

Tentative Outline

Special Thematic Issue for the journal *CMIM*

Title of Thematic Issue: Recent advances of machine learning in medical imaging

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- **Scope of the Thematic Issue:**

In medical imaging, machine learning able to assist in analyzing data and making decision, that has transformed the roles of clinicians enormously. Machine learning is a modelling method that permits machine to capture pertinent pattern and structures from the data without being explicitly manipulated by human operators. With current fast computational infrastructure as well as large amount of medical imaging data, machine learning techniques, particularly deep learning have been frequently applied to extract pattern from the medical imaging data. Common tasks performed are classification and localization of pathologies using images from various modalities of medical imaging. This capability to analyze the image accurately can help clinicians greatly as this capability requires years of training for human expertise to obtain. This special issue focuses on the recent advances that have been made to medical image analysis using machine learning technique from traditional machine learning techniques (such as support vector machine) to more recent deep learning techniques (such as convolutional neural network). We anticipate readers will gain insights from these interesting topics.

Keywords: Artificial Intelligence, Medical Imaging, Machine Learning, Image Processing

Sub-topics:

The sub-topics to be covered within the issue should be provided:

- Deep learning for medical image;
- Medical Image segmentation, registration, and fusion;
- Application of Image processing in medical imaging;
- image quality assessment in medical imaging;
- Contrast enhancement in medical imaging
- Computer aided diagnosis
- Detection and classification of diseases

Tentative titles of the articles and list of contributors:

- Aortic Valve Segmentation using Deep Learning - Aortic stenosis is the most common type of valvular heart disease (VHD), requiring echocardiography examination for diagnosing and monitoring of the patient. Segmentation of aortic valve is one of the crucial medical tasks as it helps in different cardiac treatment, e.g. in aortic valve replacement. Manual segmentation is tedious and depends upon the expertise of clinicians so automated segmentation of aortic valve is primarily significant. Deep learning is a viable solution for the

automatic segmentation of the aortic valve. Unfortunately, there is lacking knowledge in the application of deep learning in echocardiography. This study proposes a deep learning technique to segment the aortic valve. Echocardiography data of 58 patients for training and evaluating the neural networks were obtained from 'Institut Jantung Negara' (IJN) patients., Bi-Directional ConvLSTM U-NET (BDCU-Net), XNet and UNet with its variations were trained to segment planimetry aortic valve area. BDCU-Net had the highest F1-score (91.092%), followed by XNet (90.887%) and U-Net variation of two additional layers (90.718%). The results show that BDCU-Net performance is best among others.

- **CLASSIFICATION OF COVID-19 AND NON-COVID-19 LUNG COMPUTED TOMOGRAPHY IMAGES USING MACHINE LEARNING** - A new novel coronavirus, currently termed Coronavirus Disease 2019 (COVID-19) was first reported in Wuhan, China in late December 2019. In March 2020, WHO declared this sudden epidemic as a global pandemic. It is highly contagious and can cause serious lung inflammation. The typical symptoms are fever, cough, shortness of breath, headache and sore throat. At the time of this study, there are no cures available and the developed vaccines are yet to be tested. Hence, early detection is crucial to control the spread. Currently, the key diagnosis method is RT-PCR test using swab samples. However, it is subjected to certain limitations such as low sensitivity and shortage of kits. To address these issues, lung CT scan can be the alternative as it is fast, easy and proven to be sensitive in detecting COVID-19 cases. Since the accuracy of the diagnosis depends strongly on radiologists, DL approaches had been investigated to provide more standard and accurate diagnosis tool as well as to reduce the workloads of physicians. This study presented an automated method to differentiate the COVID-19 CT images from the Non-COVID-19 images using different CNNs through three stages procedures. In the first stage, the dataset which consists of 746 images of COVID-19 and Non-COVID-19 was split into 3 parts for training, validation and testing respectively. The training and validation data were then applied with different augmentation techniques to increase the dataset while the testing data remained with no augmentation. In stage 2, 10 different pre-trained CNNs were initialized to train and classify the binary class. In stage 3, GradCAM was used for abnormality localization. The best performance was achieved by ResNet152, ResNeXt, GoogleNet and DenseNet201 with the highest overall accuracy of 98.51%. ResNet152, GoogleNet and DenseNet201 had achieved a sensitivity of 100% and specificity of 97.06% while ResNeXt had achieved a sensitivity of 96.97% and specificity of 100%. In conclusion, CNN models achieved high accuracy and can be considered as a quick screening tool for early detection of COVID-19 cases.
- The contributors are from the various autonomous institutions in developed as well as developing countries

Schedule:

Manuscript submission deadline: July 30, 2021

Announcement of acceptance by the Guest Editors: October 30, 2021

Final manuscripts due: December 20, 2021

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