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THYROID NODULES SEGMENTATION USING DEEP LEARNING APPROACHES

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ABSTARCT-- *ultrasound is an clear procedure that interpret the internal structure of an organ.It is an unique method that provides most important,rapid and clear evaluation in everymeans.Due to the presence of an unwanted noise in an image it is an challenging task to segementing an image.So in this work we introduce an effective method to segment the image and findout the problem more clear.ultrasound image is the most common method that used nowdays because of its imaging technique and the visibility of the internal structure of an organ.The medical reports usually offer quantative analysis of data due to the changes in prior study.Henceforth it is important to give information about an image based upon its size and shape.Image segmentation is the most common tools that used in processing the medical image.Different algorithms that are used to segment the ultrasound image and for further classification.*

KEYWORDS--*ultrasound,segmentation,deep learning,Nodules*

I. INTRODUCTION

Thyroid is a small gland that located in the region of our neck.The insulating thyroid which generates the harmones that travels across our body to all parts through blood.This regulates the body's metabolism.It also relases harmones that are basics for the functioning of various parts in our body.The tissuses that present inside the thyroid gland isresponsible for thyroid cancer.It is a serious condition in which the cells grows abundantly and abnormally that will spread all over our body.A high performance computer aided technique is used to find the accuracy of thyroid detection.For better convenience for doctors,the segmentation of thyroid areas to find out the affected region make the diagnosis very easy and also it is able to detmine whether it is cancer or disease.It is not always very easy to segment the ultrasound image automatically and accurately.The segmentation of left lobe and right lobe present inside the thyroid gland is not at all successful and easy.The separation of lobes from the us image is difficult. . This paper describes about different segmentation technique such as u-net segmentation, SegNet segmentation and FCN segmentation and the results are compared to find out which one give better accuracy. . This paper describes about different segmentation technique such as u-net segmentation, SegNet segmentation and FCN segmentation and the results are compared to find out which one give better accuracy.Deep learning approaches are used in this work for segment the ultrasound image for further classification.

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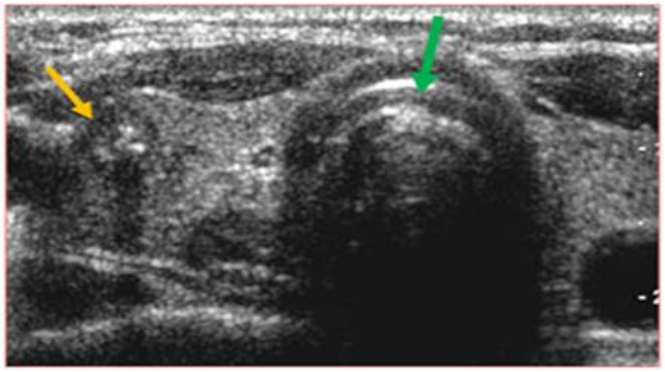


Figure 1.1: Thyroid Ultrasound Image

1.1 WORK FOCUSS

1.The image is got segmented by using deep learning segmentation approaches such as segnet,unet and fcn and the metrices are calculated and performance is evaluated to find which one is more efficient than another two

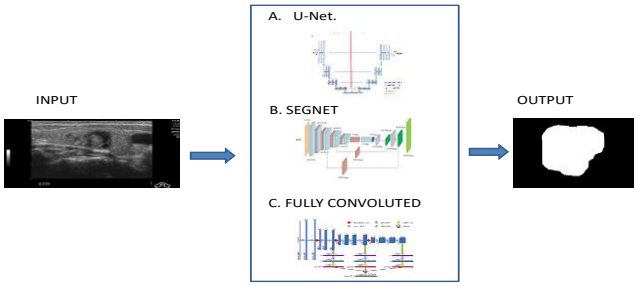
II. METHODOLOGIES

Three different deep learning techniques are used to segmented the given ultrasound images.

a.SEGNET

b.UNET

C.FCN



The above diagram explains about the segmentation of an ultrasound image. The us image is segmented by means of using the deep learning approaches such as U-net,Segnet,Fully convoluted .IN every methodologies the image is fed up in to various layers and finally its is concatenated.From this three methodologies which one give high level of performance is the major criteria of my work.

