mathematics

MDPI

Editorial

Preface to the Special Issue on "Mathematical Methods for Computer Science"

Zhongyun Hua [1,*] and Yushu Zhang [2,*]

[1] School of Computer Science and Technology, Harbin Institute of Technology, Shenzhen 518000, China
[2] College of Computer Science and Technology, Nanjing University of Aeronautics and Astronautics, Nanjing 211106, China
* Correspondence: huazhongyun@hit.edu.cn (Z.H.); yushu@nuaa.edu.cn (Y.Z.)

MSC: 68P25; 94A08; 68M25; 94A62

In the last few decades, the relationship between mathematics and algorithms has become increasingly important and influential in computer science. The rapid advancements in technology and the growing complexity of computational problems have highlighted the need for robust mathematical techniques to design efficient algorithms and analyze their performance. The objective of this Special Issue is to expand the applicability of designing efficient algorithms, developing robust systems, and advancing the field of computer science. The response of the scientific community has been significant, with many papers being submitted for consideration; finally, thirteen papers were accepted after undergoing a careful peer-review process based on quality and novelty criteria.

The paper by Li et al. [1] proposes a new technology for multimedia image copyright protection and content authentication, using an inter-block coefficient difference algorithm for robust watermarking in the transform domain, dual embedding of a fragile watermark in the spatial domain for tamper detection, and the application of an encryption algorithm combined with the Arnold transform for data encryption.

The paper by Mata-Mendoza et al. [2] introduces a complete separable scheme for reversible data hiding in the encrypted domain (RDH-ED), enabling the receiver to extract data and restore the image from both the cryptogram with hidden data and the directly decrypted version. The scheme utilizes versatile bit-depth management, encrypting the most significant bits of each pixel with the AES-CTR cipher algorithm and embedding additional data in the least significant bit planes of the encrypted pixels using code division multiplexing.

The paper by Wang et al. [3] introduces a novel source camera identification method called Prototype Construction with Ensemble Projection (PCEP) to address the challenge of low accuracy in few-shot scenarios. The proposed method utilizes feature extraction, feature projection, classifier training, and ensemble learning in a unified framework. By leveraging semi-supervised learning and rich prior information from few-shot datasets, PCEP constructs prototype sets and retrains SVM classifiers to obtain posterior probabilities for classification.

The paper by Kasereka et al. [4] examines two modeling approaches, equation-based modeling (EBM) and agent-based modeling (ABM), in analyzing the dynamics of infectious diseases.

The paper by Shi et al. [5] presents a novel reversible data hiding (RDH) scheme that introduces the LS-ET (Least Square predictor with Edge Type) to accurately predict different types of pixels based on stronger local consistency and a prediction-based histogram-shifting (HS) framework to hide embedding traces in stego images.

The paper by Zeng et al. [6] proposes AttDAU-Net, which combines spatially rich model filtering, attention mechanisms, an ASPP module, and a multitask learning frame-

Citation: Hua, Z.; Zhang, Y. Preface to the Special Issue on "Mathematical Methods for Computer Science". *Mathematics* **2023**, *11*, 3608. https://doi.org/10.3390/math11163608

Received: 14 June 2023
Revised: 10 July 2023
Accepted: 14 July 2023
Published: 21 August 2023

work to capture multi-scale information, expand the receptive field, and enhance the precision of tampering detection.

The paper by Gvozdarev et al. [7] analyzes the physical layer security of a wireless communication system in the presence of multipath fading and wiretap and explores the dependence of secrecy outage probability on various channel parameters, including fading scenarios and the presence of dominant and multipath components, revealing non-uniqueness with respect to average signal-to-noise ratios and the receiver distance.

The paper by Liu et al. [8] introduces a novel image reconstruction algorithm, IR-DWT-CGAN, which utilizes DWT for wavelet analysis, employs a U-net generator to reconstruct the image from a coarse version obtained via inverse DWT, and uses a fully convolutional discriminator network to distinguish the restored image from the real image.

The paper by Zhang et al. [9] addresses the cooperative optimization problem of the traditional microgrid, incorporating micro-gas turbines, diesel engines, carbon capture and storage, and a power-to-gas system. Three optimization scheduling models based on an improved BBO algorithm are proposed, which consider system operation cost, environmental governance cost, and comprehensive economic benefit.

The paper by Zhu et al. [10] introduces a new steganography algorithm, Resen-Hi-Net, which combines image encryption and image hiding using residual networks and pixel shuffle. Resen-Hi-Net encrypts a secret image and hides it within a carrier image, resulting in a visually high-quality container image with reduced vulnerability to attacks.

