Foreword and Editorial

International Journal of Signal Processing, Image Processing and Pattern Recognition

We are very happy to publish this issue of International Journal of Signal Processing, Image Processing and Pattern Recognition by Science and Engineering Research Support Society.

This issue contains 37 articles. Achieving such a high quality of papers would have been impossible without the huge work that was undertaken by the Editorial Board members and External Reviewers. We take this opportunity to thank them for their great support and cooperation.

The paper “Iris Recognition Algorithm based on MMC-SPP” proposes a iris recognition algorithm based on maximum margin criterion (MMC) and structure preserving projection (SPP). Firstly, the original high dimensional data is divided into several subsystems, and then SPP algorithm is used to reduce the iris feature dimension, the structural relationship between iris sample pattern collection manifold structure and the same sample of different pattern at the same time, finally, MMC function is introduced to improve the ability of classification algorithm by considering the iris category information, and the nearest neighbor classification algorithm is used to classify the iris image, and the recognition result of iris images is obtained by using the voting method.

Paper “Research on Sensing Compression Method in Image Denoising” studies a kind of different from the traditional signal processing theory, compressed sensing. The theory in the process of data transmission greatly save the space and the cost of storage and transmission is a new breakthrough in the data mining technology. Application of compressed sensing principle, the discrete tracking algorithm combined with matrix learning algorithm, to deal with the noise of original image.

In the paper “Research on Support Vector Machine in Image Denoising”, a denoising algorithm and simulation experiments of algorithm based on wavelet transform and support vector machine (SVM) image is proposed, a new method is adopted in the selection of characteristic vector of support vector machine, based on training of support vector machine, the support vector machine model is used to distinguish between noise and the original image, to achieve the effect of denoising.

In the paper “Image Denoising Method based on Threshold, Wavelet Transform and Genetic Algorithm”, wavelet transform is used in the image denoising, and the genetic algorithm is used to estimate the denoising results. Experimental results show the validity of the new algorithm.

Paper “Multi-modal Medical Image Fusion Based on Non-subsampled Shearlet Transform” proposed a multi-modal medical image fusion method based on Non-subsampled Shearlet Transform. Firstly, in this method, source images are decomposed into low-pass and high-pass subbands by NSST. Then, due to the characteristic features--large sparsity and strong
contrast, the high-frequency and low-frequency coefficients of the images are fused by the different fusion rules. Finally, the image is reconstructed by the inverse non-sampled shearlet transform. In the method, the fusion rules are designed based on the regional energy and the average gradient; the image entropy, relative quality, average gradient, standard deviation and spatial frequency were used to evaluate the fusion results objectively. In the experiments, CT and MRI images are chosen to verify the method. Both the visual and the objective analysis show that the proposed method is better than the conventional Wavelet-based and non-subsampling Contourlet-based methods.

In the paper “Compute Similarity of CAD Models Based on Bipartite Graph”, a new method to compute the similarity between two CAD models is presented in which a bipartite graph is used to match source faces with target faces in order to retrieve a satisfied CAD model from a large model library. The number of edges in faces is extracted from CAD models. Based on the number of edges in faces, the similarity between source face and target face is computed. The maximum matching weight is calculated by KM algorithm. Then, the similarity between two CAD models is gotten. Several CAD models are given and their similarities are computed.

Author of the paper “A Graph-based Algorithm to Build Knowledge Map for Minority Languages” study how to discover the evolution of knowledge map in multi-languages. The approach is uniquely designed to capture the rich topology of semantic items and to link the sub-graph to a global knowledge map. Instead of building a knowledge map start from scratch, it conceptually defines semantic classes as a quantized unit of evolutionary link in sub-graph and discovers new knowledge with multi-language dictionaries. Discovered new knowledge items are then connected to form an evolution knowledge map using a measure derived from the underlying semantic classes. It integrates these noisy items and entities into a unified probabilistic knowledge map using ideas from graph-based algorithm.

The paper “Investigation on Digital Media Image Processing Algorithm Based on Asynchronous and Inertia Adaptive Particle Swarm Optimization” propose a new algorithm for digital media image segmentation, and it is also can be used in the image processing. The algorithm is based on asynchronous particle swarm optimization algorithm to obtain the adaptive threshold; take the inertia factor into the algorithm, the optimal threshold has been acquired for the image segmentation. Compared with other particle swarm optimization algorithm, the algorithm has the advantages of stable, easy to converge to the optimal solution, and high segmentation speed.

