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Editorial

Special Issue on "Advances in Image Processing, Analysis and Recognition Technology"

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For many decades researchers have been trying to make computer analysis of images as effective as the human vision system is. For this purpose many algorithms and systems have been proposed so far. The whole process covers various stages including image processing, representation and recognition. The results of this work find many applications in computer-assisted areas of everyday life. They improve particular activities, give handy tools, sometimes only for entertainment, but quite often significantly increasing our safety. In fact, the practical implementation of image processing algorithms is particularly wide. Moreover, the rapid growth of computational complexity and computer efficiency has allowed for the development of more sophisticated and effective algorithms and tools. Although significant progress has been made so far, many issues still remain open, resulting in the need for the development of novel approaches.

The aim of this Special Issue on "Advances in Image Processing, Analysis and Recognition Technology" was to give the researchers the opportunity to provide new trends, latest achievements and research directions as well as present their current work on the important problem of image processing, analysis and recognition. The Special Issue includes 22 papers devoted to various aspects of digital image processing, analysis and recognition, of which there are 21 research articles and one review paper.

In [1] CIELab, a color-based component substitution pan sharpening algorithm is proposed for pan sharpening of the Pleiades Very High Resolution images. The proposed approach obtained promising results and improved the spectral and spatial information preservation. The pan sharpening was also the subject of [2]. In the latter, a method for pan sharpening by focusing on a compressed sensing technique was proposed.

The paper [3] provides a proposition of a texture description method with a set of multifractal descriptors for the identification of different macerals. The proposed method is based on the multifractal spectrum calculated from the method of multifractal detrended fluctuation analysis (MF-DFA).

A lightweight solution for the estimation of affine parameters in affine motion compensation is proposed in [4]. It tries to speed up the process by means of evaluating affine prediction when it is likely to bring no encoding efficiency benefit as well as estimating better initial values for the iteration process. The optical flow between the reference image and the current image is applied in order to estimate the best encoding mode and achieve a better initial estimation.

In paper [5] an image registration algorithm based on convolutional neural network (CNN) and local homography transformation is proposed. It applies firstly a novel sample and label generation method based on Moving Direct Linear Transformation (MDLT). Later, the local homography matrices between the two images are estimated by means of the MDLT and finally the image registration can be realized.

The Authors of [6] proposed a pre-classified deep-learning algorithm (MGEP-SRCNN) applying a Multi-label Gene Expression Programming (MGEP), which screens out a sample sub-bank with high relevance to the target image before image block extraction, pre-classifies samples in a multi-label framework, and then performs nonlinear mapping and image reconstruction.

The detection of suspicious behavior using video sequences in a CCTV video stream is the subject of [7]. The proposed method detected suspicious behavior with a temporal saliency map by combining the moving reactivity features of motion magnitude and gradient extracted by optical flow.

The paper [8] is devoted to the problem of haze removal from a single image in real-time. For this purpose, a normalized pixel-wise dark-channel prior is applied. In order to solve some problems with computational cost normalized pixel-wise haze estimation without losing the detailed structure of, the transmission map is used. The Authors additionally proposed robust atmospheric-light estimation using a coarse-to-fine search strategy and down-sampled haze estimation.

In [9] a stable sparse model with a non-tight frame (SSM-NTF) is proposed and a dictionary pair learning model to stably recover the signals is formulated. The approach is applied on various image restoration tasks such as denoising, super resolution and inpainting.

The paper [10] provides a proposition of a stronger adaptive local dimming method with details preservation. The approach, combining the advantages of some existing methods and introducing the combination of the subjective and objective evaluation, obtains a stronger adaptation. Additionally, in the paper the bi-histogram equalization algorithm is developed and a new pixel compensation method is proposed.

In [11] the Authors use image quality metrics to evaluate the performance of several image fusion techniques to assess the spectral and spatial quality of pan-sharpened images. They evaluated twelve pan-sharpening algorithms, and experimentally proved that the Local Mean and Variance Matching (IMVM) algorithm was the best in terms of spectral consistency and synthesis.

The Authors of [12] propose a data-driven redundant transform based on Parseval frames (DRTPF) by applying the frame and its dual frame as the backward and forward transform operators, respectively. The proposed model combines a synthesis and an analysis sparse systems.

