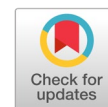


Lung cancer medical images classification using hybrid CNN-SVM



Abdulrazak Yahya Saleh ^{a,1,*}, Chee Ka Chin ^{b,2}, Vanessa Panshie ^{a,3},
Hamada Rasheed Hassan Al-Absi ^{c,4}

^a Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak, Sarawak, Malaysia

^b Faculty of Engineering, Universiti Malaysia Sarawak, Sarawak, Malaysia

^c College of Science and Engineering, Hamad Bin Khalifa University, Doha, Qatar

¹ ysahabdulrazak@unimas.my; ² cheekachin@yahoo.com.my; ³ vanessapanshie@gmail.com, ⁴ hrha@outlook.com

* corresponding author

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ABSTRACT

Lung cancer is one of the leading causes of death worldwide. Early detection of this disease increases the chances of survival. Computer-Aided Detection (CAD) has been used to process CT images of the lung to determine whether an image has traces of cancer. This paper presents an image classification method based on the hybrid Convolutional Neural Network (CNN) algorithm and Support Vector Machine (SVM). This algorithm is capable of automatically classifying and analyzing each lung image to check if there is any presence of cancer cells or not. CNN is easier to train and has fewer parameters compared to a fully connected network with the same number of hidden units. Moreover, SVM has been utilized to eliminate useless information that affects accuracy negatively. In recent years, Convolutional Neural Networks (CNNs) have achieved excellent performance in many computer visions tasks. In this study, the performance of this algorithm is evaluated, and the results indicated that our proposed CNN-SVM algorithm has been succeed in classifying lung images with 97.91% accuracy. This has shown the method's merit and its ability to classify lung cancer in CT images accurately.



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1. Introduction

Lung cancer is one of the leading causes of death in Malaysia and around the world [1]. In 2018, lung cancer had the highest percentage of new cases and deaths worldwide, by 11.6% [2]. According to the statistics by World Health Organization, lung cancer has the second-highest rate of cases in Malaysia in 2018 after breast cancer. About 16.6% of the patients are male, while 5.4% are female. Based on The Malaysia National Cancer Registry Report 2012-2016, lung cancer stands as third-highest cancer detected among Malaysians, affecting males more than females [3]. It begins in the lungs, where cancer cells then may spread to lymph nodes or other organs in the body, such as the brain [4]. This disease is categorized into two main types called small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). These two types of cancer are treated differently. The common type which affects about 80%-85% of lung cancer patients is non-small cell cancer [5].

A small round or oval-shaped growth in lung sections is known as a pulmonary nodule. It is also called a 'coin lesion', which is usually larger than three centimeters in diameter [6]. Any nodule smaller than three centimeters is known as micro-nodules. Non-nodules such as blood vessels and bronchi walls have the same appearances as nodules and can cause false positives during the detection process [7].