The paper by Feng et al. [11] proposes an image encryption algorithm, IEA-IF-DLT, that utilizes plane-level image filtering and discrete logarithmic transformation to achieve a balance between security and efficiency. By rationally utilizing the hash value and incorporating plane-level and three-dimensional encryption operations, IEA-IF-DLT improves encryption efficiency and avoids the overhead of repeated chaotic sequence generation. Additionally, the algorithm includes a discrete logarithmic transformation to enhance security against differential attacks.

The paper by Ahanger et al. [12] proposes to address privacy concerns in IoT networks by utilizing Federated Learning (FL) for anomaly detection, which involves exchanging updated weights with a centralized FL-server, federating training cycles over GRU models, and employing an ensemble module to improve the accuracy of the global ML technique by assessing updates from multiple sources.

The paper by Zhang et al. [13] proposes a novel fusion application scheme to overcome the shortcomings of the standard compressive sensing (CS) encryption framework. The proposed scheme compresses and encrypts two images into a single image, leveraging CS's simultaneous compression and encryption capabilities.

As the Guest Editor of this Special Issue, we are grateful to all the authors who contributed their articles. We would also like to express our gratitude to all the reviewers for their valuable comments on improving the submitted papers. This Special Issue aimed to attract quality and novel papers in the field of "Mathematical Methods for Computer Science". It is hoped that the selected research will be found to be impactful by the international scientific community and inspire further research in the area of mathematical methods for computer science.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Li, M.; Yue, Y. Security Analysis and Improvement of Dual Watermarking Framework for Multimedia Privacy Protection and Content Authentication. *Mathematics* **2023**, *11*, 1689. [CrossRef]
2. Mata-Mendoza, D.; Nuñez-Ramirez, D.; Cedillo-Hernandez, M.; Nakano-Miyatake, M.; Perez-Meana, H. Complete Separable Reversible Data Hiding for Encrypted Digital Images Using Code Division Multiplexing with Versatile Bit Depth Management. *Mathematics* **2023**, *11*, 1017. [CrossRef]
3. Wang, B.; Yu, F.; Ma, Y.; Zhao, H.; Hou, J.; Zheng, W. PCEP: Few-Shot Model-Based Source Camera Identification. *Mathematics* **2023**, *11*, 803. [CrossRef]

4. Kasereka, S.K.; Zohinga, G.N.; Kiketa, V.M.; Ngoie, R.-B.M.; Mputu, E.K.; Kasoro, N.M.; Kyandoghere, K. Equation-Based Modeling vs. Agent-Based Modeling with Applications to the Spread of COVID-19 Outbreak. *Mathematics* **2023**, *11*, 253. [CrossRef]
5. Shi, H.; Hu, B.; Geng, J.; Ren, Y.; Li, M. Trace Concealment Histogram-Shifting-Based Reversible Data Hiding with Improved Skipping Embedding and High-Precision Edge Predictor (ChinaMFS 2022). *Mathematics* **2022**, *10*, 4249. [CrossRef]
6. Zeng, P.; Tong, L.; Liang, Y.; Zhou, N.; Wu, J. Multitask Image Splicing Tampering Detection Based on Attention Mechanism. *Mathematics* **2022**, *10*, 3852. [CrossRef]
7. Gvozdarev, A.S.; Artemova, T.K. On the Physical Layer Security Peculiarities of Wireless Communications in the Presence of the Beaulieu-Xie Shadowed Fading. *Mathematics* **2022**, *10*, 3724. [CrossRef]
8. Liu, S.; Tremblais, B.; Carre, P.; Zhou, N.; Wu, J. Image Reconstruction with Multiscale Interest Points Based on a Conditional Generative Adversarial Network. *Mathematics* **2022**, *10*, 3591. [CrossRef]
9. Zhang, Q.; Wei, L.; Yang, B. Research on Improved BBO Algorithm and Its Application in Optimal Scheduling of Micro-Grid. *Mathematics* **2022**, *10*, 2998. [CrossRef]
10. Zhu, X.; Lai, Z.; Zhou, N.; Wu, J. Steganography with High Reconstruction Robustness: Hiding of Encrypted Secret Images. *Mathematics* **2022**, *10*, 2934. [CrossRef]
11. Feng, W.; Zhao, X.; Zhang, J.; Qin, Z.; Zhang, J.; He, Y. Image Encryption Algorithm Based on Plane-Level Image Filtering and Discrete Logarithmic Transform. *Mathematics* **2022**, *10*, 2751. [CrossRef]
12. Ahanger, T.A.; Aldaej, A.; Atiquzzaman, M.; Ullah, I.; Yousufudin, M. Federated Learning-Inspired Technique for Attack Classification in IoT Networks. *Mathematics* **2022**, *10*, 2141. [CrossRef]
13. Zhang, R.; Xiao, D. Double Image Encryption Scheme Based on Compressive Sensing and Double Random Phase Encoding. *Mathematics* **2022**, *10*, 1242. [CrossRef]