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Artificial Neural Network Implementation for Classification of Lung Tissues in High Resolution Tomography Images

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***Abstract:** In this digital world, the amount of information what we are getting is uncountable and speed at which it reaches us is unpredictable. We are getting is uncountable. In order to understand and predict the required data we should have the image classification technique otherwise there will be lot of confusion and misunderstanding will happen during its study. Content based image retrieval technique can be used to exploit the properties of high resolution computed tomography data which will be stored in the achieve by identifying the similar images which will helped for radiologist for self learning and differential diagnosis of intestinal lungs diseases. This technique identifies the particular image based on the content present in the image rather than keywords or tag related to the image. The content present in the image means, patterns, colors, textures etc. high resolution technique of image identification method is used in many medical applications like identifying diseases or the identification of symptoms of the diseases. in this project we are using the neural network classifier to classify the lung tissues in high resolution computed tomography images. This method gives the proper and clear classification of the lung tissues which will helps in medical science field. This neural network classifier uses the optimal subset feature to classify the pattern of the lung tissues.*

***Keywords:** content based image retrieval CBIR), interstitial lung disease (ILD), high resolution computed tomography (HRCT) neural network. .*

I. INTRODUCTION

High resolution computed tomography uses the 3d volume of the image, this will helps in clear appearance of the structures of the anatomy. It will show the proper and exact pattern of the disease compare to conventional X rays. So we will use the appearance of the images and fed it to the neural network classifier to train and test. We have used the segmentation and feature extraction technique to extract the useful information about the image based on which we have classified. The image obtained from the HRCT is fed into the neural network classifier.

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The degree of this classifier is will be analyzed with the help of the naïve bayes classifier, which will takes decision dynamically and it compares the actual sample with three different samples [1]. With the reference of the direction of the texture, the texture of the image will be grabbed by using discrete waveform transform technique. The images obtained from the HRCT techniques are used for the experiment. The results obtained from this experiment shows that the images are anisotropic in nature [2]. The images taken at different pixels and resolution frames good relationship with the help of fuzzy logic, which will enables the identification of very small and very high images based on their existing patterns and background [3]. The texture and segmentation of the image can be done by using artificial neural network. The ANN is designed or configured in such a way that it has to segment the image properly [4].many neural columns were trained and became experts in processing the input data. The predictions of the data have been averaged and processed further [5]. The effective classification of the group of particular elements or the features of the particular group of the elements can be met by using artificial neural networks. This pattern recognition technique especially used in the medical field which is used to identify the symptoms of the diseases or the pattern of the anatomy [6]. An algorithm has designed in order to identify the images of the satellite. An artificial neural network classifier has compared the patterns produced by different algorithms and stored. This technique is used in the remote sensing applications. The kappa coefficient and overall classification of the images are calculated and compared with the standards [7]. Conventional neural network contains the image processing, pattern recognition and many more features. To handle and to calculate the bulk amount of the data, parallel computing tool box will be available in the MATLAB [8]. The CT scanned images can be processed and classified by using random forest classifier and j48 decision tree. The different techniques like haralick, tamura and wold are implemented for pattern recognition and finally compared to extract the actual result [9]. The images obtained from the CT scan can be processed y using HRTC technique. The body parts of the patient can be identified based on its pattern by using HRTC [10].

II. II. BIOLOGICAL DESCRIPTION OF LUNG TISSUES:

A. Lung Anatomy

Lungs are the main part of respiratory system of human as well as in all animals. Lungs help in taking oxygen from the atmosphere and supply it to all parts of the body.

It also helps in removing the carbon dioxide from the body and sends it to the atmosphere shown in figure 1.If any problems happen to the lungs means the respiratory damaged and causes breathing problem.

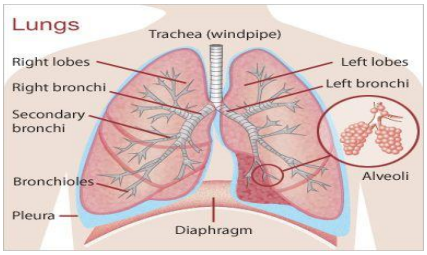

Fig 1: Lung Structure

B. CONSOLIDATION

Figure 2 indicates the diseased lung tissue which will be filled with 78 percent with liquid and remaining will be filled with solid content.

