*electronics*

MDPI

*Editorial*

# Digital Signal, Image and Video Processing for Emerging Multimedia Technology

**Byung-Gyu Kim**

Department of IT Engineering, Sookmyung Women's University, Seoul 04310, Korea; bg.kim@sookmyung.ac.kr

Received: 14 November 2020; Accepted: 19 November 2020; Published: 27 November 2020


Recent developments in image/video-based deep learning technology have enabled new services in the field of multimedia and recognition technology [1–3]. The technologies underlying the development of these recognition and emerging services are based on essential signal and image processing algorithms. In addition, the recent realistic media services, mixed reality, augmented reality and virtual reality media services also require very high-definition media creation, personalization, and transmission technologies, and this demand continues to grow [4,5]. To accommodate these needs, international standardization and industry are studying various digital signal and image processing technologies to provide a variety of new or future media services. In this issue, we present high-quality papers that study advanced signal/image processing and video data processing, including deep learning approaches.

Twenty-three papers relating to digital signal, image and video processing for emerging multimedia technology have been published in this Special Issue. They deal with some advanced issues regarding signal/image processing and video data processing, including deep learning approaches, such as the convolution neural network (CNN) and generative adversarial networks (GANs).

Classifying and recognizing objects is very important task in the image and video signal processing area. In [6], Tsai, M.-F et al. not only proposed multiple feature dependency detection to identify key parts of pets (mouth and tail), but also combined the meaning of the pet's bark (growl and cry) to identify the pet's mood and state. Nguyen, K et al. presented an evaluation of state-of-the-art deep-learning detectors including Faster Regional CNN (Faster R-CNN), Region-based Fully Convolutional Networks (RFCN), Scale Normalization for Image Pyramids with Efficient Resampling (SNIPER), Single-Shot Detector (SSD), YOLO (You Only Look Once), RetinaNet, and CenterNet for the object detection in videos captured by drones [7]. Additionally, the impact of age and gender in sentiment analysis was explored as this could help e-commerce retailers to market their products based on specific demographics by Kumar, S et al. [8]. To make a clean image, Wu, C et al. proposed an image text deblurring method based on a generative adversarial network. The model of the algorithm consists of two generative adversarial networks, combined with Wasserstein distance, using a combination of adversarial loss and perceptual loss on unpaired datasets to train the network model to restore the captured blurred images into clear and natural image [9]. In [10], the authors proposed a new and efficient method for the detection and recognition of moving objects in a sequence of images captured from a UAV, in real time and in a real environment. Kang, S et al. proposed a convolutional neural network (CNN)-based steganalytic method that allowed ternary classification to simultaneously identify WOW and UNIWARD, which were representative adaptive image steganographic algorithms [11]. A novel smoke detection algorithm that reduces false positive detection using spatial and temporal features based on deep learning from factory installed surveillance cameras was suggested by Lee, Y et al. [12]. Gómez Blas, N et al. reported a study and implementation of a convolutional neural network to identify and recognize humpback whale specimens by processing their tail patterns [13].

In the field of learning mechanism design, Xu, Y. et al. investigated a method named NL2LL to collect the underexposure images and the corresponding normal exposure images by adjusting

camera settings in the "normal" level of light during the daytime [14]. An approach to hyperparameter optimization for the objective function in machine learning was proposed by Kim, Y. et al. [15]. In [16], Xia, S.et al. suggested an effective method for exploring discriminative regions of the scene image using the gradient-weighted class activation mapping (Grad-CAM) technique and weakly supervised information to generate the attention map (AM) of scene images.

For video processing, Yan, T. et al. proposed a novel ρ domain rate control algorithm for multiview high efficiency video coding (MV-HEVC) [17]. In addition, Maturana-Espinosa, J.C. et al. proposed two rate-allocation algorithms which provided reconstructions that were progressive in quality [18]. They used Optimized Sub-band Layers Allocation (OSLA) and Estimated-Slope sub-band Layers Allocation (ESLA). To gain more coding efficiency, a perspective affine motion compensation (PAMC) method which can cope with more complex motions such as shear and shape distortion was proposed by Choi, Y.-J. et al. [19].

