An Effective Lung Cancer Detection And Classification Using Enhanced Fully Convolution Neural Networks

K. Narmada, G. Prabakaran

Abstract: Lung cancer classification can be identified to the middle aged persons nowadays. Early prediction and classification of cancer stage is mandate to take counter measures to treatment and easy diagnosis. The scanned CT images are mostly used to obtain the occurrence of lung small cell cancer. In existing techniques used by machine learning traditional techniques and advanced deep learning (DL), it can classify the cancer occurrence and predict the feasible treatment based on diagnosis. It is mandate to predict and find the level or stages of the lung cancer based on tumor size and it should be properly classified to predict better treatments. Here it is proposed to categorize the stages of lung cancer and predict the diagnosis way using fully convolution neural network (FCN). In this technique, the methodology can be improved by means of candidate generation over the screening phase to make higher optimized results. The concentration leads to the learning process over the implementation of FCN to produce results with larger in dataset size. The improved results will show the performance of proposed system rather the existing works.

Index Terms: Deep learning, machine learning, lung cancer classification, fully convolutional neural networks.

1. INTRODUCTION

Lung cancer [1] [4] [5] can cause severity to the people from any gender or any age. Recent years, even the young and middle aged peoples can able to affect through this disease. At earlier 2012, the World Health Organization (WHO) collects and produces the reports as most critical cancer type among the top severe diseases like liver fungal cancer, severe gastric cancer, breast cancer, colorectal cancer and stress esophagus cancer and that leads to death because it complex to diagnose and treat the patients. Around 1.59 million of peoples are recorded as dead caused by lung cancer that the report says. In 2014, it affects more number of men compared to the women because it usually caused by chain smoking cigarette and liquor drinking. Even more, this can also be affected through the genetic disorder. As standards, the lung cancer [2] could be classified into 4 categories; they are as Adeno carcinoma, Squamous carcinoma, tiny cell cancer and Large cell carcinomas. Usually, pathologist can able diagnose the lung cancer and their stages as traditional approach. Almost computed tomography acquisition can be used for identification. However, they diagnose as much as possible, but it may be time consuming and mislead to side effects. This can be avoided through identification of severity based on their stage of lung cancer. It can be identified and predicted through the image processing operations [5] [8][12] over the CT images. The easy and effective prediction can be done through the implementation of DL techniques. Rather than the machine learning techniques [9][10], the DL [2][6] can be obtained through the large sparse set of dataset representation. It can be effectively predicted through the huge set of training samples. The shape and texture features can be extracted and used for the implementation of classification. This can be achieved through the fully Convolutional neural network (CNN) [2] [3] to obtain the betterment results when compared to the CNNs [3] [10]. In existing, we had this same problem with the high number of convolutions over the implementations. Thus may obtained somewhat improved better results when compared to their existing works. Here, this implementation with proposed candidate generation in fully convolution neural network (FCN) with two phases such as screening and discrimination phase using the tools for detection, type based.

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1 RELATED WORKS

Vas M and Dessai A [8] have used image procedure techniques to make exposure of untimely stage lung cancer. It uses the feature extraction and segmentation methods for obtaining the classification results through the Artificial Neural Networks. Likewise, in [5] and [13], the authors have proposed the detection mechanism using the image processing tools to obtain effective results. In [11], the authors used the implementation effective feature extraction through the Artificial Neural Networks and also the existing works [12] has been proposed margin based images procedure methods. To enhance the accurateness over the exposure mechanisms, the CNN techniques were implemented with the slight changes in the layers of processing works. The existing works [14] and [15] are used the DL technique to identified the cancer tumor in the CT image. Kumar S et al. [2] have proposed same DL technique with advancements in the methodology to make this fully convolution neural network. Thus the arrangement of layers can be optimized to make complications in the CNN and detect tumor more effectively and accuractely.

2 BACKGROUND KNOWLEDGE

In this section, the background knowledge should be learnt and analyzed through the discussions made. Thus, the in-depth details are discussed here.