2.1 SEGNET

The pixel wise segmentation of an fully convolutional neural network architecture was described as Segnet.The classification layer that present inside the segnet that consists of both encoder network and decoder network.The encoder network which consists of 13 convolutional layer named as VGG network.The feature map pixel based classification is done by the encoder and decoder network.To map the low resolution in an image we used decoder network and for the fully resolution maps in the pixel wise classification encoder was used. The decoder which used the low resolution to featurethe input maps.The decoder which used the low resolution to

feature the input maps.The decoder usually uses pooling indicies values which is obtained from max-pooling.It is used to perform non-linear upsampling.Then the sampled maps are joined and then combined with trainable filter maps

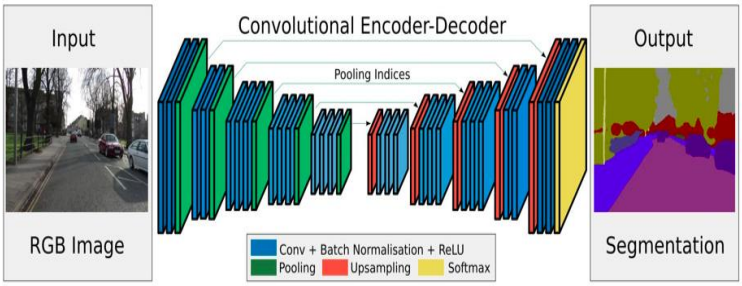


Figure [2.1]: segnet architecture using various layers

2.2.U-NET SEGMENTATION

The architecture shown in [fig3.b] .The architecture consists of two sets of path.To capture the shape analysis of the given image the contracting path must be used.To identify the clear localization of the image the expanding path is used.The U-net architecture ressembles the alphabetic letter 'U' in which the left side indicates the contracting path and the right side indicates the expanding path.The convolutional network is followed by the contracting path.The convolutional network is based upon 3*3 convolution which uses the RELU Layer and max pooling with stride value for down sampling.The down sampling is used to double the feature channels.The upsampling is done by means of the expansive path which is segmented by2*2 convolution and concatenation is done in the contracting path.To prevent the border pixel in every convolution cropping is used.

At last all the layers are concatenated by using1*1 convolution.In total the U-Net architecture used23 convolutional network.

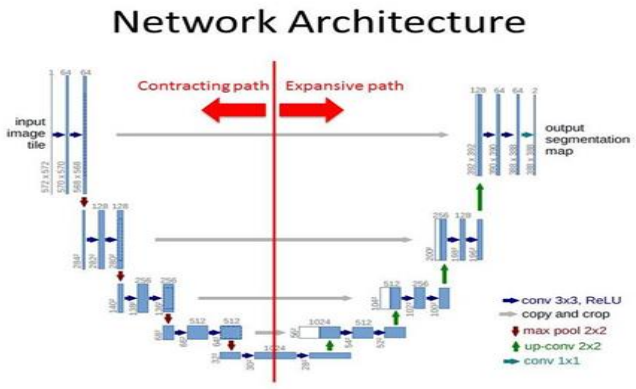


Figure [2.2]: Diagrammatic representation of U-Net segmentation

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2.3.FULLY CONVOLUTED NETWORK

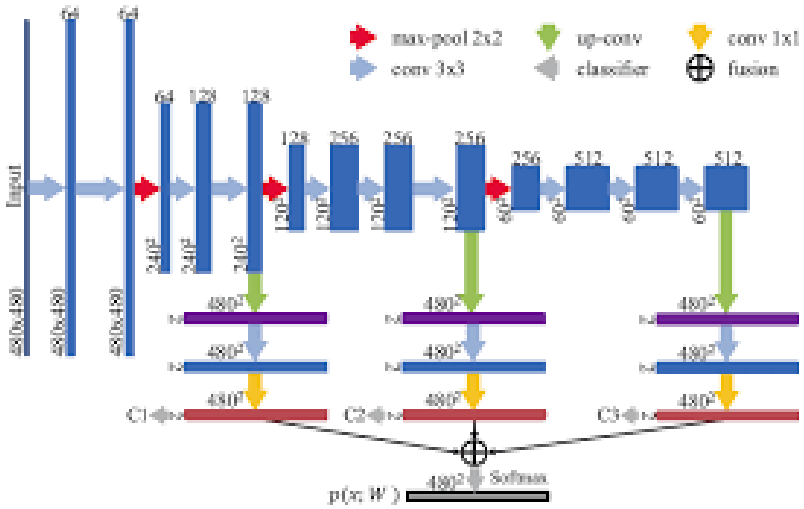

Figure [2.3]: Thefigure depicts the fully convoluted network architecture

The layers which are connected locally by means of convolution,pooling and upsampling[3] the architecture fully convoluted network is used.FCN layer architecture is proably to reduce the total amount o9f time for segmentation of image.The dense layer is not present in the Fcn.The Fcn architecture works on an image without obtain any data from the original image because the layers that are concatenated locally.The Fcn segmentation that is done by means of a.Down sampling path It is used to capture the semantic information of the image to be segmented

b.Upsampling path

It is used to decrease the storing capacity and transmission requirements of the image The downsampling path is used to recover and explain the proper meaning of the given image.The upsampling path is used to find the proper location of the image.To recover the spatial information that may lost during down sampling and upsampling path a technique called skip connection was used.A skip connection is a procedure that is used to concatenate at least one layer.The information from one layer to another layer is concatenate by feature maps.The features from various layers arefinally combined as an context information and spatial information

