SEGMENTATION OF THYROID NODULES

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Abstract: 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 every means. Due to the presence of an unwanted noise in an image it is an challenging task to segmenting an image. So in this work we introduce an effective method to segment the image and find out 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 quantitate 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.

I. INTRODUCTION

Thyroid is a small gland that located in the region of our neck. The insulating thyroid which generates the hormones that travels across our body to all parts through blood. This regulates the body's metabolism. It also releases hormones that are basics for the functioning of various parts in our body. The tissues that present inside the thyroid gland is responsible 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 demine 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.

II. METHODOLOGY

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

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

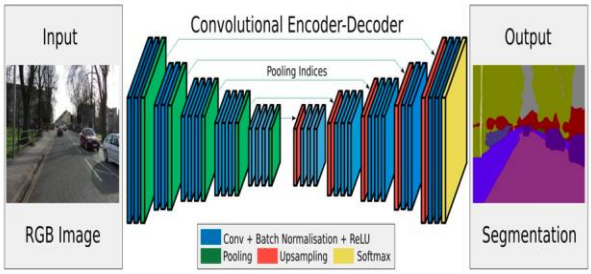


Figure [3.a]-segnet architecture using various layers

B. 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 resembles 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.

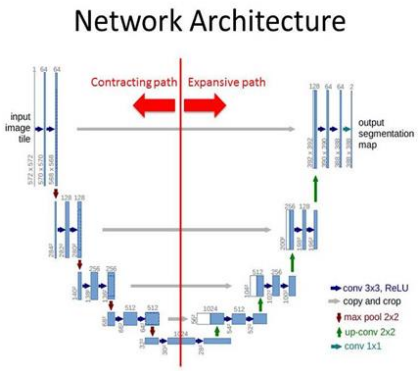


Fig [3.b] Diagrammatic representation of U-Net segmentation

C. FCN Segmentation

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 probably 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 two paths

1.Down sampling path: It is used to capture the semantic information of the image to be segmented

2.Upsampling path: It is used to decrease the storing capacity and transmission requirements of the image

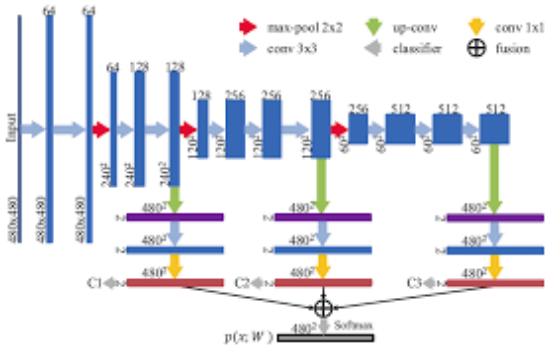


Fig [3.C] -The figure depicts the fully convoluted network architecture

III. 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,

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.

Accuracy:

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

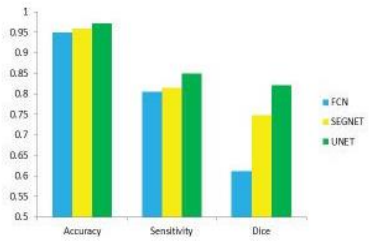
Accuracy=TP+TN/TP+FP+FN+TN

Sensitivity:

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

Sensitivity=TP/TP+FN

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



V. CONCLUSION

The overall methodologies describes an effective way for the segmentation of thyroid images. While comparing the three segmentation methods segnet, unet and fcn. The unet 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.