

Editorial

Recent Advances in Biometrics and Its Applications

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1. Introduction

Biometric recognition has become a burgeoning research area due to the industrial and government needs for security and privacy concerns. It has also become a center of focus for many authentication and identification applications in the civil and forensic fields. This Special Issue [1] aims to provide original research papers, as well as review articles focusing on recent advances in biometrics and its applications. It covers a wide range of topics in the field of biometrics, including biometrics-based authentication and identification, physiological and behavioral biometrics (e.g., finger, palm, face, eye, ear, iris, retina, gait, handwriting, voice, etc.), biometric feature extraction and matching, signal image and video processing in biometrics, advanced pattern recognition in biometrics, machine learning and deep learning in biometrics, fusion techniques in biometrics, soft biometrics, multimodal biometrics, security and privacy in biometrics, Big Data challenges in biometrics, online biometric systems, embedded biometric systems, emerging biometrics, and related applications.

2. In This Special Issue

The present issue [1] consists of twelve articles on some topics in the wide range of research topics covered in this special issue. Among many paper submissions that we received, these articles have been accepted after a careful peer-review process. This section summarizes the main contributions of these articles.

In [2], Wang et al. present an efficient biometric identification method using electrocardiogram signals. The proposed method is based on a feature learning process in the wavelet domain using sparse temporal-frequency autoencoding. Iula and Micucci in [3] propose a palmprint recognition system based on ultrasound images. The proposed system uses a gel pad to obtain acoustic coupling between the ultrasound probe and the user's hand. The collected volumetric image is then processed to extract 2D images of the palmprint at various under-skin depths, which can be used for palmprint recognition. In [4], Ammour et al. propose a multimodal biometric identification system based on face and iris traits. The proposed system is based on an efficient feature extraction method, which applies 2D log-Gabor filters for iris feature extraction and singular spectrum analysis with wavelet transform for facial feature extraction, and a fusion process that combines the relevant features from both modalities. Nakanishi and Maruoka (in [5]) study the biometric recognition using electroencephalograms (EEGs) stimulated by personal ultrasound. They propose a method based on individual features extracted from the log power spectra of EEG signals using principal component analysis. The verification process is achieved using a support vector machine technique with the extracted features. In [6], Heravi et al. study the impact of aging on the performance of three-dimensional facial verification. The authors propose an interesting method to simulate the possible facial appearance of a young adult in the future. The proposed method based on three-dimensional faces obtained from a 3D morphable face aging model, allows to enhance the performance of the 3D verification process. Ilyas et al. (in [7]) present an anti-spoofing system for human age verification. The proposed system is based on auditory perception, and it is identified as



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vulnerable to spoofing attacks. In [8], Fang et al. investigate the correlation between the left and right irises of an individual using a convolutional neural network (CNN) for iris recognition. They propose a method based on VGG16 architecture to classify left and right irises from the same or different individuals with high accuracy.

Other related applications that can involve biometrics have been presented in [9–13]. The authors propose interesting detection and recognition approaches with applications in the domain of watermarking [9], health [10–12], and nutrients analysis [13]. We found that the ideas of the proposed contributions for data processing, feature extraction, learning, and embedded systems, seem interesting to be considered in the field of biometrics. The authors highlighted some perspectives on how their work can be considered for biometric applications.

3. Future Perspectives

We have solicited original research work covering novel theories, innovative methods, and meaningful applications that can potentially lead to significant advances in biometrics. Based on the various contributions discussed in this Special Issue, research and development in this field will remain very active. Many different perspectives can be envisaged which, from our point of view, require more attention. For example, deep learning for biometrics, Big Data challenges in biometrics, and biometrics in the Internet-of-Things (IoT) technology.

Finally, we hope that the readers will find useful information and interesting contributions in this Special Issue.

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References

1. Boubchir, L.; Daachi, B. Special Issue Recent Advances in Biometrics and its Applications. *Electronics*. Available online: https://www.mdpi.com/journal/electronics/special_issues/biometrics_applications (accessed on 4 May 2021).
2. Wang, D.; Si, Y.; Yang, W.; Zhang, G.; Li, J. A Novel Electrocardiogram Biometric Identification Method Based on Temporal-Frequency Autoencoding. *Electronics* **2019**, *8*, 667. [CrossRef]
3. Iula, A.; Micucci, M. Experimental Validation of a Reliable Palmprint Recognition System Based on 2D Ultrasound Images. *Electronics* **2019**, *8*, 1393. [CrossRef]
4. Ammour, B.; Boubchir, L.; Bouden, T.; Ramdani, M. Face-Iris Multimodal Biometric Identification System. *Electronics* **2020**, *9*, 85. [CrossRef]
5. Nakanishi, I.; Maruoka, T. Biometrics Using Electroencephalograms Stimulated by Personal Ultrasound and Multidimensional Nonlinear Features. *Electronics* **2020**, *9*, 24. [CrossRef]
6. Heravi, F.M.Z.; Farazdaghi, E.; Fournier, R.; Nait-ali, A. Impact of Aging on Three-Dimensional Facial Verification. *Electronics* **2019**, *8*, 1170. [CrossRef]
7. Ilyas, M.; Othmani, A.; Fournier, R.; Nait-ali, A. Auditory Perception Based Anti-Spoofing System for Human Age Verification. *Electronics* **2019**, *8*, 1313. [CrossRef]
8. Fang, B.; Yuanfu, L.; Zhou, Z.; Li, Z.; Yan, Y.; Yang, L.; Jiao, G.; Li, G. Classification of Genetically Identical Left and Right Irises Using a Convolutional Neural Network. *Electronics* **2019**, *8*, 1109. [CrossRef]
9. Shoron, S.H.; Islam, M.; Uddin, J.; Shon, D.; Im, K.; Park, J.-H.; Lim, D.-S.; Jang, B.; Kim, J.-M. A Watermarking Technique for Biomedical Images Using SMQT, Otsu, and Fuzzy C-Means. *Electronics* **2019**, *8*, 975. [CrossRef]
10. De la Peña, S.; Polo, A.; Robles-Algarín, C. Implementation of a Portable Electromyographic Prototype for the Detection of Muscle Fatigue. *Electronics* **2019**, *8*, 619. [CrossRef]
11. Galkin, I.; Vorobyov, M.; Gainutdinovs, O.; Studers, P. Customized Vibration Generator for State of Health Monitoring of Prosthetic Implants and Pseudo-Bionic Machine-Human Feedbacks. *Electronics* **2019**, *8*, 810. [CrossRef]
12. Gil-Martín, M.; Montero, J.M.; San-Segundo, R. Parkinson's Disease Detection from Drawing Movements Using Convolutional Neural Networks. *Electronics* **2019**, *8*, 907. [CrossRef]
13. Ma, L.; Li, Z.; Birech, Z.; Li, S.; Yang, Y.; Zhang, W.; Hu, J. Multi-Channel Optoelectronic Measurement System for Soil Nutrients Analysis. *Electronics* **2019**, *8*, 451. [CrossRef]