2.1 Lung Cancer Data Collection

Lung cancer is a tumor like disease affected in the spongy like area of lungs and it is leading cause of cancer deaths. Lung cancer disease has probably caused by the smoking, liquor

drinking and genetic disorder. This can be categorized based on the tumor cells spread in the lungs and their area. This could be majorly classified into 2 varieties. They are tiny cell lung cancer as well as non tiny cell lung cancer. Thus the non tiny cell lung cancer has categorized as Squamous carcinoma, Adeno carcinoma as well as huge cell carcinoma.

2.2 FCN

The FCN is usual CNNs like architecture, where the end layer named fully connected layer is changed to another layer called receptive field layer. Here the discrimination analysis can be done to detect and classify the data through the large context.

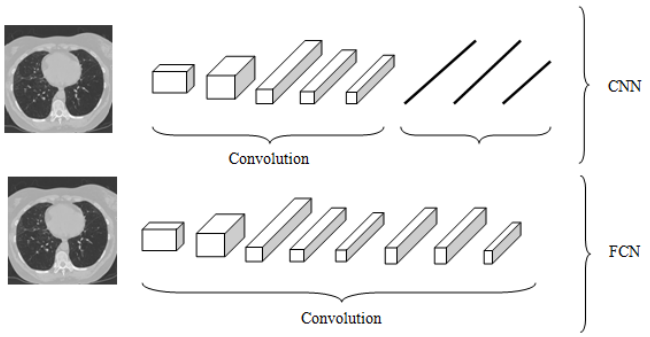

***Figure.1**. Conversion of Normal CNN to FCN*

The figure 1 shows the real conversion of normal CNN procedure to fully convolution neural network by replacing the fully connected layer to throughout the convolution layer works.

3 SYSTEM IMPLEMENTATION

The figure 2 illustrated the system architecture of implementation work. Usually the images can be preprocessed before the indulging with the proposed implementation. In preprocessing process, initially the images can be converted into the gray scale to perform the image processing methods. After that the image should be denoised through Gaussian Filter to make filtered and preprocessed image.

It is having the difference of usual fully convolutional neural network with the two different phases. Thus the system model consists of three sequence of different layers to make the effective classification such as convolution phase, screening phase and discrimination phase. It can be divided into three important phases after that the preprocessing technique. In first phase, the convolution layer can be done. In this phase, the sub-sampling and convolution processes are done with the variations in the pixel size. In screening phase, it cats as a decoder and also score volume also calculated here to make candidate generation. Finally, in discrimination phase, the lung cancer tumor can be detected and stage can be classified through the fine and coarse segmentation.

Algorithm: Proposed FCN based lung classification

[1] Initiate with input image I
[2] Preprocess the image I with two main processes
[3] Convert the image I into Ig as gray scale
[4] Denoise the image Ig as In using Gaussian Filter
[5] Apply convolution phase with these attributes
  a. Perform 3 x 3 convolution with different 32, 64, 128, 256 ReLU functions
  b. Perform 2 x 2 Max Pooling as sub sampling
[6] Applying Screening phase
  a. Perform 32 x 32 transpose convolution
  b. Prevents the over-fitting
[7] Apply discrimination phase
  a. Select the convolution coordinates from previous input
  b. Computes the class scores
  c. Matching with the 1-D array of size
  d. Define the classes from the array
  e. Detection of stages through the variations in pixels

Thus the above algorithm is used to perform the effective classification of lung cancer with three different phases. To improve the efficiency the transpose convolution matrix attributes can be hiked and array classes can be accurately defined and stages are detected.

