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Intelligent Sensing and Decision Making in Smart Technologies

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Editorial

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Over the past several years, we have seen dramatic advancement in many application domains enabled by the use of mobile, wearable sensors, and other Internet of Things.[1] These hardware systems are made smart by various computational intelligence algorithms and sensing technologies.[2] This development has resulted in many emerging highly multidisciplinary research areas typically termed as smart-* technologies, including smart-healthcare,[3–6] smart-home,[7,8] smart-grid,[9] as well as smart vehicles and intelligent transportation systems.[10] These new technologies are transforming our society and have enormous economic impact. This Special Collection aims to bring together researchers and engineers from all these areas to disseminate their findings and to foster a community for researchers and engineers to exchange ideas and to form collaborations to further the advancement of the state of the art of smart and intelligent technologies.

This Special Collection accepted 14 articles submitted by authors from China, Taiwan, South Korea, Japan, United Kingdom, and Slovenia after rigorous peer reviews. These articles can be roughly divided into two categories: (1) research on fundamental issues related to wireless sensor networks, such as routing, energy management, and so on and (2) applications of wireless sensor networks in various fields, such as indoor localization, human activity and gesture recognition, and structural health monitoring.

Four articles belong to the first category. Liu et al. proposed a new way to evaluate the energy efficiency of data compression algorithms in wireless sensor networks in their article titled "A new scheme for evaluating energy efficiency of data compression in wireless sensor networks." They identified two key factors related to energy efficiency: (1) compression ratio and (2) the ratio of hardware energy consumption factor to the software energy consumption factor. The energy efficiency is higher if the compression ratio is higher and the hardware to software ratio is lower. By considering these two factors, they proposed a mechanism to improve the energy efficiency by the most effective compression algorithm according to the radio frequency power.

Lu et al. presented a path selection algorithm for anonymous communication in wireless sensor networks in their article titled "Path selection algorithm with minimal delay in wireless sensor networks." The path selection considers the round-trip time as a way to improve the performance of communication.

Wang et al. reported their work on service recommending in an article titled "Hybrid recommendation-based quality of service prediction for sensor services." They combined the latent Dirichlet allocation model to compute the similarity of the latent topics of the services, and the user's latent semantic themes to extract the potential services that are of most interest to the user. They showed that this hybrid recommendation method is more effective than traditional methods.

Xie et al. proposed a distributed beamforming algorithm for device-to-device communication in their article titled "Distributed beamforming algorithm based on game theory in device-to-device communications." Wireless device-to-device communication is becoming more popular among smartphone users because they can easily share multimedia and other types of files. The authors framed the problem as a noncooperative game and fully analyzed the complexity and overhead of proposed algorithm. They also assessed their algorithm with detailed simulations.

The remaining 10 articles belong to the second category. The article "Electromyogram-based hand gesture recognition robust to various arm postures" by Rhee and Shin proposed a new way of recognizing hand gesture that is robust to diverse arm postures based on fusion of accelerometer sensor data and electromyogram. They showed experimentally that their method

could achieve an average detection accuracy of 85.7%, which is a significant improvement over competing methods.

The article "Life prediction of the tensile damage progress for high-speed train gearbox shell based on acoustic emission sensor and an automatic optimization method" by Ai, Sun and Zhang reported their work on using data collected from acoustic emission sensors to predict the tensile damage progress for high-speed train gearbox shell. This method can make prediction in real-time and it is non-destructive. Their experiments show that their method can achieve a life prediction within 50 s. Their work can be very useful for passenger evaluation and train failure prevention.

The article "A hierarchical vision-based localization of rotor unmanned aerial vehicles for autonomous landing" by Yuan et al. presented a hierarchical framework to increase the working range of autonomous landing for unmanned aerial vehicles using computer vision-based localization. They conducted both simulation and field tests to verify their framework.

The article "A wireless sensor data-based coal mine gas monitoring algorithm with least squares support vector machines optimized by swarm intelligence techniques" by Chen at al. proposed a new algorithm to monitor coal mine gas level using wireless sensors. They developed a least squares support vector machine and optimized the algorithm with swarm intelligence techniques.

The article "Indoor positioning system for wireless sensor networks based on two-stage fuzzy inference" by Cheng and Yan proposed a new algorithm for more accurate indoor positioning system using wireless sensor networks. The algorithm is based on two-stage fuzzy inference to minimize the uncertainty in the received signal strength indicator from reference nodes. Via a simulation study, they confirmed that their algorithm performs better than non-fuzzy-based algorithms, including k-nearest neighbor-based localization and traditional triangular splitting schemes.

The article "Safety monitoring and evacuation guide system for pipeline testing laboratory by indoor positioning technique and distributed sensor network" by Ding et al. reported the design of a safety monitoring and evacuation guide system for pipeline laboratory. The system employs an indoor positioning technique and a distributed sensor network. The system has two key components. One is to detect gas levels with gas sensors. The other is to quickly plan on an evaluation route based on the gas detection and indoor positioning information.

The article "Development of unmanned remote smart rescue platform applying Internet of Things technology" by Kim, Sul, and Choi described the design and implementation of an unmanned remote smart rescue platform that can quickly respond on the occurrence of a distress call. This system consists of an unmanned remote smart rescue box, a cloud service, and an Android mobile application. The unmanned remote smart rescue box was tested under a sequence of scenarios with success.

Wang, Wu, and Zhang proposed a new energy management technique that can be used toward smart cities in their article titled "Consumer preference-enabled intelligent energy management for smart cities using game theoretic social tie." They framed the problem as a consumer preference-induced game and applied the cooperative game theory toward more intelligent energy management.

Wei et al. presented their work on sensor selection for activity recognition using wearable wireless sensors for human activity recognition in their article titled "Sensor Selection Scheme in Activity Recognition based on Hierarchical Feature Reduction." They proposed a new scheme to determine the number of sensors needed and their placement on the body by applying hierarchical feature reduction.

Xue et al. proposed a way of identifying structural parameters for structural health monitoring in their article titled "Parameter identification for structural health monitoring based on Monte Carlo method and likelihood estimate." Their method is based on Monte Carlo method and likelihood estimate, where parameters such as stiffness and damping are examined under three different conditions with no noise, with Gaussian noise, and with non-Gaussian noise.

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