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Editorial

Intelligent Computing for Pattern Recognition, Image Processing and Computer Vision

This special issue titled "Intelligent Computing for Pattern Recognition, Image Processing and Computer Vision" publishes extended versions of the best articles presented at the 19th Iberoamerican Congress on Pattern Recognition (Congreso Iberoamericano de Reconocimiento de Patrones CIARP'2014), held in Puerto Vallarta, Jalisco, Mexico, 2–5 November 2014. Under a strict peer review, the accepted papers present state-of-the-art research on mathematical and intelligent computing techniques for pattern recognition, computer vision, image, and signal analyses as well as on a wide range of their applications. Following the goal of this special issue, we identify two sets of papers involving intelligent computing: one discusses feature extraction, classification, and geometric algebra voting, and the second concerns geometric recognition, color image processing, detection, and tracking.

Vladimir Ryazanov estimates the quality of clustering results based on an estimation of the stability of clustering. The criterion does not use any probabilistic assumptions or distances in feature space. For some well-known clustering algorithms, the author obtains efficient methods for computing the introduced stability criteria according to the training set. This approach is shown using real and artificial examples for various situations. The forensic detection of median filtering has recently attracted the attention of the research community, mainly because of the median filtering's potential uses for tampering and concealing image tampering traces in digital images. A. Ferreira, J.-A. Dos Santos, and A. Rocha propose multiscale and multiperturbation solutions that build a highly discriminative feature space, which highlights the artifacts of median filtering via image quality measures. The proposed methods achieve promising results when validated with a series of real-world test cases, comprising different image compression levels, resolutions, and also a cross-dataset validation protocol. A. Rosales-Perez, J.-A. Gonzalez, C. A. Coello Coello, C.-A. Reyes-Garcia, and H. J. Escalante introduce a multiobjective evolutionary approach for data reduction. Their method simultaneously generates prototypes and selects features for k-nearest-neighbors classifiers. Contrary to most existing approaches, this method treats the problem with multiobjective evolutionary optimizers. The authors show the effectiveness of their proposal in benchmark data and compare its performance with state-of-the-art techniques. R. Ocampo-Vega, G. Sanchez-Antey, M. A. de Lunaz, R, Vega, Luis E. Falcon-Morales, and H. Sossa improve pattern classification of DNA microarray data by using principal component analysis (PCA) and logistic regression. As the predictive accuracy of supervised classifiers decays with irrelevant and redundant features, the necessity of a dimensionality reduction process is essential. The main idea is to retain only the genes that are the most influential in the classification of the disease. In this paper, a new methodology based on PCA and logistic regression is proposed. Their method enables the selection of particular genes that are relevant for classification. Experiments were run using eight different classifiers on two benchmark datasets: leukemia and lymphoma. The results show that our method not only reduces the number of required attributes, but also increases the classification accuracy in more than 10% of all the cases we tested. G.-E. Altamirano-Gomez and E. Bayro-Corrochano introduce a novel geometric voting scheme that extends previous algorithms, such as the Hough transform and tensor voting, in order to tackle perceptual organization problems. Their approach is based on three methodologies: representation of information using conformal geometric algebra; a local voting process, which introduces global perceptual considerations on a low level; and a global voting process, which clusters salient geometric entities

that are supported in the whole image. Conformal geometric algebra provides a suitable mathematical framework, which allows their algorithm to infer high-level geometric representations of percepts in an image. Experiments show the capability of their algorithm to represent objects in images in terms of circles and lines, even though it contains noisy input, incomplete data, illusory or nonlinear contours. G. Hernandez-Sierra, J.-R. Calvo, and J.-F. Bonastre utilized new temporal information for speaker recognition systems and specificity selection approach using a mask in the cumulative vector space. Furthermore in this space, temporal information can be exploited to compensate for the effects of session variability. A variable compensation method in the temporal space is used to remove the unwanted attributes of session variability and the common attributes among speakers. The goal is to increase effectiveness in the speaker's binary key paradigm. The experimental validation, done on the NIST-SRE framework, demonstrates the efficiency of the proposed solutions, which shows an EER improvement of 9%. The combination of i-vector and binary approaches, using the proposed methods, showed the complementarity of the discriminatory information each exploited.

The contributions in the second set of papers for geometric recognition, color image processing, detection, and tracking show exciting developments. Models based on q-grams are widely used in communication theory, natural language processing, statistical pattern classification, and other areas of machine learning. In this paper, C.-L. Alvarez and A.-R. Dominguez used the idea of a geometric q-gram to solve the place recognition problem, which is fundamental in autonomous navigation. A conventional approach for solving the place recognition problem uses histograms of visual features, typically losing the spatial location of said features in the process. The authors' approach first detects points of interest and assigns labels to them based on visual features; then the images are represented by a set of geometric q-grams obtained from triangles of an expanded Delaunay triangulation, thus implicitly encoding relative spatial information. Through this representation and the use of an inverted index, images that match a query can be efficiently recovered in real time. The proposed approach is path independent and was tested on publicly available datasets, resulting in a high recall rate and reduced time complexity. It has been reported in many works on skin detection and segmentation from color images that skin color models suffer from low specificity and high variance of the skin color, and this problem can be addressed by conforming the skin model to a presented scene. The paper of G. López-Gonzalez, N. Arana-Daniel, and E. Bayro-Corrochano concerns quaternion support vector machines for classification as a generalization of the real- and complex-valued support vector machines. In this framework they handle the design of kernels involving the Clifford or quaternion product. The application section shows interesting experiments on pattern recognition and color image processing. They also present a way to expand the number of classes without the need to increase the number of classifiers as in standard approaches. M. Kawulok, J. Kawulok, J. Nalepa, and B. Smolka introduce a new hybrid adaptation system that combines adaptation from a detected facial region and a self-adaptive scheme that creates a local model based on the response obtained using the global one. As a result of this hybrid adaptation, they obtain a local skin color model and use it to extract seeds for the geodesic distance transform that determines the boundaries of skin regions. The results of their extensive experimental study confirm that the proposed algorithm outperforms several state-of-the-art methods as well as their earlier adaptive skin detectors. Tracking-by-detection methods have become increasingly popular recently. Y. Martinez-Diaz, N. Hernandez, and H. Mendez-Vazquez present a new multiface tracking algorithm based on the association of detection responses given by a spatiotemporal face detector, which are considered initial small trajectories or tracklets. An appearance model based on the spatiotemporal information is used to guide the tracker. Additionally, a new adaptive Kalman filter that dynamically adjusts its parameters on the basis of the quality of the detector output is proposed. The approach introduced here is evaluated on several challenging video sequences from the YouTube Faces database, achieving a very good performance.

This special issue highlights new developments in novel mathematical and intelligent computing techniques for low- and middle-level processing, illustrating new trends in image processing and 2D analysis using intelligent computing. The guest editor is very thankful to all the anonymous reviewers of the journal and the unwavering and generous support of the editor-in-chief, Fazel Famili.

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