III. DATA DESCRIPTION

The data was collected from publicly available thyroid ultrasound image datyabase.In which the data base consists of 476 thyroid ultrasound images.In my research work I used 334for training and 142for testing. The three different methodology such as Segnet,Unet and fully convoluted networks are implemented on this training data and segmentation was done on the data and the results are analysed below.

IV. METRICS CALCULATION

The ultrasound images that are segmented by using Fcn,Segnet,U-net.The performance of the three deep learning methodologies are calculated by using the below metrics.

i)Dice-coefficient

The dice co-efficient is used to calculate the similarity between the image that is segmented and the ground truth The formula is $\frac{2*|A \cap B|}{|A|+|B|}$

where $|A|$ and $|B|$ which represents the number of elements in a set.AnB is the common characteristics of the image in which A is an segmented image and B is the ground truth.The intersection between A and B is twice multiplied with individual value of A and B.

ii)Accuracy

Accuracy is the most important performance measure and it is simply a ratio of corrected predicted observsation to the total observation

Accuracy=TP+TN/TP+FP+FN+TN

TP-True Positive

TN-True Negative

FP-False positive

FN-False Negative

iii)Sensitivity

Sensitivity is the ratio of correctly predicted positive observations in actual class

Sensitivity=TP/TP+FN

TP:The result that detected was positive and foreseen result was also positive

FN:The result that detected was positive and foreseen result was negative

TN:The result that dectected was positive and foreseen result was negative

FP:The result that detected was negative and foreseen result was positive

V. RESULT AND ANALYSIS

The three different methodology such as SEGNET,UNET and FCN are implemented on this training data and segmentation was done based upon their different characteristics. The results are obtained after segmentation of the data and the results are analysed below.

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Figure 3: Orginal ultrasound image

Figure 4: The thyroid nodules segmented after using segnet deep learning

Figure 5: The image segmented after fcn segmentation

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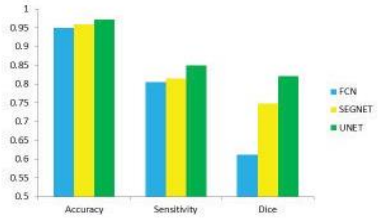
Figure 6: segmentation after unet approach

	FCN	SEGNET	UNET
Accuracy	0.950426881	0.960007	0.97168
Sensitivity	0.806036575	0.815356	0.84927
Dice	0.61227355	0.748585	0.82171



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VI. CONCLUSION

The overall methodologies describes an effective way for the segmentation of thyroid images. While comparing the three segmentation methods segnet,unet and fcn.Theunet segmentation which gave high accuracy when compared with other two methodology. The unet segmentation is an effective one to segment the nodules and it is helpful for further diagnosis . . The deep learning and machine learning approaches are much more widely used for the classification of thyroid nodules. This work basically provides an summary about the existing automatic tools available to develop illness analysis portion easier and also fine effective. Different execution evaluation metrics are studied and upcoming growths and movements are also examined. Such techniques will help the diagnosis process by automatically detect the nodules in thyroid images and reduce the false diagnosis. The feasible feature extraction and classification methods for detecting thyroid nodules can be determined and applied to ultrasound images using various methods and techniques for application in an combined actual system for thyroid gland in future.

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thyroid nodules correctly and efficiently

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32. This paper proposed deep learning approaches such as CNN.CNN can be obtained by using 12 layers.The network used in CNN was well trained and CT image is taken and augumentation process is done\
33. By using multi layer networks and machine learning algorithms the image is segmented by using multiple layers of information that can be followed by pattern analysis of classification..
34. Multi model image technique was most commonly used to segment the medical image.The segmented image uses image fusion architecture based on concepts to obtain the image more clear
35. The loss in the noisy image can be demonstrated by the neural network to produce a high quality image obtained by using weighed loss function.

    By conducting deep learning methods for medical imageProcessing in multi modal image analysis by an algorithmic architecture such as cross modality and feature learning extraction based on CNN