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Editorial

Pattern Recognition: Recent Advances and Applications

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Research in pattern recognition has exponentially increased in the past decades due to the improvement in both quality and resolution of imaging sensors and the dramatic increase in computational power. These advances have also been accompanied by smoothing the boundaries between different applications of pattern recognition, making it really interdisciplinary. Numeric mathematical methods combined with novel neural network techniques have been especially successful for pattern recognition.

This special issue collects six original research contributions that present recent advances in mathematical methods of pattern recognition as well as important applications in engineering and social activities. In particular, the papers address the following areas of pattern recognition: template and descriptor-based matching algorithms, gesture recognition, visual object tracking, deep learning techniques, event detection, document processing, and recognition. The collection of papers with different areas of pattern recognition clearly points to the need for communication between researches of these areas. It is the hope that this special issue will help the dialog to fruition.

First, the paper by J. Diaz-Escobar et al. entitled "LUIFT: LUminance Invariant Feature Transform" provides an illumination-invariant method for computing local feature points and descriptors. The method is well stated mathematically and is able to extract the most significant local features in images degraded by nonuniform illumination, geometric distortions, and heavy scene noise. Since the method utilizes image phase information rather than intensity variations, as most of the state-of-the-art descriptors, it is robust to nonuniform illumination and noise degradation. It is interesting to note a fruitful use of the monogenic scale-space framework to compute the local phase, orientation, energy, and phase congruency from the image at different scales. The proposed descriptor is created from the histograms of oriented gradients of phase congruency. Extensive simulation results show that the proposed method yields a superior feature detection and matching performance under illumination changes, noise degradation, and slight geometric distortions comparing with that of the state-of-the-art descriptors.

S. A. Wibowo et al. in the paper entitled "Convolutional Shallow Features for Performance Improvement of Histogram of Oriented Gradients in Visual Object Tracking" describe how to improve the performance of histogram of oriented gradients (HOG) features-based visual object tracking algorithm when the target is influenced by a change in motion or size. The proposed method combines a response map between the HOG and convolutional shallow features. The latter features are computed from a shallow layer of a pretrained convolutional neural network with the input. The target location is predicted based on the maximum value of the optimized final response map. To overcome the change in target appearance during tracking a model update is utilized. Extensive computer results using a common benchmark dataset show that the proposed method significantly improves the robustness performance of a HOG-feature based approach.

The paper entitled "Modified Dynamic Time Warping Based on Direction Similarity for Fast Gesture Recognition" by H-R. Choi and T. Kim suggests a modified dynamic

time warping (DTW) algorithm for application to gesture recognition. The proposed method compares gesture-position sequences based on direction of the gestural movement. Since a standard DTW does not specifically consider two-dimensional characteristics of the user's movement, the sequence comparison by the standard DTW could be improved. The proposed gesture-recognition system compares sequences of the input gesture position with ones saved in database and selects the most similar gesture by filtering out unrelated gestures. The suggested algorithm uses the cosine similarity of the movement direction at each moment to calculate the difference. It also reflects the characteristics of the gesture movement by using the ratio of the Euclidean distance and the proportional distance to the calculated difference. Selective spline interpolation assists in solving the issue of recognition-decline at instances of gestures. Through experiments with public databases, the suggested algorithm yields an improved performance compared to that of common methods.

The paper by S. Huang et al. entitled "Learning Multimodal Deep Representations for Crowd Anomaly Event Detection" utilizes unsupervised deep learning framework to detect anomaly events in crowded scenes. Specifically, low-level visual features, energy features, and motion map features are simultaneously extracted based on spatiotemporal energy measurements. Three convolutional restricted Boltzmann machines are trained to model the mid-level feature representation of normal patterns. Then a multimodal fusion scheme is utilized to learn the deep representation of crowd patterns. Based on the learned deep representation, a one-class support vector machine model is used to detect anomaly events. The proposed method is evaluated using two available public datasets and compared with state-of-the-art methods. The experimental results show its competitive performance for anomaly event detection in video surveillance.

The paper entitled "Reliable Recognition of Partially Occluded Objects with Correlation Filters" by A. Ruchay et al. deals with recognition of partially occluded objects using adaptive correlation approach. Basically, design of conventional correlation filters requires explicit knowledge of the appearance and shape of a target object. So the performance of correlation filters is significantly affected by changes in the appearance of the object in the input scene. In particular, the performance of correlation filters worsens when objects to be recognized are partially occluded by other objects, and the input scene contains a cluttered background and noise. The proposed system consists of a set of adaptive correlation filters for recognition of partially occluded objects in noisy scenes. Since the input scene may contain different fragments of the target, false objects, and background to be rejected, the system is designed in such a manner to guarantee equally high correlation peaks corresponding to parts of the target in the scene. The key points of the system are as follows: (i) it contains a bank of composite optimum filters, which yield the best performance for different parts of the target; (ii) it includes a fragmentation of the target into a given number of parts in the training stage to provide equal intensity responses of the system for each part of the target. With the help of computer simulation, the performance of the proposed algorithm for recognition partially occluded objects is compared with that of common algorithms in terms of objective metrics.

Finally, the paper entitled "ANACONJ Analyzer of the Conjunction AND in Spanish Using Syntactic Patterns and Semantic Frames" by A. D. C. Rasgado addresses this issue in the field of document processing and recognition. ANACONJ is an algorithm for text recognition, which uses rules and syntactic patterns to analyze each word of a sentence in a phrase, identifying those sentences with conjunctions to build a semantic tree of the sentence. The proposed algorithm can be used as teaching Spanish software and can be applied for a service robot. Computer simulation results show that the algorithm is able to identify semantics of more than 90% of conjunctions.

We believe that the special issue will be useful for researchers and practitioners working in the broad computer vision and pattern recognition communities.

Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of the special issue.

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The guest editorial team would like to express gratitude to all the authors for their interest in selecting this special issue as a venue for disseminating their scholarly work. The editors also wish to thank the anonymous reviewers for their careful reading of the manuscripts submitted to this special issue collection and their many insightful comments and suggestions.

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