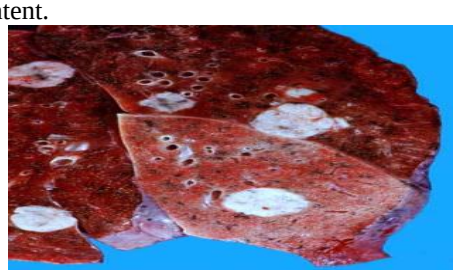

Fig 2: Consolidation

C. EMPHYSEMA

Figure 3 shows the lung under emphysema condition. It means it becomes large due too break down of its walls.

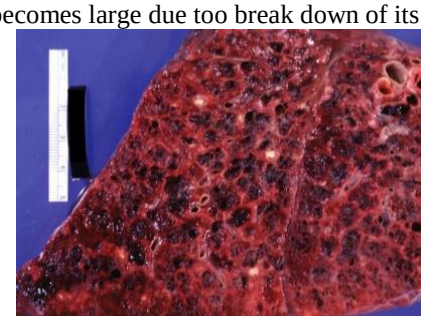

Fig 3: Consolidation

D. FIBROSIS

Pulmonary fibrosis can form by quickly or slowly shown in figure 4. It depends on the person who suffers from this disease. If a person suffers from these diseases means he will suffer from respiratory problem and breathing problem occurs.

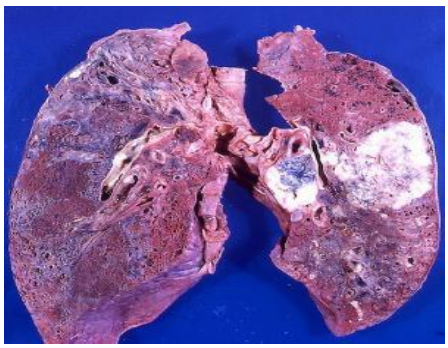

Fig 4: Fibrosis

E. NODULAR

It is a mass found in lung which is smaller than three centimeters in diameter. It can be found the it covers 02% space when we use X rays and 1% when we used to see by using CT scan shown in figure 5. The majority of this organ will be found in people who addicted to smoke and some old people.

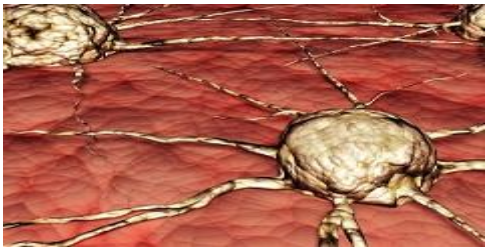

Fig 5: Nodular

III. TWO LAYER NEURAL NETWORK

As its name indicates the neural network consist of two layers. Any layered neural network consists of three layers inside them. First one is input layer, second layer is hidden layer and last layer is output layer. The input variables are applied to the input layer. The intermediate layer which exists between input and output layer is called as hidden layer. The output variables can be collected from the output layer, all these layers may contain single or multi nodes as shown in figure 6.

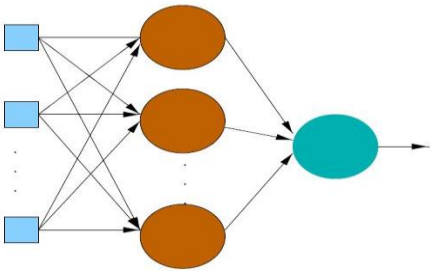

Fig 6: Two layer neural network

IV. METHODOLOGY

The method of classification of images of lung tissue can be done by three steps like segmentation, feature extraction and technique, neural network classifier.

A. Segmentation

The main objective of this process is to decompose the image into several parts. It means the image which needs to be processed has to be divided into several parts by and analyzed. The regions of the images have grouped based on the pixels and borders on the images are marked as line segments and arc circular segments for analysis purpose.

B. feature extraction

the initial set data has measured has been measured and with the help of derived initial values the pattern recognition and pattern identification has carried out in machine learning. It reduces the overall dimension of the image. when the algorithm used for the analysis becomes larges than it will be reduced into smaller by extracting its feature by using this technique.