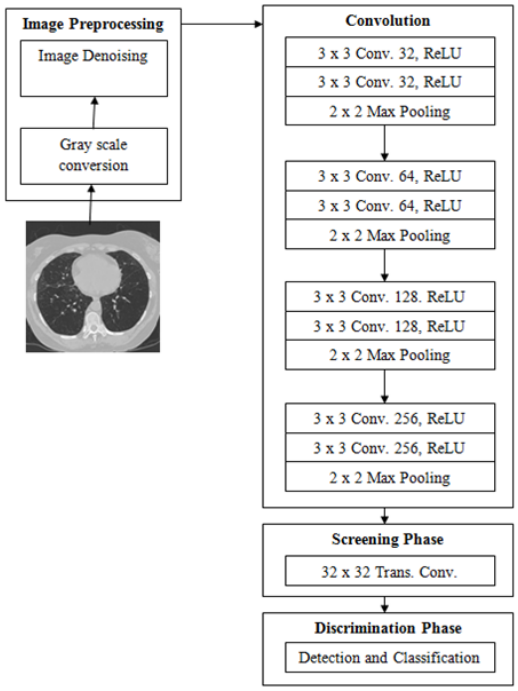

***Figure.2**. Proposed system Implementation*

4 EXPERIMENTS AND DISCUSSIONS

Thus the image classification mostly done through the implementation of husband proposed and enhanced fully convolution neural networks. This can be implemented through the OpenCV image processing packages. The input images can be taken to make classification analysis has illustrated in the Fig. 3.a and Fig. 3.b.

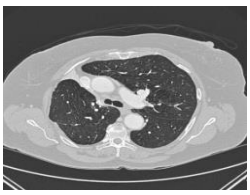

***Fig. 3**.a. Process source image sample 1*

***Fig. 3**.b. Process source image sample*

This implementation obtains the score volume for the detection and classification of the tumor through the screening phase. Thus the obtained screening phase image can be displayed in figure 4.a and 4.b.

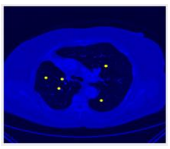

Fig. 4.a. *Score volume for source CT image sample 1*

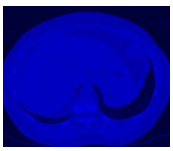

Fig.4. b. *Score volume for source CT m image sample 2*

This process of screening should also denote as candidate generation for the classification analysis. Then the score volume can be denoted at the positive regions through the yellow shown in above figure. Also discussing the figure 4.b. there is no possibility of candidate generation so that it would not have the identification of tumors in that image. This would be considered as the coarse segmentation of the tumors in the images.

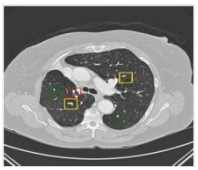

Fig.5.a*. Positive results obtained*

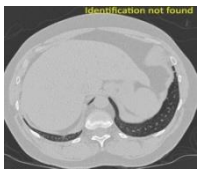

Fig.5.*b. Negative results obtained*

Thus the final output for the detection and stage classification can be displayed in above Fig. 5.a and 5.b. In Fig. 6.a. the identification of the tumor can be displayed in square boxes as fine segmentation of the FCN and also the stages are denoted using various colors. The green color images are shown very small cell tumors can be curable through the medicine itself. The yellow and red denotes the next stages of the lung cancer and based on its severity. In Fig. 5.b it should be shown any identification because of its negative results. The above table shows the performance comparison of training data through the implementation of deep learning techniques such as usual FCN and enhanced FCN with the phases. The improved mechanism with the enhanced algorithm shows the 97% accuracy through the learning process of the data.

Tumors	Confusion Matrix of FCN				Confusion Matrix of enhanced FCN			
	Precision	Recall	F1 Score	Support	Precision	Recall	F1 Score	Support
0.1	0.95	0.93	0.95	123	0.96	0.98	0.97	108
1.0	0.93	0.96	0.95	134	0.98	0.97	0.97	118
Total	0.94	0.95	0.95	192	0.97	0.97	0.97	206

Table 1. *Performance comparison*

5 CONCLUSIONS

In this paper, we learn the FCN with the conversion and arrangement of layers. Thus the lung cancer tumor can be identified through this technique and also obtained the effective and accurate classification of stages of cancer. The CT images are used and also training samples can be identified. Even though the increase of training samples, itwill give more accurate results over the detection methodology. In future, the optimization technique will used to improve the effectiveness of the detection and classification mechanism. Even more the treatment prediction will also identify in further improvements.

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