Mathematical Biosciences and Engineering

MBE, 20 (3): 5917–5920.
DOI: 10.3934/mbe.2023255
Received: 11 January 2023
Revised: 12 January 2023
Accepted: 13 January 2023
Published: 13 January 2023

http://www.aimspress.com/journal/MBE

Editorial

Optimization Algorithms and Machine Learning Techniques in Medical Image Analysis

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Keywords: optimization algorithms; machine learning

The publication of this special issue of the journal "Mathematical Biosciences and Engineering" is a matter of great pleasure for us. It contains 15 refereed research papers on recent developments in optimization algorithms (OAs) and machine learning (ML). There is a particular focus on applications of OA and ML in the medical image analysis fields.

Song, J. H. et al. (2022) [1] propose a non-local fuzzy c-means clustering framework incorporating the Markov random field for brain tissue segmentation. Their experimental results demonstrate that the proposed method can eliminate the noise and intensity inhomogeneity of the MRI image and effectively improve image segmentation accuracy.

Bi, K. et al. (2022) [2] propose an approach to extract the left ventricle (LV) in a sequence of MR images. The authors evaluate their method on two cardiac MRI datasets. The mean absolute distance (MAD) metric and the Hausdorff distance (HD) metric demonstrate that their proposed approach performs well in segmenting the boundaries of the LV.

Lv, P. Q. et al. (2022) [3] propose an improved ResU-Net framework for automatic liver CT segmentation. By employing a new loss function and data augmentation strategy, the accuracy of liver segmentation is improved, and the performance is verified on two public datasets, LiTS17 and SLiver07.

Wang, Y. T. et al. (2021) [4] assess the overall survival of patients with high-grade glioma (HG5918G) using a nomogram that combines the optimized radiomics with deep signatures extracted from 3D Magnetic Resonance Images (MRI) as well as clinical predictors.

Lohchab, V. et al. (2021) [5] focus on the potential of thermal imaging for total knee replacement and its relation with clinical inflammatory markers. The paper provides an automatic and non-invasive way of screening patients for raised skin temperature levels, which can signify inflammation. Their proposed temperature-based technique can help clinicians with visual assessment of the post-operative recovery of patients.

Wang, Z. J. et al. (2021) [6] propose a deep learning structure based on MRI images. The deep learning structure is designed to consider the brain's connections at different sizes and the attention to connections. The authors propose a 3D multiscale view convolutional neural network with attention (3D MVA-CNN) for classification of MRI images for mental disease.

Shao, Q. et al. (2021) [7] explore whether the nomogram, which was constructed by combining the deep learning and radiomics features of T2-weighted MR images with clinical factors (NDRC), could accurately predict placenta invasion. The results show that their method outperforms the traditional machine learning methods, which rely on radiomics features and deep learning features alone.

Qi, H. et al. (2021) [8] propose a hybrid equilibrium optimizer algorithm for multi-level image segmentation. Their proposed method optimizes the multi-level threshold method and gets the optimal threshold from the color image. The experimental results show that their proposed method performs well in uniformity measure, peak signal-to-noise ratio, feature similarity index, and CPU time.

Li, C. K. et al. (2021) [9] propose a robust and accurate computer-aided diagnosis (CAD) system based on radiomics and clinical índices. A novel feature selection algorithm named BLR (Bootstrapping repeated LASSO with Random selections) is proposed to select the most effective features. Then the selected features are sent to the support vector machine (SVM) to differentiate the benign or malignant.

Mehmood, A. et al. (2021) [10] present a clustering-based contrast enhancement technique for computed tomography (CT) images. Their approach uses the recursive splitting of data into clusters, targeting each cluster's maximum error reduction. The authors compare their method with several existing contrast enhancement algorithms and show that the proposed technique provides better execution efficiency and quality of enhanced images.

Yang, J. Z. et al. (2021) [11] propose a method of liver vessel segmentation based on an improved V-Net network. The public datasets 3Dircadb are used to perform liver vessel segmentation experiments. The experimental results show that the improved V-Net network can automatically and accurately segment labeled or even other unlabeled liver vessels from the CT images.

Mao, Q. et al. (2021) [12] propose and develop a novel method using an intelligent immune clonal selection and classification algorithm. To verify its accuracy, the authors use their proposed method to analyze 90 CT scans with 652 nodules. The experimental results reveal that their proposed method has an accuracy of 97.87% and produces 1.52 false positives per scan (FPs/scan).

Tran, A. Q. et al. (2021) [13] propose combining a combined compressed sensing (CS) method and parallel magnetic resonance imaging (pMRI) for better accelerating the MRI acquisition. The performance of the proposed method is simulated and evaluated using the reconstruction error measure, the universal image quality Q-index, and the peak signal-to-noise ratio (PSNR).

Yuan, T. R. et al. (2021) [14] propose a general algorithm to reconstruct the watertight 2-manifold 3D bone surface model from CT images based on the visual hyper-spherical mapping. Experiment and

comparison results show that their proposed algorithm can reconstruct the watertight 3D bone surface model from CT images, and local details of the bone surface can be restored accurately for the cases used in this paper.

Finally, Shabbir, A. et al. (2021) [15] present a comprehensive review about the various types of glaucoma, causes of glaucoma, the details about the possible treatment, details about the publicly available image benchmarks, performance metrics, and various approaches based on digital image processing, computer vision, and deep learning. The review article presents a detailed study of various published research models that aim to detect glaucoma from low-level feature extraction to recent trends based on deep learning.

We want to express our heartfelt thanks to the researchers who contributed to this special issue. We greatly acknowledge the help of the MBE editorial assistants in handling all these papers, and we would like to thank all anonymous referees for their honest opinions, valuable comments, and helpful suggestions.

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