The Paper “A Research about Adaptive Subdivision Algorithm Based On Doo-Sabin Mode” proposed an adaptive Doo-Sabin Mode subdivision algorithm to solve this problem, which take the average vector of the vertex and the angle between the intersecting surfaces of the vertex as a measurement criterion. This criterion is used to divide the surface, and then make local subdivision. In this way, when the times of subdivision are fewer (the demand of smoothness is not too high), the effect of subdivision has little difference, but efficiency of the algorithm can be greatly improved. Compared with the normal Doo-Sabin subdivision model, experimental results showed that adaptive Doo-Sabin subdivision algorithm can largely slow the growth speed of the amount of model data on the premise that guarantee the quality of surface.
Result of the paper “Single-camera Three-dimensional Tracking of Underwater Objects” says that the trajectory exactly describing the three-dimensional motion trend of the interest objects is produced by the video filmed by a single camera. They present results over real underwater videos. Both single-object and multi-object tracking in three-dimensional space are achieved by using the proposed method.

In the paper “Phase Sensitivity to Acoustic Pressure of Microstructured Optical Fibers: A comparison Study”, the finite element solver (FES), COMSOL multiphysics, is used to study and compare the response to acoustic pressure of a hollow-core photonic band gap fiber (HC-PBF), a solid-core photonic crystal fiber (SC-PCF), and a conventional single-mode fiber (SMF) for different acoustic pressures in the frequency range from 10 kHz to 50 kHz. The key structural factors affect the sensitivity to acoustic pressure (S) of the microstructured fibers are studied and a mathematical formula describes the relation of S and the dominant structural factor is proposed. Simulation results of the investigated optical fibers show that the normalized responsivity (NR) of the HC-1550, LMA-5, and SMF are -344 dB, -367.5 dB, and -366 dB, respectively.

The Authors of “Iris Recognition based on Block Theory and Self-adaptive Feature Selection” proposed a novel method for iris recognition based on block theory and self-adaptive feature selection. Firstly, the normalized iris image is decomposed by convolving with multi-scale and multi-orientation Gabor filters, and then separated into several blocks, the block feature vector which includes mean and variance of Gabor coefficients inside each block can be obtained through statistical techniques, the iris feature vector of the whole iris image is then constructed by conjugating the block feature vector in row column order, finally the two-classifier of iris image are established based on the most distinguishable features, and the multi-classifiers of iris image are established by voting mechanism, and the performance is test by CASIA iris database.

Paper “Dynamic Behavior Analysis of a Class of Neurons Network Model” studied on a mathematical model of neurons network cells. Firstly the study conducted numerical calculation by the C language program, and then simulated drawings with the grapher to analyze the model's complex dynamic conduct under different control parameters in the change interval of bifurcation parameter. Period-adding bifurcation and period doubling bifurcation must exist in the graph of ISI for different control parameters. As the external electric fields join in, the dynamic conduct of neuron model will change under corresponding parameters.

The paper entitled “A New Parallel Segmentation Algorithm for Medical Image” proposed a new parallel segmentation algorithm with regional growth and support vector machine (SVM). SVMs have a good result in segmentation (classification) but a non-ideal convergence rate which is the advantage of regional growth method. So that, combining them and the idea of the algorithm is: classify by SVM to search the seed points, segment by regional growth method. A curvature flow filter is also used in this algorithm to reduce the noise.

Results of the study “Detection of Low Frequency Signals using Interferometric Fiber Sensors based on Phase Generated Carrier Demodulation Technique” indicate that in the demodulation of weak ELF signals, DC drift occurs in the DCM approach, while the Arctangent approach does not have this problem. Then, an optical fiber sensing system for
ELF signals is established based on optical fiber interferometer, indicating the Arctangent approach is able to demodulate the VLF signals accurately.

The paper “Multi-Focus Image Fusion Based on Sparse Decomposition”, proposed a novel multi-focus image fusion approach with sparse decomposition in order to effectively improve fusion quality. The source images are decomposed into principal and sparse components by robust principal component analysis (RPCA) decomposition. A sliding window technique is applied to inhibiting blocking artifacts. The focused pixels of the source images are detected by using the salient features within the sliding window and integrated to construct the final fused image.