Discrete Wavelet Transform

The DWT plays an important role is image processing field. .the images obtained from the HRTC is divided into four different bands by using DWT those are LL, LH, HL and HH. A discrete wavelet transform is given as

$$\widehat{w}(u, s) = \int \hat{x}(t)\hat{h}\left(\frac{t-u}{s}\right) dt$$

The samples of the Wavelet function is given as,

$$W(b, a) = \frac{1}{|a|^{1/2}} \sum_{i=b}^{i=aNw\ +b-1} x(i)\hat{h}\left(\frac{i-b}{a}\right)C.$$

C. Classification

After obtaining the different types of features from feature extractor next step is like we should. No need to write the separate algorithm for the classification purpose which will be hectic again, so we can direct fed the data obtaining from the feature extractor to the input port of the classifier. There are many different classifier have existed but we are using artificial neural network classifier as shown in figure 7. The input to the classifier is applied at input port and each input data is multiplied with their weights. The weighted inputs are summed up inside the classifier and the weighted output will be obtained at output terminals of the classifier.

If the summed up value is greater than zero than weighted output 1 or it will be zero.

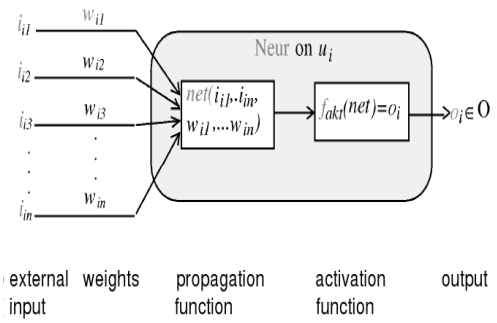

Fig 7: Working of Neural Network Classifier

Before weighted data collected at output ports it has to be activated by using the following function as an activator as shown in figure 8.

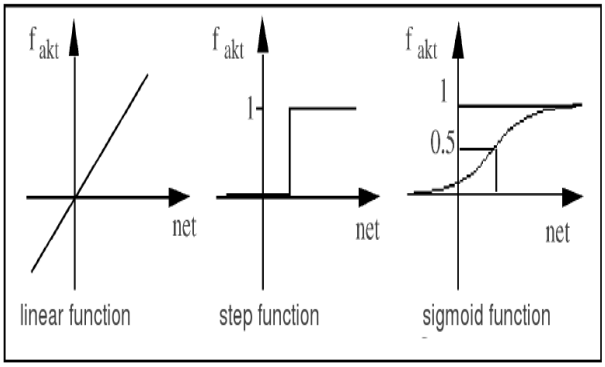

Fig 8: types of activation functions

V. RESULTS

The experiment has conducted on almost 120 different types images in on the format of dicom. The classification and types of these images has performed and groped them as shown in the table 1 shown below. These different types have already discussed above.

Table 1: types of functions

Consol idation	Emphysema	Fibrosis	Nodular	Ground glass	normal	total
20	20	20	20	20	20	120

The data have obtained from the university hospital Geneva and tested. The data obtained from the extractor and classified by using neural network classifier as discussed above. The images of the interstitial lung dieses are trained and tested in neural network classifier, the confusion matrix for the given data base is as shown in figure 8.

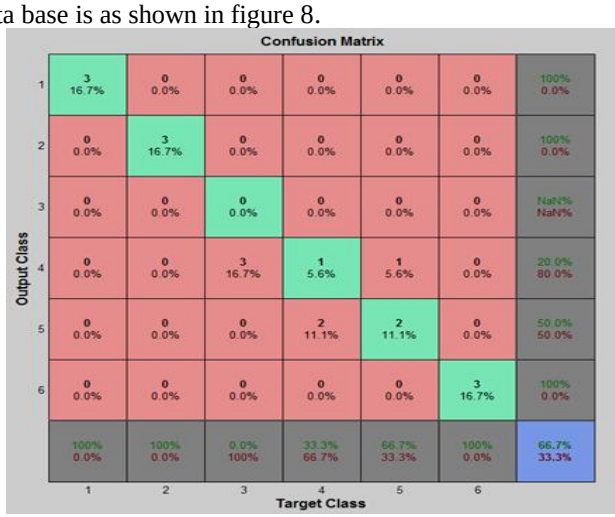

Fig 9: Confusion Matrix for the given data

VI. CONCLUSION AND FUTURE SCOPE

The computer based image classification or identification technique will helps for the staff members of medical science to easily detection of the type of images with clear pictures. From figure 8 we can see that the implemented technique is not giving proper information regarding fibrosis type of lung disease hence we can conclude theta the implemented technique does not give accurate result about all types of lung diseases. Hence we need to work on improving the accuracy of the given system in identifying all types of lung diseases

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