Editorial

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Biographical notes: Jianwei Niu (SM'13) received his PhD Degree in Computer Science in 2002 from Beihang University. He is a professor in the School of Computer Science and Engineering, BUAA, China. He has published more than 100 referred papers and filed more than 30 patents in mobile and pervasive computing. His current research interests include mobile and pervasive computing, mobile video analysis.

Lei Shu received the PhD Degree in Digital Enterprise Research Institute, from National University of Ireland, Galway, Ireland, in 2010. Until March 2012, he was a Specially Assigned Researcher in Department of Multimedia Engineering, Graduate School of Information Science and Technology, Osaka University, Japan. Since October 2012, he works as a full Professor in Guangdong University of Petrochemical Technology, China. He is a member of IEEE, IEEE IES, IEEE ComSoc, EAI and ACM.

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With the increasing proliferation of the internet of things (IoTs) as well as sensor cloud and big data, more and more mobile devices, such as smart phones, wrist straps and various sensors, can sense and collect sensory data anytime and anywhere. We are entering the era of worldwide sensor networks, where a huge amount of heterogeneous sensory data will be generated every day, which require advanced data processing and management techniques. In this context, efficiently acquiring, collecting, sharing, fusing and managing these spatial temporal data, and then extracting valuable knowledge in a timely manner, are big challenges. As we move towards a mobile world, data management requires a collection of centralised and distributed algorithms, architectures and systems to store, process and analyse the immense amount of spatial temporal data, where these data are cooperatively gathered through a huge amount of mobile sensing devices which move in space over time. This special issue on mobile sensing and data management for sensor networks is intended to provide a venue for presenting, exchanging and discussing the most recent advances in sensing and data management techniques.

Data gathering is one of the most important tasks in wireless sensor networks. However, data gathering failure may often occur in disconnected or random networks. To address this issue, in the paper 'Data gathering architecture for temporary worksites based on a uniform deployment of wireless sensors', the authors propose two distributed redeployment algorithms (DVFA and ADVFA) based on virtual forces. The authors propose a method to compute the optimal number of sensors needed to cover the whole area. Based on the results, they parameterise DVFA and evaluate its performance. To deal with the drawbacks of DVFA, the authors propose ADVFA to adapt the target distance between two neighbours to the number of operational nodes discovered. ADVFA outperforms DVFA in terms of the distance travelled by nodes and energy consumption.

Sensor networks used for IoT are usually deployed in harsh environments. In the paper, 'Fault-tolerant topology evolution and analysis of sensing systems in IoT based on complex networks', the authors propose a fault-tolerant topology evolution mechanism for the heterogeneous sensing network systems in IoT based on complex network techniques, and further analyse the properties of the evolved network structure. The authors theoretically prove that the degree distribution of the network evolution obeys the power law distribution, which has the scale-free property and provides networks with good fault-tolerance ability against random failures. The authors also validate their proposed fault-tolerant topology evolution mechanism via simulations and numerical analysis.

Recently fuzzy c-means clustering (FCM) has become very popular in pattern recognition, image processing and data analysis. Owing to the huge amount of data and computational complexity, FCM becomes intractable for clustering big sensor data in real time. The paper 'Distributed fuzzy c-means algorithms for big sensor data based on cloud computing' presents three distributed FCM algorithms, namely distributed FCM algorithm based on MapReduce (DFCM), distributed online FCM algorithm based on sampled affinity propagation (AP) clustering (DOFCM) and distributed kernel FCM algorithm based on MapReduce (DKFCM). The proposed algorithms use the cloud computing technology to improve the efficiency of clustering big sensor data. Experimental results prove the superiority of the proposed methods in terms of clustering accuracy and clustering speed.

Detecting sensor faults is very important for various task-critical applications. In the paper, 'P7: a sensor monitoring and management framework for industrial sensor networks', the authors employ a time window-based method to fuse and compress the data from multiple sensors which enables them to achieve more reliable sensor data. The authors divide sensors into groups, define the state transformation space to represent the normal sensor status and assign a health index to each index. A system adopting this method is designed and implemented. The test results show that the system can detect more than 90% sensor faults successfully and help users manage the sensors easily.

It is a key issue to address real-time data storage and query for many sensor-based applications. However, it is challenging to design a query processing mechanism that meets both time and energy constraints. In the paper, 'Real-time query processing optimisation for wireless sensor networks', the authors address this challenge and propose a new architecture and a query processing algorithm to optimise the real-time user query processing. The experiments based on real and synthetic data sets demonstrate that the proposed solution optimises the real-time query processing to save energy while meeting time constraints.

A promising way of reducing the energy consumption of continuous sensor data collection is to utilise the techniques of adaptive data collection and aggregation. In the paper, 'An adaptive scheme for data collection and aggregation in periodic sensor networks', the authors present an adaptive data collection and aggregation scheme for periodic sensor networks. The major contributions of this paper include two aspects:

- It presents an adaptive sampling method based on the dependence of conditional variance on measurements varying over time. The key idea behind this method is to allow each sensor node to adapt its sampling rates to the physical changing dynamics.
- It proposes a new data aggregation method to merge similar data. This approach is validated via simulation on real sensor data and comparison with other existing data aggregation techniques.