In the paper “ECG Compression Algorithm Based on Empirical Mode Decomposition”, a compression algorithm based on Empirical Mode Decomposition (EMD) is described in order to investigate the performance of EMD in biomedical signals, and especially in the case of electrocardiogram (ECG). The proposed algorithm is computationally simple to treat non-stationary and nonlinear data without pre- or post-processing. In order to evaluate the performance of the proposed compression algorithm, MIT-BIH arrhythmia database is applied, and the compress ratio (CR), percent root mean square difference (PRD), percent root mean square difference normalized (PRDN), root mean square (RMS), signal to noise ratio (SNR), and quality score (QS) values are obtained. When compared, good fidelity parameters are yielded with high CR as compared to wavelet transform (WT).

Authors of the paper “M-estimation Methods for Fetal Heart Rate Estimation in Impulse Noises” introduce the M-estimation methods, a more robust methodology, to extract pure MECG in impulse noises. In order to evaluate the performance of M-estimation methods, two innovative quantitative performance metrics, namely loss degree of fetal R wave and sensitivity of initial value, are proposed. Numerical results show that: (1) FHR estimation using M-estimation methods is more accurate than least square method (LSM) in impulse noises; (2) the robust performance of Fair is better than that of Cauchy in low SNR; (3) the robust performance of Cauchy is superior to that of Fair in high SNR.

The study “A New Finger-Knuckle-Print ROI Extraction Method Based on Two-Stage Center Point Detection” proposes a new FKP region of interest (ROI) extraction method based on two-stage center point detection. In the method, a center point preliminary detection is constructed to capture the center point initially. Then, an efficient center point positioned algorithm is presented to locate the center point more precisely in real time. Finally, it selects the Hong Kong Polytechnic University (PolyU) database to verify the efficiency of the proposed method. The experimental results show that the proposed method can extract ROI not only accurately but also in real time.

Paper “On-board Robust Vehicle Detection Using Knowledge-based Features and Motion Trajectory” presents a robust and efficient method for vehicle detection in dynamic traffic environments. First, two adaptive vehicle hypothesis generation methods based on shadow and vehicle wave are presented, and then it assemble these two features into vehicle hypothesis. A hypothesis verification algorithm based on vehicle motion trajectory is proposed, the on-line hypothesis verification algorithm based on vehicle motion trajectory can not only reduce the false positive alarm caused by interferences, but also handle the problem that the classifiers generated in the off-line training phase is closely related to the diversity of positive and negative samples. Quantitative analysis on both public vehicle image datasets
and real-time video presents a result of 85.58% detection rate with 4.13% false positive rate. And the algorithm could run as fast as 40ms/frame on PC platform.

Paper “A Remote Sensing Industrial Solid Waste Image Segmentation Method Based on Improved Watershed Algorithm” proposes a new image segmentation method based on marker-controlled watershed transform and region merging. The method gets the final partition result by two-phrase segmentation on the pan-sharpened true color ALOS image. In the first phase, color gradient image of original image should be calculated and then it is modified by morphological impose minima, which should use markers extracted in two different ways. Lastly, preliminary segmentation result is obtained by watershed transform operates on the modified color gradient image. To solve the over-segmentation of industrial solid waste and other ground objects, region merging operation is performed according to the similarity measure criterion based on segmented objects’ color histogram Bhattacharyya coefficient in the second phrase, and then the final result is obtained. This method has been tested on the pan-sharpened ALOS image of 2.5 meters resolution in Shizuishan industrial zone, China.

The experiment result in “Face Automatic Detection based on Elliptic Skin Model and Improved Adaboost Algorithm” a method of face automatic detection based on improved elliptic skin extraction combining Adaboost algorithm is proposed. Firstly, the image is transformed from RGB space into nonlinear YCbCr space using nonlinear color transformation technology. Secondly, skin area is extracted based on elliptic skin model and after morphological image processing and face candidate region judgment, possible face region is determined preliminarily. Finally, face is detected accurately using improved cascade classifier.

The paper “Human Action Recognition Based on Global Gist Feature and Local Patch Coding” proposed a novel combination representation called global Gist feature and local patch coding. Firstly, Gist feature captures spectrum information of actions in a global view, with spatial relationship among body parts. Secondly, Gist feature located in different grids of the action-centric region is divided into four patches according to the frequencies of action variance. Afterwards on the basis of traditional bag-of-words (BoW) model, a novel formation of local patch coding is adopted. Each patch is encoded independently and finally all the visual words are concatenated to represent high variability of human actions. By combining local patch coding, the proposed method not only solves the problem that global descriptors cannot reliably identified actions in complex backgrounds, but also reduces the redundant features in a video.

