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Preface

This issue of the *Journal of Telecommunications and Information Technology* contains papers devoted to various aspects of biometrical authentication systems, and in particular, to iris, face, speech, and on-line signature biometrics, multi-biometrics, and biometric template formation. The papers in this issue deal also with certain issues of crosstalk propagation in silicon substrates and with some mobile networks problems.

The first two papers of this issue deal with the iris biometrics. Przemysław Strzelczyk in his paper on *Robust and Accurate Iris Segmentation Algorithm for Color and Noisy Eye Images* addresses the segmentation problem of iris images captured in uncontrolled environments. His novel coarse-to-fine segmentation algorithm first uses modified Hough transform to roughly localize possible iris and pupil boundaries, initially approximating them by circles. Voting mechanisms are then applied to select the candidate iris regions, and the detailed iris boundary is approximated by a spline curve that minimize a boundary energy function. This algorithm is suitable for both monochrome and color eye images.

The paper on *Iris Recognition System Based on Zak-Gabor Wavelet Packets*, by Adam Czajka and Andrzej Pacut proposes a new iris coding method based on Zak-Gabor wavelet packet transform. The essential component of the proposed methodology is an effective adaptation of the transformation parameters that makes the coding sensitive to the frequencies characterizing the individual eye. The between-to-within class ratio of weakly correlated Zak-Gabor transformation coefficients is calculated, which allows for selection of the frequencies most suitable for iris recognition. The method provides a possibility to embed the biometric replay attack prevention methodology into the coding. The entire system includes a dedicated hardware, and its properties were evaluated using the database of 720 images. The methodology was also tested in remote access scenario, biometric smart cart development, and an iris recognition system with aliveness detection.

The next two papers discuss the face biometrics. In his *Image Preprocessing for Illumination Invariant Face Verification*, Mariusz Leszczyński discusses the crucial problem of the influence of face illumination conditions. Fourteen normalization algorithms based on histogram normalization, illumination properties and the human perception theory were compared using three verification methods. The best results were achieved using human perception related MSQ algorithm, with 38% less verification errors compared to the same DLDA discriminant method using un-preprocessed images. Very promising seems to be a combination of both histogram approach and photometric normalization.

In *Face Tracking and Recognition with the Use of Particle-Filtered Local Features* Łukasz A. Stasiak and Andrzej Pacut propose a particle filtering framework for parallel face tracking and recognition from video sequences. Randomized, particle filtering-driven local face features form a base for a cumulation mechanism of classification decisions. Application of the proposed mechanisms makes the framework resistant to brief visual distortions, such as occlusions, head rotations or face expressions. The framework can be implemented to operate in real time on a PC, and is tunable to various application requirements (security level, hardware constraints), achieving a high performance even on low resolution video frames.

Three next papers are devoted to speech analysis and speech biometrics. An invited paper of Mindaugas Greibus and Laimutis Telksnys on *Rule Based Speech Signal Segmentation* presents a solutions to an automated speech segmentation problem. Segmentation algorithms based on energetic threshold may fail in noisy environments. The Authors show that a rule based postprocessing of segments can give more stable result. Offline, online and extrema types of rules were investigated. The proposed extrema-type segmentation algorithms is enhanced by a rule base to extract higher energy level segments from noise. The algorithm performs about 8% better than threshold or dynamic threshold algorithms, yet its numerical complexity is low.

In their invited paper on *Speech Segmentation Algorithm Based on an Analysis of the Normalized Power Spectral Density*, Dzmitry Pekar and Siarhei Tsikhanenka present a new approach to speaker independent phoneme detection, which does not require any prior information about the signal, acoustic models of phonemes, or speaker's individual characteristics. In their approach, the distance between normalized power spectral densities is measured in adjacent, short-time segments and verified using velocity of changes in short-time signal energy. The proposed algorithm enables to reveal a phoneme structure of pronounced speech with about 90% probability.

The invited paper on *Relaxing the WDO Assumption in Blind Extraction of Speakers from Speech Mixtures* is presented by Włodzimierz Kasprzak, Ning Ding, and Nozomu Hamada. The time-frequency masking approach in blind speech extraction includes the spectrogram masking used to reconstruct the sources. Usually the binary mask is generated under strong W-disjoint orthogonality (WDO) assumption which is often violated in practice, thus leading to weak quality of reconstructed sources. The Authors propose WDO to be relaxed by allowing some frequency bins to be shared by both sources. Along with a detection of instantaneous fundamental frequencies, a harmonic structure of speech is explored to support creation of the mask. The proposed method is proved to be effective and reliable in both simulations and in experiments with genuinely acquired mixtures.

