sensor data by standard protocols. In an applications scenario that has high security requirements, the nodes of social networking WSNs could belong to different security levels; thus, these data can be controlled only by specific types of users. Hence, a cross-domain fine-grained data usage is the core problem for this approach. In the paper by Dong et al. (Cross-domain fine-grained data usage control service for social networking WSNs in industrial system), the authors focus on cross-domain fine-grained data usage control mechanism of social networking WSNs in industrial systems, which includes cross-domain fine-grained access control and fuzzy clustering for sensing data for efficient analysis.

Due to complexities of big video data management, such as massive processing of large amount of video data to do a video summary, it is challenging to effectively and efficiently store and process these video data in a user friendly way. In the paper by Zhang et al. (A distributed video management cloud platform using Hadoop), the authors propose a practical massive video management platform using Hadoop, which can achieve a fast video processing (such as video summary, encoding, and decoding) using MapReduce, with good usability, performance, and availability. Red5 streaming media server is used to get video stream from Hadoop distributed file system, and Flex is used to play video in browsers. A user-friendly interface is designed for managing the whole platform in a browser-server style using J2EE.

To address task-scheduling problems in cloud computing, in the paper by Shu et al. (A multi-objective optimization scheduling method based on the ant colony algorithm in cloud computing), the authors propose a multi-objective optimization method. With an aim toward the biodiversity of resources and tasks in cloud computing, the authors propose a resource cost model that defines the demand of tasks on resources. This model reflects the relation between the user's resource costs and budget costs. A multi-objective optimization scheduling method has been proposed based on this resource cost model. This method considers the makespan and the user's budget costs as constraints of the optimization problem, achieving multi-objective optimization of both performance and cost. An improved ant colony algorithm has been proposed to solve this problem. Two constraint functions were used to evaluate and provide feedback regarding the performance and budget cost.

Finally, we would like to thank the authors to submit their high quality manuscripts to this special session. We would like to acknowledge the contribution of the reviewers who have participated in the review process, and provided helpful comments and suggestions to the authors on improving their manuscripts. We specially thank Professor Michael Pecht, the Editor-in-Chief of IEEE ACCESS, for his advice and strong support during the process of putting together this special

session. We also hope that the readers will enjoy reading the papers included in this special session.

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