**EDITORIAL**

# Introduction to the Special Issue on Computer-Assisted Imaging Processing and Machine Learning Applications on Diagnosis of Chest Radiograph

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The chest radiograph has been one of the most frequently performed radiological investigation tools. In clinical medicine, the chest radiograph can provide technical basis and scientific instruction to recognize a series of thoracic diseases (such as Atelectasis, Nodule, and Pneumonia, etc.). Importantly, it is of paramount importance for clinical screening, diagnosis, treatment planning, and efficacy evaluation. However, it remains challenging for automated chest radiograph diagnosis and interpretation at the level of an experienced radiologist. In recent years, many studies on biomedical image processing have advanced rapidly with the development of artificial intelligence especially deep learning techniques and algorithms. How to build an efficient and accurate deep learning model for automatic chest radiograph processing is an important scientific problem that needs to be solved.

To address the unique problems in diagnosis of chest radiological images, various techniques need to be developed to advance such research fields. This special issue intends to demonstrate the new development and application of automatic chest radiograph processing, and thereby promote the research and development of chest radiology imaging in biomedical intelligence. The goal is to provide a platform for researchers to disseminate their recent advances and views of computer-assisted imaging processing and machine learning applications on diagnosis of chest Radiograph by publishing high-quality research papers in this interdisciplinary field.

A total of 40 manuscripts were submitted and 8 were selected based on a robust peer reviewed process. The 8 articles are authored by researchers from world-wide universities, and reflect state of the research developments and initiatives in Computer-Assisted Imaging Processing and Machine Learning Applications on Diagnosis of Chest Radiograph.

The first paper "Edge Detection of COVID-19 CT Image Based on GF_SSR, Improved Multiscale Morphology, and Adaptive Threshold" by Hou et al. [1]. They proposed a weak edge detection method based on Gaussian filtering and single scale Retinex (GF_SSR), and improved multiscale morphology and adaptive threshold binarization (IMSM_ATB). To evaluate their method, they used images from three datasets, namely COVID-19, Kaggle-COVID-19, and COVID-Chestxray, respectively. Through comparison with the other four algorithms, they argued that the proposed algorithm effectively detected the weak edge of the lesion and provided help for image segmentation and feature extraction.

The second paper "COVID-19 Imaging Detection in the Context of Artificial Intelligence and the Internet of Things" by Gu et al. [2]. They introduced the segmentation of methods and applications. CXR and CT diagnosis of COVID-19 based on deep learning, which can be widely used to fight against COVID-19.

The third paper "An Optimized Convolutional Neural Network with Combination Blocks for Chinese Sign Language Identification" by Gao et al. [3]. They presented a novel sign language image recognition method based on an optimized convolutional neural network.

The fourth paper "Human Stress Recognition from Facial Thermal-Based Signature: A Literature Survey" by Babu et al. [4]. They presented a brief review of previous work on thermal imaging related stress detection in humans. This paper also presented the stages of stress detection based on thermal face signatures such as dataset type, thermal image face detection, feature descriptors and classification performance comparisons are presented. This paper can help future researchers to understand stress detection based on thermal imaging by presenting the popular methods previous researchers used for stress detection based on thermal images.

The fifth paper "COVID-19 Detection via a 6-Layer Deep Convolutional Neural Network" by Hou et al. [5]. They proposed a six-layer convolutional neural network combined with max pooling, batch normalization and Adam algorithm to improve the detection effect of COVID-19 patients. In the 10-fold cross-validation methods, their method was proved as superior to several state-of-the-art methods. In addition, they used Grad-CAM technology to realize heat map visualization to observe the process of model training and detection.

The sixth paper "BEVGGC: Biogeography-Based Optimization Expert-VGG for Diagnosis COVID-19 via Chest X-ray Images" by Sun et al. [6]. They proposed a novel framework—BEVGG and three methods (BEVGGC-I, BEVGGC-II, and BEVGGC-III) to diagnose COVID-19 via chest X-ray images. Besides, they used biogeography-based optimization to optimize the values of hyperparameters of the convolutional neural network. The experimental results showed that the OA of our proposed three methods is 97.65% ± 0.65%, 94.49% ± 0.22% and 94.81% ± 0.52%. BEVGGC-I has the best performance of all methods.

The seventh paper "The Research of Automatic Classification of Ultrasound Thyroid Nodules" by An et al. [7]. This paper proposed a computer-aided diagnosis system which can automatically detect thyroid nodules (TNs) and discriminate them as benign or malignant. The system firstly used variational level set active contour with gradients and phase information to complete automatic extraction of the boundaries of thyroid nodules images. Then according to thyroid ultrasound images and clinical diagnostic criteria, a new feature extraction method based on the fusion of shape, gray and texture was explored.

The eighth paper "ANC: Attention Network for COVID-19 Explainable Diagnosis Based on Convolutional Block Attention Module" by Zhang et al. [8]. This paper proposed an 18-way data augmentation to avoid overfitting. Then, convolutional block attention module (CBAM) was integrated to the proposed model, the structure of which is fine-tuned. Finally, Grad-CAM was used to provide an explainable diagnosis.

**Conflicts of Interest:** The authors declare that they have no conflicts of interest to report regarding the present study.

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