Paper “A Study on Image Processing of Log Inner Decay Derived from Stress Wave Testing Based on MATLAB” deals about image processing of log internal decays using MATLAB technique. Specifically, image enhancement, image edge detection and decay area extraction and calculation on the two-dimension image of log inner decays that were derived by using the non-destructive inspection technique of stress wave were conducted. The results showed that the testing image of stress wave can visually reflect wood inner decay, and the image resolution can also be improved by using the functions of image enhancement and edge detection in MATLAB software. The detection precision of stress wave is closely associated with the ratio of log internal decay area to tested wood cross-sectional area. When the ratio between wood actual inner decay area and tested log cross-sectional area increased from 4.77% to 45.52%, the relative error between tested decay area and actual decay area reduced.
from 16.42% to 7.39%. The study has provided an advanced method to judge the degree of wood inner decay for most forest practitioners and researchers. Through the image processing and computing on the images derived by stress wave testing, the accuracy of logs internal decay discrimination can be significantly improved.

In the paper, “A Face Detection Method Used for Color Images”, a novel method is proposed based on skin color segmentation and geometry features. Firstly, some common color models are analyzed, and a large amount of skin images are used to establish an YCbCr color model for region segmentation. Then, the morphological processing is executed on the binary image, and the facial regions filtering is conducted by adopting some geometry constraints such as Euler number, the ratio of width and height, centroid. Finally, the face region is located and labeled with a rectangle.

The paper “Visual Attention Saliency Model for License Plate Location” proposed a license plate location model based on visual attention, which imitates the biological mechanism of human visual. Four major visual sensitive characteristics of Chinese license plate are applied. First, the features of intensity, color and texture are extracted and integrated to structure the saliency map; second, the obtaining the optimal threshold based on the shape feature for foreground segmentation; at last, support vector machine is applied to eliminate the false plates in the image.

Paper “Moving Crack detection based on Improved VIBE and Multiple Filtering in Image Processing Techniques” presents a new approach in image processing for detection crack in video. This method involves two main steps: First, it use based on Visual Background Extractor (Vibe) to detection moving crack in video. Second steps: Using a suitable threshold in a binary image and classifies all pixels two groups’ background and foreground. And use filter area and changes the area if less than the specific number to back; and using filtering to elimination of residual noise. This paper describes a method for detection crack in video it use Image Processing Techniques. The advantage of this method is clearly and accurate detection of cracks in video.

The study “A Combined Color and Texture Features Based Methodology for Recognition of Crop Field Image” presents a methodology to recognize certain crop fields’ images using texture, color and combination of both types of features. In this work, it have considered eight varieties of crop images, namely, Brinjal, Cotton, Groundnut, Paddy, Soyabean, Sugarcane and Sunflower. Texture features using GLCM and color features using HSV are deployed. Artificial Neural Network (ANN) is used for recognition. Considering only as feature, classification accuracies of 63.75%, 66.25% and 84.375% are obtained using texture, color and their combination respectively. The work is helpful in the area of agriculture for early detection and prevention of diseases.

The paper “Improving brightness using Dynamic Fuzzy Histogram Equalization” proposed brightness preserving dynamic fuzzy histogram equalization using triangular membership function which is the modified technique of histogram equalization. This modified technique, called Brightness Preserving Dynamic Fuzzy Histogram Equalization (BPDFHE), uses fuzzy statistics of digital images for their representation and processing in the fuzzy area which enables the technique to handle the approximation of gray level values in a better way for better presentation. This algorithm enhances image contrast as well as conserves the
brightness very well. Some images are not available to excellent quality, so proposed Fuzzy algorithm can be used for image enhancement to improve the quality of the image.

In the paper “Sensor Fusion based on Complementary Algorithms using MEMS IMU” presented a comparative analysis for the orientation problem using different approaches. Kalman filter and particle filter are considered the benchmark for position and attitude estimation, however, the associated computation burden in some circumstances are undesirable. Complementary filters are ideal in such situation. Both ECA and GDCA are effective and novel approaches in this regard. With the power of adjustable gain, these techniques find places in most of the real world applications.