As the advanced theory of digital signal and image processing, Maqsood, S. et al. proposed a novel multiscale image fusion system based on contrast enhancement, spatial gradient information and multiscale image matting to extract the focused region information from multiple source images [20]. In [21], an edge-preserving nonlinear filter was proposed to reduce multiplicative noise by using a filter structure based on mathematical morphology by Ince, I. F. et al. This method was called the minimum index of dispersion (MID) filter. Zhu, Y. et al. suggested an altered adaptive algorithm on block-compressive sensing (BCS) by using saliency and error analysis [22]. In [23], Benavides-Álvarez, C. et al. implemented a new strategy called Wiener-Granger Causality theory based on self-content images extracted using a Content-Based Image Retrieval (CBIR) methodology, for classifying natural scenery images. A scale-invariant deep neural network model based on wavelets for single image super-resolution (SISR) was proposed by Sahito, F. et al. [24].

In the field of security and data protection, Khan, A.N. et al. suggested an efficient separable reversible data hiding scheme over a homomorphically encrypted image that assures privacy preservation of the contents in the cloud environment [25]. In addition, Lee, J.Y. improved the performance of embedding capacity using PEE, inter-component prediction, and allowable pixel ranges. Inter-component prediction utilized a strong correlation between the texture image and the depth map in 3D video [26]. For CCTV video security, a character order preserving (COP)-transformation technique that allows the secure protection of video meta-data was proposed by Kim, J. et al. [27].

Lastly, Lee, J. et al. developed a wrist-mounted dive computer, so called DiverPAD, for underwater drawing and writing. For the framework design, firmware, communication protocol, user interface (UI), and underwater touchscreen functions were designed and integrated on DiverPAD [28].

I hope that the technical papers published in this Special Issue can help researchers and readers to understand the emerging theories and technologies in the field of digital signal, image, and video signal processing.

**Acknowledgments:** We thank all authors, who submitted excellent research work to this special issue. We are grateful to all reviewers who contributed evaluations of scientific merits and quality of the manuscripts and provided countless valuable suggestions to improve their quality and the overall value for the scientific community. Our special thanks go to the editorial board of MDPI Electronics journal for the opportunity to guest edit this special issue, and to the Electronics Editorial Office staff for the hard and precise work to keep a rigorous peer-review schedule and timely publication.

**Conflicts of Interest:** The author declare no conflict of interest.

## References

1. Kim, J.-H.; Hong, G.-S.; Kim, B.-G.; Dogra, D.P. deepGesture: Deep learning-based gesture recognition scheme using motion sensors. *Displays* **2018**, *55*, 38–45. [CrossRef]
2. Kim, J.-H.; Kim, B.-G.; Roy, P.P.; Jeong, D.-M. Efficient Facial Expression Recognition Algorithm Based on Hierarchical Deep Neural Network Structure. *IEEE Access* **2019**, *7*, 41273–41285. [CrossRef]