The signature biometrics is discussed by Joanna Putz-Leszczynska and Michał Kudelski in their paper on *Hidden Signature for DTW Signature Verification in Authorizing Payment Transactions*. The authors propose to form the on-line signature template using an approach that combines the dynamic time warping (DTW) technique with the least squares estimation. The verification algorithm employs a standardized error signals between the signature in question and the model. The method can also be used in mobile or embedded systems. The Authors describe a real-world implementation of the algorithm, namely the complete system designed for biometric payment transactions authorization. The authorization is performed directly at a point of sale.

In the paper on *Simulation Models of Biometric Authentication Systems Using Multi-Agent Approach*, Adrian Kapczyński and Tomasz Owczarek present an application of multiagent approach to biometric authentication systems. After presenting the state of the art, four simulation models of biometric authentication environments are examined. Those models are appropriately parameterized and explored under various conditions with the use of programmable modeling environment for simulating natural and social phenomena.

The next two papers discuss the problem of creation of biometric templates. Since the variability of biometric data obtained for the same person is an intrinsic property of every biometric system, the problem of finding "a best representative" of the enrollment set, called the template, is present since the beginning of biometrics. This problem is solved differently for different biometric types, yet usually the template somehow averages the collected data samples. Andrzej Pacut in his paper on *Probabilistic Issues in Biometric Template Design* discuss various basic possible meanings of the term "the best representative", basing his derivations on minimization of various average dissimilarity indexes in L_1 or L_2 spaces. He solves the underlying minimization problems and discuss some properties of the resulting

templates. In particular, for i.i.d. samples of independent component vectors, a probability is derived how likely it is for a vector of medians to belong to the sample.

Marcin Chochowski in his paper on *The Template Selection in Biometric Systems Based on Binary Iris Codes* considers the general problem of a small enrolment sample size as compared to sample vector lengths, using as an important example the iris biometrics. He shows by simulations that the averaging is justified also in the case of iris template creation. This is an important fact, which can significantly improve the performance of biometric template protection methods. In particular, binary iris coding algorithms using the majority code as the template lead to better results.

The next paper on *Impact of Crosstalk into High Resistivity Silicon Substrate on the RF Performance of SOI MOSFET*, Khaled Ben Ali, César Roda Neve, Ali Gharsallah, and Jean-Pierre Raskin discuss crosstalk propagation through silicon substrate, which is a serious limiting factor of the performance of the RF devices and circuits. They analyze experimentally the substrate crosstalk in high resistivity silicon substrate, and discuss its impact on the RF behavior of silicon-on-insulator (SOI) MOS transistors. The authors demonstrate an efficiency in the reduction of the sideband noise tones of the solution that employs a trap-rich polysilicon layer located underneath the buried oxide (BOX) of the high resistivity (HR) SOI wafer. They also propose an equivalent circuit to model and analyze the generation of these sideband noise tones.

Ayodeji James Bamisaye and Michael O. Kolawole in their paper on *Capacity and Quality Optimization of CDMA Networks* discuss coverage and capacity issues of the process of planning cellular mobile networks of third generation (3G) that aims to allow the maximum number of users sending and receiving signal of adequate strength. The paper describes conceptual expressions required for network coverage and capacity optimization analysis, examines service quality issues, and presents some practical solutions to CDMA networks.

The paper of Sunilkumar S. Manvi, Lokesh B. Bhajantri, and Vittalkumar K. Vagga on *Routing Misbehavior Detection in MANETs Using 2ACK* proposes a routing misbehavior detection in mobile ad-hoc networks (MANETs) using 2ACK scheme. The MANETs routing protocols are designed on the assumption that all participating nodes are fully cooperative. This may not be fulfilled due to the open structure and scarcely available battery-based energy. As there is no retransmission of packets once it is sent in MANETs, care must be taken not to lose packets. The authors analyze and evaluate the 2ACK technique to detect and mitigate the effect of a routing misbehavior and propose to embed certain security aspects to the 2ACK scheme to check confidentiality of the message. They use a verification of the original hash code with the hash code generated at the destination. If 2ACK is not received within the wait time or the hash code of the message is changed then the node to next hop link of sender is declared as the misbehaving link. The performance of the proposed setup is checked by simulations.

Andrzej Pacut
Guest Editor

*Institute of Control and Computation Engineering
Warsaw University of Technology
Biometric Laboratories
Research and Academic Computer Network NASK*

