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Robust Classification of Lung Nodule and Cancer using Yolo v5

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Abstract—Lung nodule classification plays an important role in diagnosis of lung cancer which isessential to patients' survival. However, because the number of lung CT images in current dataset is relatively small and the ratio of nodule samples to non-nodule samples is usually very different, this makes the training of neural networks difficult and poor performance of neural networks. **In this paper, an improved YOLOv5 method is proposed for lung nodule detection. By adding an attention mechanism to the feature extraction network, the feature expression capability is effectively improved. The method of feature fusion has also changed to make feature fusion more adequate. The experiments are conducted using the publicly available dataset LUNA16.** Moreover, a series of comparative experiments were conducted to further confirm that the proposed algorithm has the higher accuracy and robustness through verification and discussion

Keywords—LDNNET[1], Yolo v5, Classification, Lung nodule, Lung Cancer.

I.INTRODUCTION

Lung cancer is one of the deadliest cancers worldwide. However, the early detection of lung cancer significantly improves survival rate. Cancerous and noncancerous pulmonary nodules are the small growths of cells inside the lung. Detection of malignant lung nodules at an early stage is necessary for the crucial prognosis. Early-stage cancerous lung nodules are very much similar to noncancerous nodules and need a differential diagnosis on the basis of slight morphological changes, locations, and clinical biomarkers.However, mostly invasive methods such as biopsies or surgeries are used by healthcare practitioners to differentiate between benign and malignant lung nodules. For such a fragile and sensitive organ, invasive methods involve lots of risks and increase patients' anxieties.

II. PROBLEM DEFINITION

Nowadays lung cancer has become a huge death-threat which is threatening human health worldwide.Lung cancer is one of the most malignant tumors in the world and its 5-year-survival rate is only 18%.Early and accurate classification of lung nodule and lung cancer is of great significance to the treatment of patients and the improvement of survival. Because, early lung cancer often appears as lung nodules with or without malignant signs on CT, therefore the classification of lungnodules is the first step in the early diagnosis of lung cancer.The second step is to classify lung and non-lung cancer on CT images of lung nodules to assist doctors in medical diagnosis.

III. LITERATURE SURVEY

Traditional lung nodule classification[2] and lung cancer classification algorithms [3]based on transfer domain may not require large number of samples for training but takes several years to form and these methods are not robust enough since input lung image are separate part of lung images. Lung nodule classification[4] and lung cancer classification algorithms [5]based on deep neural networks[6] has higher accuracy rate than traditional algorithms but takes a considerable amount of time for training the data.LDNNET(Lung Dense NeuralNetwork) also has higher accuracy but the dense connections takes longer time to train the model than other network.

IV. PROPOSED SYSTEM

In this paper, automated lung nodule detection and classification using deep learning with multiple strategies is proposed. The proposed system works on three-dimensional (3D) lung CT scans.We will be developing a model to classify the lung nodules and predict whether the input images has cancer or not.The object detection model Yolov5 is used for training and testing the model because the time consumes to train the model is lower than LDNNET (existing system).Yolo v5 is a novel convolutional neural network (CNN) that detects objects in realtime with great accuracy and is now the most advanced object identification algorithm available.Yolo v5 outperforms yolo v3 and yolo v4 in terms of accuracy.This approach uses a single neural network to process the entire picture, then separates it into parts and predicts bounding boxes and probabilities for each component. The method "just looks once" at the image in the sense that it makes predictions after only one forward propagation run through the neural network.We are using a post-processing technique called non-max suppression(which ensures that the object detection algorithm only identifies each object once).Yolo V5 contains 3 layers:Backbone which performs feature extraction using CSPNET

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which has shown significant improvement in processing time with deeper networks.Neck Layer performs feature fusion using PANet using which is not in existing system and help models to perform well on unseen data.Top layer in neckhas SPP which removes fixed-size image constraint.model Head is mainly used to perform the final detection part. The procedure of this research including three stages: Augmentation,nodule detection using yolov5, Classification using Convolutional layer and Analyzing the performance of the classifier.

