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EDITORIAL

# New technologies and research trends for smartphone sensing in intelligent multimedia systems

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**Abstract** Research progresses in smartphone sensing have been recently explored and developed by various researchers. This special issue on new technologies and research trends for smartphone sensing in intelligent multimedia systems, provides high-quality contributions addressing related, theoretical and practical aspects of intelligent smartphone sensing technologies and their applications. We have selected nine research papers whose topics are strongly related to this special issue.

## 1 Introduction

In recent years, one of the world's largest IT market issues is the smartphone. The smartphone has shown its versatility in connecting to the wireless internet or using applications and continues to increase its influence on daily life and business. At first, the cellular phone was a simple device for the voice call, and later, text message exchange. Currently, it has become ubiquitous, and has expanded its functionality to support various types of multimedia applications. Most smartphones are equipped with diverse technologies such as cameras, speakers, microphone, and sensors, including GPS, Wi-Fi, accelerometer, Bluetooth, light, and gyro. Sensor data can be used for various purposes such as recognizing user location or inferring user's activity and social context. Using the interactive user interface and sensor devices, it is possible to improve user convenience dramatically and to develop context-aware applications. So far, many studies have been done to pursue these purposes. Therefore, we are looking for efficient and effective, context-sensing algorithms, frameworks, and systems particularly in intelligent multimedia systems.

Each manuscript was blindly reviewed by at least three reviewers consisting of guest editors and external reviewers. After two review processes, nine manuscripts were finally selected to be included in this special issue.

In Sect. 2, we briefly summarize these manuscripts. Section 3 presents a conclusion to this special issue and acknowledgment to the authors and reviewers.

## 2 Paper descriptions

The first paper "Cooperative spectrum sensing via relay-assisted random broadcast in cognitive smartphone network" by Zhao et al. [1] proposes a relay-assisted random broadcast scheme to extend the range of message sharing for improving the performance of cooperative spectrum sensing (CSS) by providing a practical power-limited, cluster-based cognitive smartphone network. They also discuss the sensing-sharing tradeoff when their proposed scheme is employed for CSS and show that both the minimum average probability of false alarm and the maximum average probability of detection are unique within the range of the given total sensing time.

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The paper entitled "Triangular inequality-based rotation-invariant boundary image matching for smart devices" by Moon and Loh [2] proposes a reversible data-hiding algorithm that solves the underflow and overflow problems using the location map and embeds more data than other lossless, data-hiding algorithms employing multi-level data hiding with the characteristics of difference image. It is a good solution for sensitive imagery applications, such as military and medical images.

Another paper entitled "Envelope-based boundary image matching for smart devices under arbitrary rotations" by Loh et al. [3] proposes the novel rotation-invariant matching algorithms to significantly reduce the number of distance computations based on the triangular inequality. A new notion of 'self rotation' distance is presented, and it is proven that the self-rotation distance with the triangular inequality produces a tight lower bound and prunes many unnecessary distance computations. A triangular inequality-based algorithm for rotation-invariant image matching is proposed. Then, the self-rotation distance is generalized to define the *k*-self rotation distance, which produces a tighter lower bound and prunes more unnecessary distance computations. An advanced rotation-invariant image matching algorithm based on the *k*-self rotation distance is proposed. It is shown through a series of experiments that the proposed algorithms significantly outperform the existing ones by up to one or two orders of magnitude.

The fourth paper entitled "Robust anonymous authentication protocol for health-care applications using wireless medical sensor networks" by He et al. [4] proposes an efficient authentication protocol for healthcare applications using WMSNs and claimed their protocol could withstand various attacks. However, authors find that their protocol is vulnerable to the off-line password guessing attack and privileged insider attack. The authors also point out that their protocol cannot provide anonymity. In this paper, authors proposed a robust anonymous authentication protocol for healthcare applications using WMSNs. Compared with [5], the proposed protocol has strong security and computational efficiency. Therefore, it is more suitable for healthcare applications using WMSNs.

The next paper entitled "Real-time smartphone sensing and recommendations towards context-awareness shopping" by Chen et al. [6] proposes a shopping model and implements the smart shopping environment in which the system provides the most appropriate products to customers according to their history of purchasing records by combining customers' personal information and purchasing frequency with customer lifetime value.

The sixth paper entitled "TwitterTrends: a spatio-temporal trend detection and related keywords recommendation scheme" by Kim et al. [7] investigates a spatio-temporal trend detection and related keyword recommendation scheme, which can identify hot keywords and recommend their related keywords at a given location and time by analyzing user tweets and their GPS metadata.

The next paper entitled "The power of smartphones" by Xia et al. [8] describes the typical smartphone computing systems, energy consumption of smartphone, and state-of-the-art techniques of energy saving for smartphones. They also propose a location-assisted Wi-Fi discovery scheme, which discovers the nearest Wi-Fi network access points (APs) using the user's location information which allows the user to switch to the Wi-Fi interface in an intelligent manner when the user arrives at the nearest Wi-Fi network AP.

The eighth paper entitled "Smartphone intelligent applications: a brief review" by Rashvand and Hsiao [9] discusses the main features at device level, system level, and application level in the deployment-oriented, objective review of smartphones (SFs). In order to perform a wide range of new and intelligent applications, they propose three classes of optimum solutions: (1) info-smartphones (SF-G0), (2) gadget-smartphones (SF-G1), and (3) professional-smartphones (SF-G2).

In the last paper entitled "User-centric incremental learning model of dynamic personal identification for mobile devices" by Tsai et al. [10] developed the system which focuses on multiview personal identification as captured images vary frequently in the mobile devices. The multiview personal identification is based on body direction detection and incremental learning. The former can provide different new training samples of the same person for the system, whereas the latter is developed to decide whether or not a recognized result should be added to the model. To dynamically select new samples from captured images, candidate analysis and output selection strategy (OSS) are applied to the system. The candidate analysis uses the recognition results to compute vital parameters, which are subsequently delivered to the OSS. The OSS method decides what important information can be learnt. By using these two mechanisms, the robustness of the model is enhanced. Besides, the learning model can adapt itself when different facial views are available. Such a work demonstrates a good example in the mobile environments.

## 3 Conclusion

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