Guest Editorial Preface

Special Issue of on Combining AI-Driven Ubiquitous Computing on Wearable Devices and Smart Distributed Systems

Wei Liu, China University of Geosciences, Beijing, China
Sudip Kumar Sahana, Birla Institute of Technology, Mesra, India
Wenjie Zhang, Nanjing University of Information Science and Technology, Nanjing, China

In recent years, more and more communications and commercial activities are moved to Internet, which promote the popularization of wearable devices and smart distributed systems (SDSs). Ubiquitous computing is a great way to handle the data from wearable devices and implement distributed computing systems, including Internet of Things (IoT) and wireless sensor networks (WSNs). It becomes a new trend to combine artificial intelligence (AI) with ubiquitous computing to enhance the quality of service and user experience. With the continuous emergence of wearable devices and SDSs with intelligence computing capacities, huge volumes of data floods the services and applications at the edge of networks by means of IoT and WSNs. The distributed data source poses some new challenges for ubiquitous computing with regard to data fabric analysis, data acquisition, data mining and data representation. Additionally, AI-driven technology may assist distributed systems to make decisions, which can make the systems become smart.

This special issue tries to provide a platform for both researchers in academia and practitioners in industry to share their latest studies and practices about AI technology and ubiquitous computing to enhance wearable devices and distribute systems. After strictly reviewing, eight articles are selected to cover the theme in this special issue.

The first article, "A Genetic Algorithm-Based Approach to Solve a New Time-Limited Travelling Salesman Problem", is authored by Moumita Mondal, and Durgesh Srivastava. In this article, the authors explained a time limited travelling salesman problem (TSP) where a time limit is associated with each city. The proposed TSP is solved by using a Genetic Algorithm based method. The cyclic crossover and special mutation operations have been adapted to GA for solving the proposed TSP. To show the effectiveness of proposed algorithm, the authors considered some benchmark instances. Computational results with different data sets are presented.

The second article, "Kinect Body Sensor Technology-Based Quantitative Assessment Method for Basketball Teaching", is authored by Youyang Wang. In this article, the author takes the quantitative assessment of basketball teaching as an example and proposes a new Kinect body sensor technology based quantitative assessment method for basketball teaching. Specifically, for basketball technology recognition and assessment tasks, the Kinect body sensor is first used to collect volunteer's 3D skeleton motion data, then feeding the collected skeleton sequence to the vision Transformer network to model the long-distance dependency. And based on this, the

skeleton motion recognition network and skeleton motion assessment network are developed. The experimental results show that our proposed networks can well recognize and quantitative assess the standard and non-standard basketball skill motions.

The third article, "An Effectively Volleyball Trajectory Estimation and Analysis Method With Embedded Graph Convolution", is authored by Guanghui Huang. In this article, the author proposes an effectively variant YOLOv4 framework to predict and analyze the volleyball trajectory based on video sequences. In the proposed framework, we adopt the pre-trained YOLOv4 to select some proposal regions with a high confidence score. Then, we embed graph convolution to effectively aggregate deep features. Moreover, to improve the detection and localization capacity of small targets, we introduce a new loss function by modeling the target area with Gaussian distribution. The experimental results show that the proposed framework can effectively prompt the performance of volleyball detection.

The fourth article, "Analysis on the Steps of Physical Education Teaching Based on Deep Learning", is authored by Aixia Dong. In this article, the author designs an analysis and evaluation system of physical education teaching steps based on deep learning technology. The intelligent wearable devices are used to conduct real-time dynamic monitoring students' exercise steps and heart rate in class, so as to build a sports teaching activity data set. We propose to analyze the time step sequence based on Transformer deep model to realize the estimation of motion effect. In addition, we propose a hierarchical fusion model based on Transformer, which makes full use of the steps and heart rate information to predict the abnormal situation in physical education. The experimental results show the effectiveness of our system.

The fifth article, "Wearable Device-Based Intelligent Patrol Inspection System Design and Implementation", is authored by Chengming Jin and Donghui Tong. In this article, the authors propose a wearable device based remote and intelligent patrol inspection system, which uses the cloud video transmission mode of both public and private clouds to realize the video connection between the power stations and the remote diagnosis center and uses the wearable devices for real experience. In this way, we can simulate real operation guidance and safety supervision, etc., so as to realize the remote management patrol operations, improve the fault detection efficiency and equipment reliability.

The sixth article, "Smart Sports Outward Bound Training Assistant System Based on WSNs", is authored by Jiali Zang. In this article, the author establishes an intelligent system to monitor fatigue status during outward bound training by using surface electromyography (sEMG) signals. The system consists of three parts: a wearable device, edge node, and cloud server. First, the wearable device collects sEMG signals. Second, the edge node processes the collected sEMG signals and send the sEMG signal features to cloud server. Finally, the cloud server returns the results to edge node according to a stored classification model which learnt from massive historical sEMG signals. The experimental results show the effectiveness of the proposed system.

The seventh article, "Sport Fatigue Monitoring and Analyzing Through Multi-Source Sensors", is authored by Jiya Wang and Huan Meng. In this article, the authors propose a fatigue monitoring system by using multi-source sensors. First, the sEMG signals of athlete are collected by multi-source sensors which are installed in a wearable device. Second, the collected sEMG signals are segmented by using fixed window to convert as Mel-frequency cepstral coefficients (MFCCs). Third, the MFCC features are used learn a Gaussian Processing model which is used to monitor future muscle fatigue status. The experiments show that the proposed system can recognize more than 90% muscle fatigue states.

The eighth article, "Physiological Big Data Mining Through Machine Learning and Wireless Sensor Network", is authored by Qianlin Tan, Xinyou Xu and Hongjia Liang. In this article, the authors propose establishing a wireless sensor network based medical platform, which implements sleep monitoring by mining electroencephalogram signals. The wireless sensor network based

medical platform adopts the end-edge-cloud architecture. The experiments and simulations show the effectiveness of proposed end-edge-cloud architecture based medical platform.

In conclusion, we hope that reading these high-quality articles can inspire you to make your own contributions to Ubiquitous Computing and Distributed Systems. We wish to thank both the authors and the reviewers for their hard work to help us assemble this Special Issue and would like to express our sincere gratitude to the Editor-in-Chief, Prof. Nik Bessis, for providing this opportunity and lots of guidance throughout the process.

Wei Liu
Sudip Kumar Sahana
Wenjie Zhang
Guest Editors
IJMBL