V.DATASET

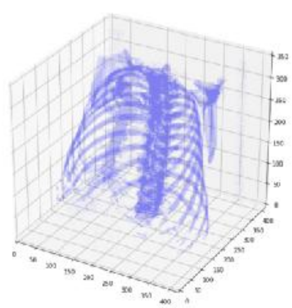
Dataset is Collected from LUNA16[7]. Image format is DICOM.Number of patients and series are 888 and 888 CT . Number of nodule and non-nodule images are 1186 and 551065.Total number of images are 754976.Classification standard/Label are Non-nodule/0 and Nodule/1.

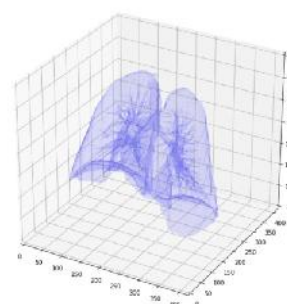
VI. AUGMENTATION

The ratio of nodule and non-nodule are not balanced in the dataset , so data augmentation is adopted to solve this problem.And overfitting is a result of network parameters greatly outnumbering the number of features in the input images.The number of lung CT images for experiment is relatively small.Hence the method of augmenting data is executed by us for avoiding overfitting. Vertical, horizontal, and vertical-horizontal flips,180º Rotation, Average blurring and Raise the hue value are some of the augmentation techniques

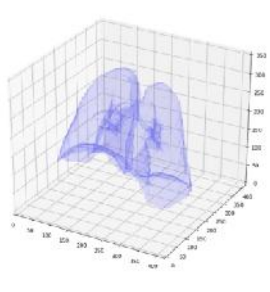
VII. 3D CONVERSION OF IMAGES

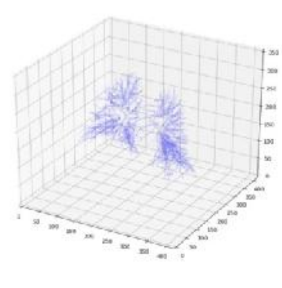
Images will be converted to 3D shown in Figure 1 to detect the depth of the nodules thereby increasing the accuracy.





(i) **(ii)**





(iii) (iv)

Figure 1

VIII. YOLO V5

The whole structure of YOLOv5[8]is shown in Figure 2.

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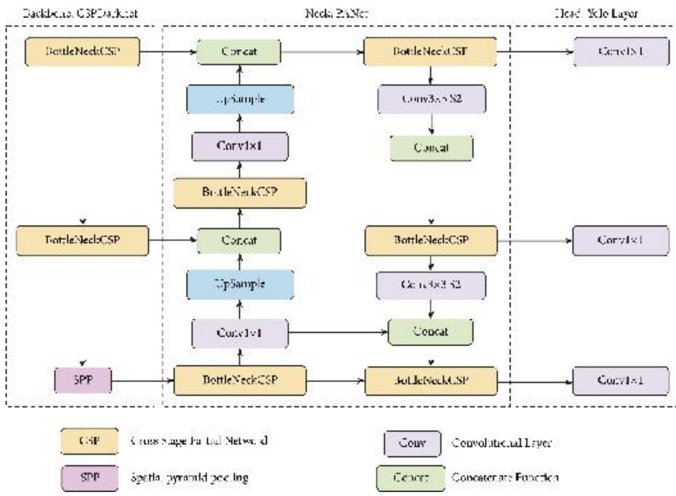

Figure 2

The YOLO family of models consists of three main architectural blocks: Backbone, Neck, and Head.(i)YOLOv5 Backbone: it employs CSPDarknet as the backbone for feature extraction from images consisting of cross-stage partial networks(ii)YOLOv5 Neck: it uses PANet to generate a feature pyramids network to perform aggregation on the features and pass it to Head for prediction(iii)YOLOv5 Head: it has layers that generate predictions from the anchor boxes for object detection.

YOLO an acronym for 'You only look once', is an object detection algorithm that divides images into a grid system which is shown in Figure 3. Each cell in the grid is responsible for detecting objects within itself.

