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EDITORIAL

Introduction to the special issue on unconstrained biometrics: advances and trends

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1 Overview

To date, no research effort has produced a machine able to autonomously and covertly perform reliable recognition of human beings. Perhaps, contrary to popular belief, such automata are confined to science fiction, although it is not hard to anticipate the potential impact that they would have in modern societies (e.g., forensics and surveillance). Some of the biological traits used to perform biometric recognition support contactless data acquisition and can be imaged covertly. Thus, at least theoretically, the subsequent biometric recognition procedure can be performed without subjects' knowledge and in uncontrolled scenarios. This *real-world* scenario brings many challenges to the Pattern Recognition process, essentially due to poor quality of the acquired data. The feasibility of this type of recognition has received increasing attention and is of particular interest in visual surveillance, computer forensics, threat assessment, and other security areas. Though a growing number of researchers are concerned about the development of biometric recognition systems that operate in unconstrained conditions, many problems remain to be solved: how to deal with varying illumination sources, variations in poses and distances or blurred and low-quality data resultant of such acquisition conditions.

This special issue is particularly devoted to emerging strategies to perform biometric recognition under uncontrolled data acquisition conditions, ideally fully covert ones. Topics of interest include the following: less controlled/covert data acquisition frameworks; biometric data quality assessment; normalization of poor-quality biometric data; contactless biometric recognition; analysis of recognition robustness; multimodal and multispectral biometrics.

2 The special issue organization

The first paper is from Marsico et al. who proposed a framework for face recognition robust to pose and light variations that starts by implementing correction procedures that convert the acquired data to a frontal pose and to a uniform lighting. Then, they also propose to exploit general-purpose reliability margins, by considering the overall composition of the classifier gallery that allow to assess the quality of the system's response and to discard those ones whose reliability index is low. A paper from Roy et al. proposes the reconstruction of gait silhouette from occluded scenes. Their approach first detects the presence of occlusion and accordingly extracts clean and unclean gait cycles from the whole input sequence. In the second step, occluded silhouette frames are reconstructed using balanced Gaussian process dynamical models. Drygajlo and Li addressed the problem of time validity of biometric models and proposed to manage the aging influence on the adult face verification system by an A-stack age modeling technique, which is believed to allow improved long-term class separation. Woodard et al. explored the utility of the various appearance features extracted from the periocular region of data acquired

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in the visible wavelength. They employed a local appearance-based feature representation, where the periocular image was divided into spatially salient patches and locally based appearance features. Gafurov et al. proposed a recognition strategy based on foot motion. Three directional motions of the foot in terms of acceleration signals and ankle accelerations from three directions were collected and observed to contain enough discriminating information between individuals, in terms of signals frequency. Inspired by studies that indicated that behavioral characteristics also provide valuable information to face analysis in the human visual system, Santos-Sierra et al. focused on hand biometrics applied to images acquired from a mobile device and proposed a finger geometry recognition system that analyzes exclusively geometrical finger properties and allowing contact-less hand image acquisition. Motivated by the weak robustness that unimodal systems frequently have, Salah-ud-din et al. extracted directional energy-based feature vectors of palm and fingerprint identifiers that were further combined and used for recognition, fused at the score level by the sum and product rules. Hegde et al. proposed a recognition techniques based on the Radon transform of electrocardiogram signals and signal quantization. Correlation techniques were used to match identities, having authors concluded about the reliability of such type of signal for biometric recognition purposes. Finally, Hadid et al. reviewed the recent developments and discussed other important issues related to the use of facial dynamics in biometric recognition.

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