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Editorial

Application and Theory of Multimedia Signal Processing Using Machine Learning or Advanced Methods

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1. Introduction

Machine learning (ML) uses algorithms to identify and predict useful patterns from data. Although it has found success in many areas, the results of multimedia mining are not satisfactory. ML in multimedia application extracts relevant data from multimedia files, such as audio, video, and still images, to perform similar searches, identify associations, and perform entity identification and classification. CNN emerged as a new breakthrough in the fields of data mining and AI, and has proven useful in both data analysis and application. In addition, CNN has made great progress in the area of multimedia. CNN is a field of machine learning that is applied in smart phones for face recognition and voice commands. Additionally, CNN technology contributes to the development of algorithms for the safety and security of multimedia data and the development of new applications.

This Special Issue will share the achievements of key researchers and practitioners in academia, as well as in the industry, dealing with a wide range of theoretical and applied problems in the field of multimedia.

2. Published Papers

In view of the above, this Special Issue is introduced to collect the latest research on the related subject and to solve the present challenging problems related to the various technologies based on digital imaging technology. In this feature, 10 papers have been published, and 21 papers have been received (i.e., 47% acceptance rate). Looking back at the special feature, various topics were covered with a focus on data hiding, encryption, object detection, image classification, and text recognition.

The first paper (Kim et al. (2020)) [1] shows an effective data hiding method for two quantization levels of each block of AMBTC using Hamming codes. Bai and Chang introduced a method of applying Hamming (7,4) to two quantization levels; however, the scheme is ineffective, and the image distortion error is relatively large. To solve the problem with the image distortion errors, this paper introduces a way of optimizing codewords and reducing pixel distortion by utilizing Hamming (7,4) and lookup tables.

The second paper provides another review of efficient inner product encryption approach by Tseng et al. (2020) [2]. The formal security proof and implementation result are also demonstrated. Compared with other state-of-the-art schemes, our scheme is the most efficient in terms of the number of pairing computations for decryption and the private key length.

The third paper proposed by Kim et al. (2021) [3] introduced a self-embedded watermarking technique based on Absolute Moment Block Truncation Coding (AMBTC) for reconstructing tampered images by cropping attacks and forgery. The watermark is embedded in the pixels of the cover image using 3LSB and 2LSB, and the checksum is hidden in the LSB. Through the recovering procedure, it is possible to recover the original marked image from the tampered marked image.

The fourth paper is a study on image reconstruction based on sparse constraints, which is an important research topic in compressed sensing. This paper is a constrained

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backtracking matching pursuit (CBMP) algorithm for image reconstruction, and is written by Bi et al. (2021) [4].

In the fifth paper, written by Kim et al. (2021) [5], they present a new method to detect foreground objects in video surveillance using multiple difference images as the input of convolutional neural networks, which guarantees improved generalization power compared to current deep learning-based methods.

The sixth paper (Xiang et al. (2021)) [6] is a study of an example for splitting the inference component of the YOLOv2 trained machine learning model between client, network, and service side processing to reduce the overall service latency. The approach of this research is not only applicable to object detection, but can also be applied in a broad variety of machine learning-based applications and services.

The seventh paper (Gu et al. (2021)) [7] proposes a method of power allocation for secrecy capacity optimization artificial-noise secure MIMO precoding systems under perfect and imperfect channel state information.

The eighth paper (Copiaco et al. (2021)) [8] presents a detailed study of the most apparent and widely-used cepstral and spectral features for multi-channel audio applications. Additionally, the paper details the development of a compact version of the AlexNet model for computationally limited platforms through studies of performances against various architectural and parameter modifications of the original network.

This ninth paper (Zhang et al. (2022)) [9] empirically evaluates two kinds of features, which are extracted, respectively, with traditional statistical methods and convolutional neural networks (CNNs), in order to improve the performance of seismic patch image classification.

The tenth paper (Tan et al. (2022)) [10] proposes a pipeline that locates texts on a page and recognizes the text types, as well as the context of the texts within the detected region.

3. Future Research Directions

Although the special feature has ended, more in-depth research on digital image security technology is expected. In order to support the basic technology of the 4th industrial revolution, it can be expected that more advanced research will occur in the future.

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References

1. Kim, C.; Shin, D.; Yang, C.; Leng, L. Hybrid Data Hiding Based on AMBTC Using Enhanced Hamming Code. *Appl. Sci.* **2020**, *10*, 5336. [CrossRef]
2. Tseng, Y.; Liu, Z.; Tso, R. Practical Inner Product Encryption with Constant Private Key. *Appl. Sci.* **2020**, *10*, 8669. [CrossRef]
3. Kim, C.; Yang, C. Self-Embedding Fragile Watermarking Scheme to Detect Image Tampering Using AMBTC and OPAP Approaches. *Appl. Sci.* **2021**, *11*, 1146. [CrossRef]
4. Bi, X.; Leng, L.; Kim, C.; Liu, X.; Du, Y.; Liu, F. Constrained Backtracking Matching Pursuit Algorithm for Image Reconstruction in Compressed Sensing. *Appl. Sci.* **2021**, *11*, 1435. [CrossRef]
5. Kim, J.; Ha, J. Foreground Objects Detection by U-Net with Multiple Difference Images. *Appl. Sci.* **2021**, *11*, 1807. [CrossRef]
6. Xiang, Z.; Seeling, P.; Fitzek, F. You Only Look Once, But Compute Twice: Service Function Chaining for Low-Latency Object Detection in Softwarized Networks. *Appl. Sci.* **2021**, *11*, 2177. [CrossRef]
7. Gu, Y.; Huang, B.; Wu, Z. Power Allocation for Secrecy-Capacity-Optimization-Artificial-Noise Secure MIMO Precoding Systems under Perfect and Imperfect Channel State Information. *Appl. Sci.* **2021**, *11*, 4558. [CrossRef]
8. Copiaco, A.; Ritz, C.; Abdulaziz, N.; Fasciani, S. A Study of Features and Deep Neural Network Architectures and Hyper-Parameters for Domestic Audio Classification. *Appl. Sci.* **2021**, *11*, 4880. [CrossRef]

9. Zhang, C.; Wei, X.; Kim, S. Empirical Evaluation on Utilizing CNN-Features for Seismic Patch Classification. *Appl. Sci.* **2022**, *12*, 197. [CrossRef]
10. Tan, Y.; Connie, T.; Goh, M.; Teoh, A. A Pipeline Approach to Context-Aware Handwritten Text Recognition. *Appl. Sci.* **2022**, *12*, 1870. [CrossRef]