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Introduction to the special section on Recent Trends in Embedded Technologies and Wearable Systems: Computational Intelligence Solutions

Background

Rapid advances in real-time control of embedded and wearable system that relates to Computational Intelligence (CI) approaches play a vital role in many applications. Today's embedded technologies and wearable systems are becoming even more intimate and controlling in human lives. As with any technology, there are a number of challenges like security and privacy, energy consumption, application development platform and human-computer interaction in the usage of wearable and embedded technology. Further, the latest advancements in health monitoring and related applications make timely and important to explore the extent of embedded and wearable system developments in CI that might offer a paradigm shift in this context.

This special section brings together recent trends in CI, focusing on real-world applications for next generation embedded and wearable technologies. It addresses the current state of problems and how to handle the uncertainty with probabilistic, machine learning and adaptation methodologies. The CI branches are not limited to expert systems, artificial immune system, swarm intelligence, fuzzy system, neural network, evolutionary computing and various hybrid systems. They can also be combinations of two or more of these basic branches.

The collected papers in this special section have explored the capabilities of CI methods and their significant impact on embedded and wearable systems. Moreover, this special section has addressed the comprehensive nature of embedded wearable computing systems to emphasize the character of CI in modelling, identification, optimization, prediction, forecasting, and control of future generative systems.

Through a peer-review process, we have accepted six papers from a total of thirteen papers submitted to this special section. Each selected paper has received at least two rounds of peer-reviews. The accepted papers represent world-wide activities in this area and propose various theoretical research results and applications of computational intelligence and embedded technologies for wearable systems.

Papers in this special section

The first paper authored by Xiong Li et al. [1] proposes an enhanced 1-round authentication protocol for wireless body area networks (WBAN) with user anonymity. The authors have presented a secure authentication protocol for WBAN to remove the weaknesses of the existing protocols. Further, this study has been compared the proposed WBAN protocol with other related protocols in the aspect of security features elaborated informally, also formally proved by employing Burrows–Abadi–Needham (BAN) logic. The comparison results show that proposed WBAN protocol improves the security with equivalent cost.

In the second paper, Kai Cui et al. [2] present the hierarchical combinatorial testing method for smart phone software in wearable Internet of Things (IoT) Systems. The smart wearable systems with numerous states usually lead to various unanticipated problems. To address this problem, this paper revealed the connective and semantic similarity clustering algorithm (CSSCA) and a hierarchical combinatorial test model based on finite state machine (FSM) has been proposed in this research. Further, the shortest regular expression generation method has been employed to test the complex software system.

In the next paper by Nikola Milosevic et al. [3] address two machine learning aided approaches (classification and clustering) based on app permissions and source code analysis to detect the malicious Android apps. The use of machine learning allows the proposed algorithms to detect new malware families with high precision and recall rates. This study

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complements existing signature-based anti-malware solutions, as the latter not capable of detecting malicious software until the appropriate signatures are released. Specifically, the authors have demonstrated that the permission-based method was able to classify malware from good-ware in 89% of cases while source code analysis classification performance was over 95%. Accuracy rates of 95.1% using support vector machine (SVM), and 95.6% using the ensemble learning method are comparable with existing state-of-the art solutions.

In the paper proposed by Shadi Aljawarneh et al. [4], authors develop an agent method that extracts unorganized data through a range of search engines to examine the recent trends in a particular domain of wearable systems research. The proposed agent approach converts the raw documents found on the Internet into relevant information. To determine the key trends, this study have traced and analysed the behaviour of the agent development aspects using keywords over a long period. Moreover, a prototype has been developed in order to search for multiple keywords at the same time and collect the required data automatically to eliminate the useless data. Subsequently, the required data is converted into usable information. The results showed that the research trends in wearable systems are divided into four zones: growing, slowing down, decreasing gradually, and quickly decreasing zones.

In the fifth paper, Seokhoon Kang et al. [5] proposes a method of processing output from wearable devices for estimation of user motion. The proposed experimental methods improved noise reduction by 2-15dB compared with the Gaussian White Noise reduction method. The authors have concluded that the large motion recognition to the right did not have any significance to the experiment. This suggests that the methods proposed in this paper efficiently reduce noise when there are larger amounts of data. Further, this indicates that after efficient noise reduction, human motion can be accurately estimated via wearable devices' acceleration-values output.

In the last paper, Jamil Ahmad et al. [6] investigate embedded deep vision in smart cameras for multi-view objects representation and retrieval. Enhanced computational and storage capabilities in smart cameras establish them as promising platforms for implementing intelligent and autonomous surveillance networks. However, poor resolution, limited number of samples per object, and pose variation in multi-view surveillance streams, make the task of efficient image representation highly challenging. To address these issues, the authors have proposed an efficient and powerful convolutional neural network (CNN) based framework for features extraction using embedded processing on smart cameras. Efficient, high performance, pre-trained CNNs are separately fine-tuned on persons and vehicles to obtain discriminative, low dimensional features from segmented surveillance objects. Furthermore, multi-view queries of surveillance objects are used to improve retrieval performance. Experiments reveal better efficiency and retrieval performance in different surveillance datasets.

In conclusion, we think that this special section exhibits the latest research achievements on CI solutions which relate to embedded technologies and wearable systems. We sincerely hope that this special section would be a foundation for future research in this exciting field for researchers and readers. We would like to thank all the authors and reviewers for their contributions and hard work, and would like to sincerely thank the Editor-in-Chief for his guidance and continuous support during the review and publication process.

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