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EDITORIAL

Introduction to the Special Issue on Recent Advances on Deep Learning for Medical Signal Analysis

Yu-Dong Zhang[1,*], Zhengchao Dong[2], Juan Manuel Gorriz[3,4], Carlo Cattani[5] and Ming Yang[6]

[1]School of Informatics, University of Leicester, Leicester, LE1 7RH, UK

[2]Molecular Imaging and Neuropathology Division, Columbia University and New York State Psychiatric Institute, New York, NY 10032, USA

[3]Department of Psychiatry, Cambridge University, Cambridge, CB2 1TN, UK

[4]Department of Signal Theory, Networking and Communications, University of Granada, Granada, Spain

[5]Engineering School (DEIM), University of Tuscia, Viterbo, Lazio, 01100, Italy

[6]Department of Radiology, Children's Hospital of Nanjing Medical University, Nanjing, 210008, China

[*]Corresponding Author: Yu-Dong Zhang. Email: yudongzhang@ieee.org

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Over the past years, deep learning has established itself as a powerful tool across a broad spectrum of domains, e.g., prediction, classification, detection, segmentation, diagnosis, interpretation, reconstruction, etc. While deep neural networks initially found nurture in the computer vision community, they have quickly spread over medical imaging applications.

The accelerating power of deep learning in diagnosing disease and analyzing medical data will empower physicians and speed-up decision making in clinical environments. Application of modern medical instruments and digitalization of medical care generated large amounts of biomedical information in recent years. However, new deep learning methods and computational models for efficient data processing, analysis, and modelling with the generated data are important for clinical applications and in understanding the underlying biological process.

The purpose of this special issue in the journal "CMES-Computer Modeling in Engineering and Sciences" aims to embrace the adoption, integration, and optimization of deep learning in medical signal analysis, providing the reader with an overview of this emerging technology and its unique applications and challenges in the domain of medical signal analysis.

A total of 45 manuscripts were submitted and 12 were selected based on a robust peer-reviewed process. The 12 articles are authored by researchers from world-wide universities, and reflect state of advances on deep learning for medical signal analysis.

In the first paper entitled "Classification of Domestic Refuse in Medical Institutions Based on Transfer Learning and Convolutional Neural Network" by Guo et al. [1], ResNet-50 convolutional neural network based on the transfer learning method is applied to design the image classifier to obtain the domestic refuse classification with high accuracy.

In the second paper entitled "Alcoholism Detection by Wavelet Energy Entropy and Linear Regression Classifier", Chen et al. [2] provide a novel alcoholism detection system by extracting

image features of wavelet energy entropy from magnetic resonance imaging combined with a linear regression classifier.

In the third paper entitled "An Emotion Analysis Method Using Multi-Channel Convolution Neural Network in Social Networks" by Lu et al. [3], an emotional analysis model using the emotional dictionary and multichannel convolutional neural network is proposed.

The fourth paper "Least-Square Support Vector Machine and Wavelet Selection for Hearing Loss Identification" by Tang et al. [4] investigates the advantages and disadvantages of three classical machine learning methods: multilayer perceptron, support vector machine, and least-square support vector machine (LS-SVM) approach, and makes a further optimization of the LS-SVM model via wavelet entropy.

The fifth review paper "Importance of Features Selection, Attributes Selection, Challenges and Future Directions for Medical Imaging Data: A Review" by Naheed et al. [5] is meant to describe feature selection techniques in a medical domain with their pros and cons and to signify its application in imaging data and data mining algorithms.

In the sixth paper entitled "A Multi-View Gait Recognition Method Using Deep Convolutional Neural Network and Channel Attention Mechanism" by Wang et al. [6], a multi-view gait recognition method using deep convolutional neural network and channel attention mechanism is proposed.

The seventh paper "PDNet: A Convolutional Neural Network Has Potential to be Deployed on Small Intelligent Devices for Arrhythmia Diagnosis" by Yang et al. [7] proposes a convolutional neural network model named PDNet to recognize different types of heart arrhythmias efficiently.

In the eighth paper "Effect of Data Augmentation of Renal Lesion Image by Nine-layer Convolutional Neural Network in Kidney CT" by Wang et al. [8], a nine-layer Convolutional Neural Network (CNN) is proposed to classify the renal Computed Tomography images.

Nasir et al. [9], in their paper "A Hybrid Deep Learning Architecture for the Classification of Superhero Fashion Products: An Application for Medical-Tech Classification", take advantage of utilizing a standard publicly dataset taken from a competition, and proposes a generic data balancing technique for imbalanced dataset to enhance and enable the in-depth training of the CNN.

Jiao et al. [10] propose a sub-network extraction method based on graph regularization nonnegative matrix factorization, in their paper entitled "Extracting Sub-Networks from Brain Functional Network Using Graph Regularized Nonnegative Matrix Factorization".

In the eleventh paper "A Mortality Risk Assessment Approach on ICU Patients Clinical Medication Events Using Deep Learning", Shi et al. [11] propose to use the heterogeneous medication events driven LSTM to predict the outcome of the patient, and the Natural Language Processing and Gaussian Process, which can handle noisy, incomplete, sparse, heterogeneous and unevenly sampled patients' medication records.

Finally, Tie et al. [12], in their paper "MRI Brain Tumor Segmentation using 3D U-Net with Dense Encoder Blocks and Residual Decoder Blocks" propose a new 3D U-Net with dense encoder blocks and residual decoder blocks.

As a final remark, we wish this special issue can contribute to the field of deep learning for medical signal analysis and it may benefit broader readers of researchers, practitioner, and students who are interested in related topics.

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