Guest Editorial
Introduction to the Special Issue on Image- and Video-Based Biometrics

OVER the past two decades, image- and video-based biometrics as a research field has experienced exponential growth. In addition to such traditional techniques as face, iris, and fingerprint recognition, many image- and video-based techniques using hand-shape, palmprint, gait, signature, and multimodal analysis have been developed. The forge-resistant nature of biometric technology makes it an ideal technology for applications ranging from forensic investigation for law enforcement and personal identification for secure access control to video surveillance for public places. Biometric technology has increasingly become a viable addition to traditional identification technology.

This Special Issue intends to collate the efforts and major achievements of scientists working on different biometric authentication techniques in an attempt to contribute to robust solutions to the many challenging problems in the area. We are very pleased with the quite large number of submissions, 41 in all. In order to accommodate all of the high-quality manuscripts, we have divided the accepted papers into two special issues. Ten papers are included in this first issue. Eight more papers will be published in the February issue of the IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY (IEEE TCSVT). This first issue focuses more on traditional biometrical technologies, such as face, iris, and fingerprint recognition. The second issue studies relatively newer technologies including gait, human body dynamics, palmprint, palm-dorsa vein-patterns, and multimodal algorithms.

This first installment of the Special Issue begins with two invited papers. The first invited paper, by Jain *et al.*, provides a comprehensive introduction to biometric recognition. A number of key issues for biometric systems are discussed, including system overview, system errors, comparison of different biometrics, applications, advantages and disadvantages of biometrics, unimodal and multimodal systems, as well as social acceptance and privacy issues. The second invited paper is on iris recognition. In this paper, Daugman systematically explains how the iris recognition algorithm works and presents new data on the statistical properties and singularity of iris patterns. Impressive results of 9.1 million comparisons of eye images from trials around the world are reported.

The next four papers focus on face detection and recognition algorithms. Xiao *et al.* propose a three-step face detection framework. Based on a simple-to-complex strategy, they develop a face detection algorithm using a simple linear filtering algorithm and a boosting chain algorithm, together with an SVM-filter and color-filter-based postfiltering algorithm. The method can detect faces of different views. The paper by Liu *et al.* presents an improved kernel Fisher discriminant analysis for face recognition. They propose a cosine kernel to increase the discriminating capability of the polynomial kernel function. Then using a geometry based feature vector selection scheme and a variant of Nearest Feature Line classifier they further improve the recognition performance of the KFDA algorithm.

Tang and Wang, in their paper, study an interesting new face recognition topic, face sketch recognition. They present a novel photo retrieval system using face sketches. By transforming a photo image into a sketch, the difference between photo and sketch is significantly reduced, thus allowing effective matching between the two. The algorithms are shown to outperform both traditional photo-based methods and the human performance.

The paper by Dorai *et al.* investigates dynamic characteristics of captured fingerprints. Traditional fingerprint capture involves only a single image; however, this paper shows that a video of a fingerprint can yield benefits in two areas. One is improved fingerprint quality by providing feedback to the subject on the placement and pressure of the finger. The other benefit is in spoof detection, where the combination of a stable fingerprint and a temporal component used for matching can defend against compromise of the fingerprint alone.

Park *et al.* explore a matching technique based on dominant ridge directions in a region of interest around a reference point. The purpose is twofold: one is to enable rotation-invariant matching, and the other is to enable matching on a small area (as is required on some new, smaller fingerprint sensors). Bazen and Velduis compare various methods for matching biometric feature vectors: Euclidean distance, likelihood ratio, and posterior probability. Chan *et al.* explore the premise that, by reducing the number of minutiae to only those within a small region of the reference point, the computation will be substantially reduced and the matching will be adequate. This is a topically interesting paper because there is increasing interest in embedded fingerprint solutions where matching is done on an inexpensive—and less powerful—processor. Their purpose is to reduce the computational load, especially for embedded system implementation, an area that is growing for fingerprints. The last face recognition paper, by Yan *et al.*, formulates the shape localization problem in the Bayesian framework. They first use a rankboost approach and an efficient iterative algorithm to accurately locate fiducial points and then extract local features around the fiducial points to combine with global texture features for face recognition.

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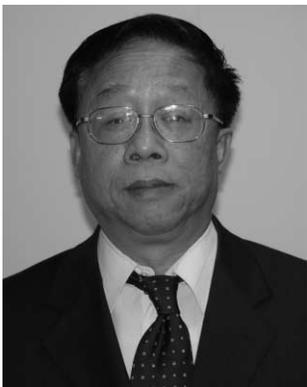
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Massimo Tistarelli was born on November 11, 1962, in Genoa, Italy. He received the degree in electronic engineering and the Ph.D. degree in computer science and robotics from the University of Genoa, Genoa, Italy, in 1987 and 1991, respectively.

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