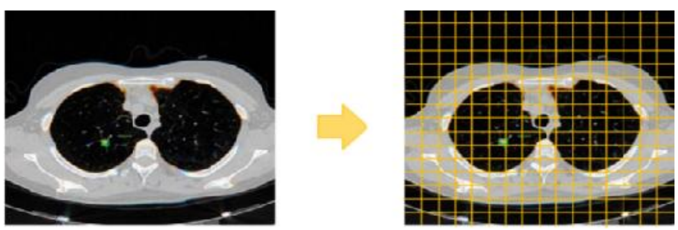

Figure 3

Grid having nodule (i) and no nodule (ii) is shown in Figure 4

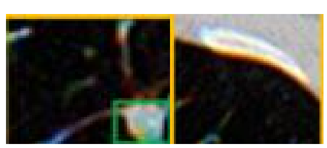

Figure 4

Nodule detected and no nodule detected in input images are shown in Figure 5

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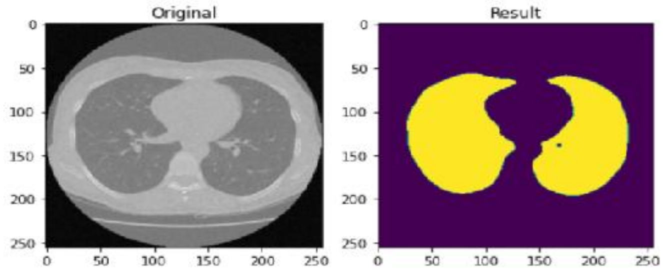
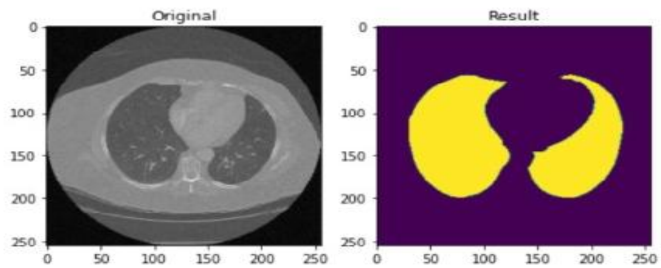


(i)

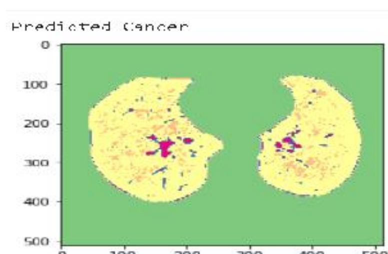


(ii)

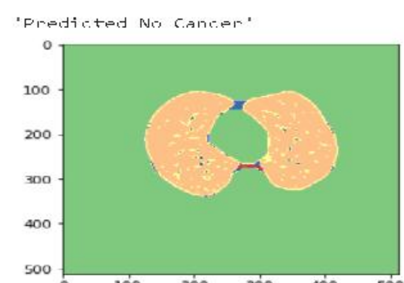
Figure 5

IX. CLASSIFICATION

After Nodule Detection classification will be performed using Convolutional layer to predict whether the images is cancerous (i)or not(ii).This is shown in Figure 6.



(i)



(ii)

Figure 6

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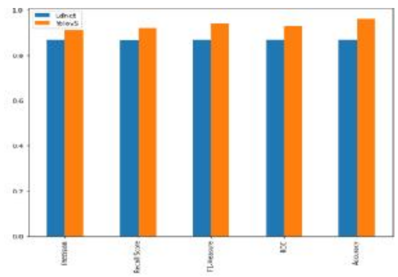
X.EXPERIMENTAL ANALYSIS



XI.CONCLUSION

This paper surveys about Classification Lung Nodule and cancer using Yolov5 method to reduce the time taken for training the data and to increase the accuracy. The prediction of classification was compared between LDNNET and Yolo v5. The whole process include augmentation, conversion of images to 3D for detection and classification of images.

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