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Editorial

Wearable Technology and Mobile Applications for Healthcare

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Wearable technology (WT) and mobile applications (apps) are providing support for continuous health monitoring of people in a wide range of diseases, including psychological and physical. WT and apps can be especially useful in the aging population [1] for tracking the evolution of certain symptoms, providing motivational engagement and supporting telemedicine with remote monitoring. WT and apps are some of the pillars in the mHealth research [2]. Among most commons applications, apps can (a) geolocate lost people with neurodegenerative impairment, (b) collate patient-reported outcome measures and patient-reported experience measures (PROMs and PREMs), (c) automatically evaluate early symptoms of some neurodegenerative diseases by assessing features such as memory, and (d) keep track of emotional evolution like in the EmoPaint app. WT can (1) monitor the physical activity during the day by counting steps, which is useful in some rehabilitation or degenerative diseases, (2) track the heart's activity to ensure that the wearer's activity keeps the heart rate in a healthy and nonrisky range, and (3) check seeping patterns for ensuring the proper rest.

This special issue includes six works about the latest advances in WT and apps, including (a) hardware innovation about multisemantic vibrotactile for feedback, (b) intelligent analyses of sensor readings for predictions, (c) gait assessment, and (d) analysis of survey data about users' perceptions.

WT and apps have boosted a number of solutions with the aim of improving health and quality of people's life. In this special issue, F. D. Guillén-Gámez and M. J. Mayorga-Fernández analyzed the perceptions of patients and family members regarding the use of these new technologies. They also analyzed these perceptions in relation to the age and gender of participants. Their study showed an increase in technology interest in young women, the influence of age on the use of wearable devices, and the importance of privacy and confidence in the use of these technologies.

These technologies also can change health monitoring and open door for new monitoring systems for better healthcare delivery opportunities. Another factor to pay attention in this field is the necessity for predicting and prioritizing individuals' influential factors which impact on the process for adoption of wearable healthcare devices by consumers. The work of S. Asadi et al. of this special issue indicates that the perceived usefulness is one of the predictors that are more significant in the adoption of these devices. Other factors are health interest, perceived ease of use, initial trust, and consumers' innovativeness.

In the context of emotions, there is a large variety of apps that can track emotions, and generally with self-reported methods. Some apps rely on simply asking users to choose their emotions from questionnaires with scales such as PANAS (Positive and Negative Affect Schedule). Other apps are based on the estimation of emotions based on the analysis of other self-reported information. For instance, the EmoPaint app estimated emotions based on the analysis of self-reported bodily sensations relying on the initial prototypes proposed by L. Nummenmaa et al. [3]. This app also allowed the user to provide feedback about their emotions to keep an emotion diary with more accurate information and to let the app automatically learn from the feedback to customize the predictions for each user. In addition, the EmoPose app allowed users to report 3D emotional poses and detect emotions from these. The underlying method is based on the initial emotional body poses presented by K. Schindler et al. [4]. However, WT can automatically detect emotions from sensor data without the need for self-reporting information by users. C. E. Galván-Tejada et al. reported that sensor data are useful for detecting depression episodes in unipolar and bipolar patients. They used genetic algorithms for analyzing the activity signal from a smartband.

In some WT and apps, artificial intelligence (AI) plays a key role in predicting user emotions and diseases from the available data. In the case of emotions, EmoPaint used computer vision techniques (i.e., analysis of color histograms in different body areas), EmoPose applied case-based reasoning, and the work reported in this special issue by C. E. Galván-Tejada et al. is based on genetic algorithms. A. U. Haq et al. presented a hybrid intelligent system for classifying people with heart disease and healthy people. Their experiments with the Cleveland heart disease dataset compared the performance of seven well-known classifiers and three feature selection algorithms for this purpose.

WT is still limited in the feedback of eye-free scenarios. In this special issue, F. Wang et al. proposed a new mechanism for providing multisemantic vibrotactile feedback in wristbands. In particular, they evaluated a wristband system with five vibration patterns, using different vibration motors located in different places and orientations of the wristband. Their experimentation showed that participants were able to distinguish different vibration patterns with 90% accuracy.

Furthermore, WT can be used for gait assessment. In this special issue, R. Zhong et al. presented an approach for evaluating gait with four smart bracelets in wrists and ankles connected to an Android app in a smartphone and a website based on Microsoft Azure. Their user study revealed the utility of their approach for assessing gait in Chinese adults and provided feedback about which aspects could be improved from user experience viewpoint like the result visualization.

In the expansion of WT and apps for healthcare, some frameworks focus on the agile software development of these apps, like FAMAP (a framework for developing mHealth apps) [5]. This framework empowers the development of different apps and WTs for healthcare incorporating big data analytics and AI (e.g., including support for advanced agent-based simulators for predicting the repercussion of certain treatments or patient situations). In particular, EmoPaint and EmoPose apps were developed with FAMAP.

This special issue has presented the advances on monitoring users with WT and apps for healthcare, considering users' perceptions, emotion tracking, AI, vibrotactile feedback, and gait assessment. However, it is worth highlighting that, besides WT and apps, the interest of Internet of things (IoT) is continuously increasing in the context of healthcare [6], since IoT can automatically collate with big data from users on their home environment. Due to the huge amount of generated information from IoT, commonly IoT use fog computing for efficiently handling all these data. Similar techniques could be applied in WT and apps. In order to properly improve this expanding field, WT and apps need to support green computing and ensure the appropriate levels of security and privacy. We hope that this special issue encourages works towards future healthcare systems that integrate WT, apps, and IoT to monitor patients for applying AI techniques and big data analytics for accurately detecting patterns in patients and predicting possible relevant medical conditions. We also hope that researchers will be motivated by this special issue to continue the research in WT and apps for healthcare considering the aforementioned challenges.

Conflicts of Interest

The guest editors do not have any conflicts of interest concerning this special issue.

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