3. Jeong, D.; Kim, B.-G.; Dong, S.-Y. Deep Joint Spatiotemporal Network (DJSTN) for Efficient Facial Expression Recognition. *Sensors* **2020**, *20*, 1936. [CrossRef]
4. Lee, J.-H.; Lee, Y.-W.; Jun, D.-S.; Kim, B.-G. Efficient Color Artifact Removal Algorithm Based on High-Efficiency Video Coding (HEVC) for High-Dynamic Range Video Sequences. *IEEE Access* **2020**, *8*, 64099–64111. [CrossRef]
5. Kim, B.-G. Novel Inter-Mode Decision Algorithm Based on Macroblock (MB) Tracking for the P-Slice in H.264/AVC Video Coding. *IEEE Trans. Circuits Syst. Video Technol.* **2008**, *18*, 273–279. [CrossRef]
6. Tsai, M.-F.; Lin, P.-C.; Huang, Z.-H.; Lin, C.-H. Multiple Feature Dependency Detection for Deep Learning Technology—Smart Pet Surveillance System Implementation. *Electronics* **2020**, *9*, 1387. [CrossRef]
7. Nguyen, K.; Huynh, N.T.; Nguyen, P.C.; Nguyen, K.-D.; Vo, N.D.; Nguyen, T.V. Detecting Objects from Space: An Evaluation of Deep-Learning Modern Approaches. *Electronics* **2020**, *9*, 583. [CrossRef]
8. Kumar, S.; Gahalawat, M.; Roy, P.P.; Dogra, D.P.; Kim, B.-G. Exploring Impact of Age and Gender on Sentiment Analysis Using Machine Learning. *Electronics* **2020**, *9*, 374. [CrossRef]
9. Wu, C.; Du, H.; Wu, Q.; Zhang, S. Image Text Deblurring Method Based on Generative Adversarial Network. *Electronics* **2020**, *9*, 220. [CrossRef]
10. Rahmaniar, W.; Wang, W.-J.; Chen, H.-C. Real-Time Detection and Recognition of Multiple Moving Objects for Aerial Surveillance. *Electronics* **2019**, *8*, 1373. [CrossRef]
11. Kang, S.; Park, H.; Park, J.-I. CNN-Based Ternary Classification for Image Steganalysis. *Electronics* **2019**, *8*, 1225. [CrossRef]
12. Lee, Y.; Shim, J. False Positive Decremented Research for Fire and Smoke Detection in Surveillance Camera using Spatial and Temporal Features Based on Deep Learning. *Electronics* **2019**, *8*, 1167. [CrossRef]
13. Gómez Blas, N.; de Mingo López, L.F.; Arteta Albert, A.; Martínez Llamas, J. Image Classification with Convolutional Neural Networks Using Gulf of Maine Humpback Whale Catalog. *Electronics* **2020**, *9*, 731. [CrossRef]
14. Xu, Y.; Wang, H.; Cooper, G.D.; Rong, S.; Sun, W. Learning to See in Extremely Low-Light Environments with Small Data. *Electronics* **2020**, *9*, 1011. [CrossRef]
15. Kim, Y.; Chung, M. An Approach to Hyperparameter Optimization for the Objective Function in Machine Learning. *Electronics* **2019**, *8*, 1267. [CrossRef]
16. Xia, S.; Zeng, J.; Leng, L.; Fu, X. WS-AM: Weakly Supervised Attention Map for Scene Recognition. *Electronics* **2019**, *8*, 1072. [CrossRef]
17. Yan, T.; Ra, I.-H.; Zhang, Q.; Xu, H.; Huang, L. A Novel Rate Control Algorithm Based on $\rho$ Model for Multiview High Efficiency Video Coding. *Electronics* **2020**, *9*, 166. [CrossRef]
18. Maturana-Espinosa, J.C.; García-Ortiz, J.P.; Müller, D.; González-Ruiz, V. Layer Selection in Progressive Transmission of Motion-Compensated JPEG2000 Video. *Electronics* **2019**, *8*, 1032. [CrossRef]
19. Choi, Y.-J.; Jun, D.-S.; Cheong, W.-S.; Kim, B.-G. Design of Efficient Perspective Affine Motion Estimation/Compensation for Versatile Video Coding (VVC) Standard. *Electronics* **2019**, *8*, 993. [CrossRef]
20. Maqsood, S.; Javed, U.; Riaz, M.M.; Muzammil, M.; Muhammad, F.; Kim, S. Multiscale Image Matting Based Multi-Focus Image Fusion Technique. *Electronics* **2020**, *9*, 472. [CrossRef]
21. Ince, I.F.; Ince, O.F.; Bulut, F. MID Filter: An Orientation-Based Nonlinear Filter For Reducing Multiplicative Noise. *Electronics* **2019**, *8*, 936. [CrossRef]
22. Zhu, Y.; Liu, W.; Shen, Q. Adaptive Algorithm on Block-Compressive Sensing and Noisy Data Estimation. *Electronics* **2019**, *8*, 753. [CrossRef]
23. Benavides-Álvarez, C.; Villegas-Cortez, J.; Román-Alonso, G.; Avilés-Cruz, C. Wiener–Granger Causality Theory Supported by a Genetic Algorithm to Characterize Natural Scenery. *Electronics* **2019**, *8*, 726. [CrossRef]
24. Sahito, F.; Zhiwen, P.; Ahmed, J.; Memon, R.A. Wavelet-Integrated Deep Networks for Single Image Super-Resolution. *Electronics* **2019**, *8*, 553. [CrossRef]
25. Khan, A.N.; Fan, M.Y.; Nazeer, M.I.; Memon, R.A.; Malik, A.; Husain, M.A. An Efficient Separable Reversible Data Hiding Using Paillier Cryptosystem for Preserving Privacy in Cloud Domain. *Electronics* **2019**, *8*, 682. [CrossRef]
26. Lee, J.Y.; Kim, C.; Yang, C.-N. Reversible Data Hiding Using Inter-Component Prediction in Multiview Video Plus Depth. *Electronics* **2019**, *8*, 514. [CrossRef]

27. Kim, J.; Park, N.; Kim, G.; Jin, S. CCTV Video Processing Metadata Security Scheme Using Character Order Preserving-Transformation in the Emerging Multimedia. *Electronics* **2019**, *8*, 412. [CrossRef]
28. Lee, J.; Jun, D. Development Design of Wrist-Mounted Dive Computer for Marine Leisure Activities. *Electronics* **2020**, *9*, 727. [CrossRef]