Paper “A Comparative Study between the Support Vectors Machines and the K-Nearest Neighbors in the Handwritten Latin Numerals Recognition” present a comparison between two methods of learning-classification, the first is the K-Nearest Neighbors (KNN) and the second is the Support Vectors Machines (SVM), these both methods are supervised and used for the recognition of handwritten Latin numerals that are extracted from the MNIST standard database. The recognition process organized as follows: in the pre-processing of numeral images, it exploited the thresholding, the centering and the normalization techniques, in the features extraction it have used the morphology mathematical, the zoning and the zig-zag methods. The classification methods include the K-Nearest Neighbors and the Support Vectors Machines.

The paper “Miniaturized Tri-Band BPF using Asymmetric SIRs and DGS” proposed a tri-band microstrip Bandpass Filter (BPF) for the application of GSM (1.8GHz), WiMAX (2.86GHz) and UWB (3.32– 5.12GHz). By integrating two narrow passbands filter with UWB filter; a tri-band response is achieved. The filter response performance is improved by introducing the asymmetric SIRs with Defected Ground structure (DGS). An appearance of transmission zeroes of the proposed structure guarantee the sharpness, the skirts of scattering parameters of triple-band Band pass filter (BPF). The proposed filter shows very low return loss of -42.57 dB, insertion loss of -0.04dB, and compact which shows that the filter is more efficient.

In the paper “Wavelet Threshold-Based ECG Data Compression Technique Using Immune Optimization Algorithm” proposed a new ECG compression method called Wavelet Threshold Based Immune Algorithm (WTBIA). This method based on finding the best threshold level for each wavelet subband using Immune Algorithm (IA). The WTBIA algorithm consists of three main steps: 1) Applying 1-D Discrete Wavelet Transform (DWT) on ECG signal; 2) Thresholding of wavelet coefficients in each subband; and 3) Minimization of the Percent Root mean square Difference (PRD) and maximization of the Compression Ratio (CR) using IA. The main advantage of this method is finding the best threshold level for each subband based on the required CR and PRD. The compression algorithm was implemented and tested upon records selected from the MIT-BIH arrhythmia database [6] using different wavelets such as Haar, Daubechies, Coiflet, Symlet and Biorthogonal.

Paper “Consistent Labeling Approach for a PTZ Camera Based on Template Cache and Least Recently Used Replacement Strategy” proposed a consistent labeling approach for a PTZ (Pan-Tilt-Zoom) camera. The same object is assigned the same label while the object in the FOV (Field-of-View) of a PTZ camera without influencing by the pan/tilt rotation. In order to achieve the above goal, the proposed approach using several methods, such as temporal
differencing, template matching, mean-shift tracking, Kalman filter, and so on. A template cache is also designed for preserving the templates of an object with various angles and a least recently used (LRU) replacement mechanism is used to update the cache.

In the paper “Fingerprint Matching Using Minutiae-Singular Points Network” presented the implementation of a new minutiae-based fingerprint pattern matching algorithm. The algorithm uses the Euclidian and spatial characteristics of the minutiae and the core points to determine the similarity score for two fingerprint images. The obtained results showed the effectiveness of the algorithm at distinguishing fingerprints from different sources with average FAR of 0%. The algorithm yielded different FRR values for the used datasets due to unequal corruption and noise levels. The first dataset is mostly affected with FRR values of 10.23% while the third dataset is least affected with FRR value of 5.51%.

The paper “A Rule Based Approach for Classification of Shades of Basic Colors of Fabric Images” presents a rule based approach to classify the different shades of basic colors of fabric images. The RGB color features are extracted. The mean and standard deviation of shades of red, green and blue colors are computed. A rule base is designed taking into account, the mean and standard deviation values. It has considered ten shades of each of the basic colors. It has got maximum recognition rate of 98% for red color and minimum recognition rate of 97.07% for blue color. The overall recognition rate of 97.64% is obtained.

Paper “A Survey on Arabic Character Recognition” described a survey of Arabic character recognition systems. The most significant approaches to recognition of printed Arabic texts have been provided. However, such systems are not useful to deal with the inherent complexity of handwriting. The investigation into problems of recognition of handwritten Arabic words shows that most techniques developed so far are based on recognition of whole words without segmentation. This is due to the cursive nature and the peculiar ligatures of Arabic script.

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