In [13] the problem of bilingual scene text reading is considered. For this purpose, an octave convolution (OctConv) feature extractor and a time-restricted attention encoder–decoder module for end-to-end scene text reading are proposed and experimentally investigated.

The next contribution describes ideas of automatic cell segmentation and counting, which is an important problem in the analysis of microscopic images [14]. For this purpose fundamental yet effective image processing algorithms were applied.

In [15] the automatic recognition of leaf images is considered. The applied approach is based on a Dual-output pulse-coupled neural network and Bag of features. Additionally, Bag of contour fragments was applied for shape feature extraction. Finally, Linear Discriminant Analysis was used for feature dimensionality reduction, and a Linear Support Vector Machine for classification. The proposed approaches were experimentally investigated using several leaf image datasets.

The application of machine learning for the extraction of information from historical documents was the subject of works described in [16]. Because of the character of the data being investigated, (numerals were written in red) firstly a red color filter was applied in order to separate numerals from documents, and then a CNN-based segmentation method for spotting these numerals.

The Authors of [17] used a fine-tuning method for image classification of large-scale remote sensing datasets. The approach applies feature extraction from the fine-tuned neural networks, and remote sensing image classification with a Support Vector Machine model with linear and Radial Basis Function kernels.

In [18] a hybrid network based on an attention mechanism for stereoscopic salient object detection was proposed. It was combined with an encoder–decoder network. The described novel attention model is based on the fusion of RGB and depth attention maps.

The problem of small objects and objects with large scale variants detection was analyzed in [19]. For solving this problem, an approach based on multi-scale balanced sampling was proposed.

The submission [20] discusses the problems connected with the segmentation of similar phases in different ironmaking feedstock materials by means of automated optical image analysis and provides the description of the algorithms designed for textural identification.

In [21] the idea of applying simple shape features for action recognition based on binary silhouettes was proposed. It was shown that basic shape features can discriminate between short, primitive actions performed by a single person.

The last paper [22] provides a review of the approaches applied for dental images. The goal of the Authors was the description of the state of the art of artificial intelligence in dental applications, such as the detection of teeth, caries, filled teeth, crown, prosthesis, dental implants and endodontic treatment.

The above brief description of the contributions provides the conclusion that the possibilities of applying image processing, analysis and recognition techniques for various problems are wide. In the papers accepted for publication in the Special Issue the analysis of high resolution satellite [1,11], aerial [17], microscopic [3,14], optical [20] and dental [22] images was provided. Image registration [5], restoration [6,9], fusion [11], and denoising [12] were also taken into account as well as the haze removal from images [8], backlight extraction [10], pan sharpening [1,2] and object detection [18,19]. Some specific applications were also considered—text detection and recognition from natural images [13], leaf image recognition [15] and historical document analysis [16]. Finally, not only still images were processed. Video coding [4] and the analysis of video sequences for suspicious behavior detection [7] and action recognition [21] were analyzed as well.

