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Cloud-assisted Industrial Systems and Applications

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1 Guest editorial

In recent years, cloud systems can provide flexible and on-need basis processing of vast amounts of data, as well as provisioning of other value-added services using Internet technologies. Cloud-based approaches will be applicable to all aspects of modern industrial systems, their applications and interactions in the large-scale systems. It is very necessary that more flexible infrastructure is designed to enhance performance, reliability and scalability in complex industrial systems. However, the majority of current cloud systems and the corresponding techniques primarily aim at the internet-based applications. The complex industrial systems give rise to some new issues and challenges to cloud computing since they are significantly different from those service-oriented and internet-based applications due to their inherent features (e.g., workload variations, process control, environment configurations, resource requirements, and life-cycle management, etc.). This special issue features six selected papers with high quality related to cloud-assisted industrial systems and applications.

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In the first article entitled "Smart Clothing: Connecting Human with Clouds and Big Data for Sustainable Health Monitoring", Chen et al., investigate the novel sustainable health monitoring via smart clothing, one of development trends in healthcare industry. The innovative design of smart clothing facilitates unobtrusive collection of various physiological indicators of human body. In order to provide pervasive intelligence for smart clothing system, mobile healthcare cloud platform is constructed by the use of mobile internet, cloud computing and big data analytics. The authors introduce various design details, key technologies and practical implementation methods of smart clothing system. The paper also provides some novel applications powered by the proposed architecture, such as medical emergency response, emotion care, disease diagnosis and real-time tactile interaction. Especially, the ECG signals collected by smart clothing are used for mood monitoring and emotion detection. Finally, the authors highlight some of the design challenges and open issues that still need to be addressed to make smart clothing ubiquitous for a wide range of applications.

External resource allocation is a very important issue in cloud-assisted industrial systems and applications because of that to solve the internal resource allocation problem, the user's needs must first be ascertained to provide the required amount of resources. In previous work, the authors have proposed DEA to analyze the various parameters in the cloud resource allocation problem. However this method is too idealistic. In the paper entitled "Learning-based Data Envelopment Analysis for External Cloud Resource Allocation", Cho et al. use Q-learning to train the input and output of DEA items so that DEA does not run the whole user's data for a user every time. In this way, the authors proposed approach can provide an acceptable policy as well as much computation time can be reduced.

The third article, "SPSIC: Semi-Physical Simulation for IoT Clouds" written by Wang et al., presents an innovative method to establish an intelligent, independent and expandable data driven IoT service platform by OPNET's Semi-Physical Simulation to combine the simulated network for IoT with the real Cloud computing (SPSIC) which applies real network to achieve the long-term surveillance, management, sharing and analysis of the collected data at any time. This approach between the test platform and the software-only simulation adopts the software simulation partially, and it is the balance and compromise among cost, scalability, flexibility and fidelity. This paper completes a sim-real simulation from wireless sensor network model based on OPNET to real cloud computing center, and compared with pure OPNET model simulation. The result shows Semi-Physical Simulation has more credibility.

The cloud-based systems can provide massive storage resources and low-cost computing as well as the flexibility of customizing the operating environment to Complex Industrial Applications (CIA). In the paper entitled "Cloud-integrated Cyber-Physical Systems for Complex Industrial Applications", Shu et al. propose a novel architecture of CCPS (termed CCPSA) and outline the enabling technologies for CIA. Then, the authors dissect three potential challenges and provide solutions from the perspective of CIA, including virtualized resource management techniques, the scheduling of cloud resources, and life cycle management. The authors hope this paper can provide insight and a roadmap for future research efforts in the emerging field of CCPS.

In the paper entitled "A Delay-aware Wireless Sensor Network Routing Protocol for Industrial Applications", Cai et al. introduce a delay-aware algorithm for industrial application. Firstly, wireless nodes determine each other's position by sending and receiving data packets with location information. According to this position information can calculate the distance between each other. Then, the authors can calculate the ideal forwarding hops from source node to target node. In this way, the position of this ideal node can be calculated based on the distance of transmission and the angle between the horizontal line and the line consisting of the source node and the target node. With the position of ideal node, the authors can calculate the nearest node from ideal node and use this node as the next forwarding node.

The cloud-based Public Vehicle (PV) system, is promising to mitigate the traffic congestion in smart cities, where passengers can share PVs and transfer among them with scheduling strategies of the cloud. To further improve the whole traffic efficiency, the paper "Transfer Problem in a Cloud-based Public Vehicle System with Sustainable Discomfort" studies the transfer problem with sustainable discomfort for passengers. Their work is separated into three steps. First, the authors introduce several factors to guarantee the comfort of passengers during transfer. Second, they propose two algorithms aiming at reducing the travel distance of all the PVs with service guarantee. Third, simulations based on the Shanghai urban road network show that, the total travel distance of PVs is reduced under the quality of service for passengers, and the traffic efficiency is improved.

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