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References

1. Rahimzadeganasl, A.; Alganci, U.; Goksel, C. An Approach for the Pan Sharpening of Very High Resolution Satellite Images Using a CIELab Color Based Component Substitution Algorithm. *Appl. Sci.* **2019**, *9*, 5234. [CrossRef]
2. Tsukamoto, N.; Sugaya, Y.; Omachi, S. Pansharpening by Complementing Compressed Sensing with Spectral Correction. *Appl. Sci.* **2020**, *10*, 5789. [CrossRef]
3. Liu, M.; Wang, P.; Chen, S.; Zhang, D. The Classification of Inertinite Macerals in Coal Based on the Multifractal Spectrum Method. *Appl. Sci.* **2019**, *9*, 5509. [CrossRef]
4. Chauvet, A.; Sugaya, Y.; Miyazaki, T.; Omachi, S. Optical Flow-Based Fast Motion Parameters Estimation for Affine Motion Compensation. *Appl. Sci.* **2020**, *10*, 729. [CrossRef]
5. Wang, Y.; Yu, M.; Jiang, G.; Pan, Z.; Lin, J. Image Registration Algorithm Based on Convolutional Neural Network and Local Homography Transformation. *Appl. Sci.* **2020**, *10*, 732. [CrossRef]
6. Tang, J.; Huang, C.; Liu, J.; Zhu, H. Image Super-Resolution Based on CNN Using Multilabel Gene Expression Programming. *Appl. Sci.* **2020**, *10*, 854. [CrossRef]
7. Cheoi, K.J. Temporal Saliency-Based Suspicious Behavior Pattern Detection. *Appl. Sci.* **2020**, *10*, 1020. [CrossRef]
8. Iwamoto, Y.; Hashimoto, N.; Chen, Y.-W. Real-Time Haze Removal Using Normalised Pixel-Wise Dark-Channel Prior and Robust Atmospheric-Light Estimation. *Appl. Sci.* **2020**, *10*, 1165. [CrossRef]
9. Zhang, M.; Shi, Y.; Qi, N.; Yin, B. Stable Sparse Model with Non-Tight Frame. *Appl. Sci.* **2020**, *10*, 1771. [CrossRef]
10. Zhang, T.; Du, W.; Wang, H.; Zeng, Q.; Fan, L. A Stronger Aadaptive Local Dimming Method with Details Preservation. *Appl. Sci.* **2020**, *10*, 1820. [CrossRef]
11. Mhangara, P.; Mapurisa, W.; Mudau, N. Comparison of Image Fusion Techniques Using *Satellite Pour l'Observation de la Terre* (SPOT) 6 Satellite Imagery. *Appl. Sci.* **2020**, *10*, 1881. [CrossRef]
12. Zhang, M.; Shi, Y.; Qi, N.; Yin, B. Data-Driven Redundant Transform Based on Parseval Frames. *Appl. Sci.* **2020**, *10*, 2891. [CrossRef]

13. Tadesse, D.A.; Liu, C.-M.; Ta, V.-D. Unconstrained Bilingual Scene Text Reading Using Octave as a Feature Extractor. *Appl. Sci.* **2020**, *10*, 4474. [CrossRef]
14. Dimauro, G.; Di Pierro, D.; Deperte, F.; Simone, L.; Fina, P.R. A Smartphone-Based Cell Segmentation to Support Nasal Cytology. *Appl. Sci.* **2020**, *10*, 4567. [CrossRef]
15. Zhang, Y.; Cui, J.; Wang, Z.; Kang, J.; Min, Y. Leaf Image Recognition Based on Bag of Features. *Appl. Sci.* **2020**, *10*, 5177. [CrossRef]
16. Can, Y.S.; Kabadayı, M.E. Automatic CNN-Based Arabic Numeral Spotting and Handwritten Digit Recognition by Using Deep Transfer Learning in Ottoman Population Registers. *Appl. Sci.* **2020**, *10*, 5430. [CrossRef]
17. Petrovska, B.; Atanasova-Pacemska, T.; Corizzo, R.; Mignone, P.; Lameski, P.; Zdravevski, E. Aerial Scene Classification through Fine-Tuning with Adaptive Learning Rates and Label Smoothing. *Appl. Sci.* **2020**, *10*, 5792. [CrossRef]
18. Chen, Y.; Zhou, W. Hybrid-Attention Network for RGB-D Salient Object Detection. *Appl. Sci.* **2020**, *10*, 5806. [CrossRef]
19. Yu, H.; Gong, J.; Chen, D. Object Detection Using Multi-Scale Balanced Sampling. *Appl. Sci.* **2020**, *10*, 6053. [CrossRef]
20. Donskoi, E.; Poliakov, A. Advances in Optical Image Analysis Textural Segmentation in Ironmaking. *Appl. Sci.* **2020**, *10*, 6242. [CrossRef]
21. Gościewska, K.; Frejlichowski, D. The Analysis of Shape Features for the Purpose of Exercise Types Classification Using Silhouette Sequences. *Appl. Sci.* **2020**, *10*, 6728. [CrossRef]
22. Prados-Privado, M.; Villalón, J.G.; Martínez-Martínez, C.H.; Ivorra, C. Dental Images Recognition Technology and Applications: A Literature Review. *Appl. Sci.* **2020**, *10*, 2856. [CrossRef]