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PERFORMANCE EVALUATION OF LIVER DISEASE DIAGNOSIS BASED ON NEURAL NETWORKS

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Abstract:
Artificial Neural Network has been developed to solve the problems facing physicians in diagnosis of liver diseases. Experience has shown that many patients suffering from liver disorder die daily as a result of misdiagnosis of the diseases. Therefore, two models Radial Bias Neural Network and Feed Forward Network Neural Network are designed to diagnose these diseases and also prevent misdiagnosis of the liver disorder patients. These systems are developed using the BUPA liver disorder dataset obtained from UCI machine learning repository. The dataset is made up of 6 attributes which are major factors that cause liver disorder in patients. The results obtained from testing of the networks were compared with each other. Also, with the previous research on liver disorder using the same dataset to ascertain the best network needed for diagnosis of the disease. Experience has shown that many patients suffering from liver disorder die daily as a result of misdiagnosis of the diseases. From the past experience has shown that many patients suffer from disorder has died due to misdiagnosis of the disease.

Keywords – UCI, BUPA, Feed forward, disorder.

1. INTRODUCTION

The Ultrasound Medical imaging technique is generally used for scanning various organs and soft tissues. The use of ultrasonography as an imaging technique has become widely spread because of its ability to visualize all the organs with clear effects. The basic idea of ultrasound imaging is to send a fine beam of ultrasonic waves through the human tissues and then receive the echo reflections from the internal body structures to form the image. It enables the person to select the right image plane to display anatomy accurately into the organs like liver, kidney, pancreas etc. The main advantages of the ultrasound medical imaging are that it is cost effective and has exact characteristics. Noninvasive diagnostic methods for liver diseases include Ultrasound, Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) .Ultrasound liver texture can be used to classify a liver as normal, fatty, cyst, Haemangioma, metastases. Liver diseases can be diagnosed by ultrasound by observing the characteristics of the liver. Ultrasound image analysis finds its most usefulness in classifying different liver diseases as discussed. Casting the Probability Density Function (PDE) approach and adaptive filtering approach by YongjianYu et.al, which developed a new model for speckle reduction called as Speckle Reducing Anisotropic Diffusion (SRAD) method. SRAD filter is shown to generate images with better quality and excels over the traditional despeckle filters and the conventional anisotropic diffusion method in terms of speckle reduction, edge preservation and image clarity. Various combinations of noise removal, segmentation, features and classification techniques give varied results and these have been analyzed by different researches to find the best method. Texture analysis methods are classified as statistical, structural and spectral methods.The universal approximation theorem for neural networks states that every continuous function that maps intervals of real numbers to some output interval of real numbers can be approximated arbitrarily closely by a multi-layer perception with just one hidden layer. There is no theoretical reason ever to use more than two hidden layers. It is also been seen that for the vast majority of principal

problems .Those problems that require two hidden layers are only rarely encountered in real life situations.

2. LITERATURE REVIEW

The main objective of this study is to develop an optimal neural network based DSS, which is aimed at precise and reliable diagnosis of Chronic Active Hepatitis (CAH) and cirrhosis (CRH). Multilayer Perceptron (MLP) neural network is designed scrupulously for classification of these diseases. The neural network is trained by eight quantified texture features, which were extracted from five different Regions of Interests (ROIs) uniformly distributed in each B-mode ultrasonic image of Normal Liver (NL), CAH and CRH. The proposed MLP NN classifier is the most efficient learning machine that is able to classify all three cases of diffused liver with average classification accuracy of 96.55%; 6 cases of cirrhosis out of 7 (6/7), all 7 cases of chronic active hepatitis (7/7) and all 15 cases of normal liver (15/15). The advantage of proposed MLP NN based Decision Support System (DSS) is its hardware compactness and computational simplicity.Artificial Neural Network has been developed to solve the problems facing physicians in diagnosis of liver diseases. Experience has shown that many patients suffering from liver disorder die daily as a result of misdiagnosis of the diseases. Therefore, two models: back propagation neural network and radial basis function neural network are designed to diagnose these diseases and also prevent misdiagnosis of the liver disorder patients. Eleven data mining classification algorithms were applied to the datasets and the performance of all classifiers are compared against each other in terms of accuracy, precision, and recall. Several investigations have also been carried out to improve performance of the classification models. Finally, the results shown promising methodology in diagnosing liver disease during the earlier stages.

3. ARTIFICIAL NEURAL NETWORKS

Artificial Neural Network (ANN) takes their name from the network of nerve cells in the brain. Recently, ANN has been found to be an important technique for classification and optimization problem. Artificial Neural Networks (ANN) has emerged as a powerful learning technique to perform complex tasks in highly nonlinear dynamic environments.

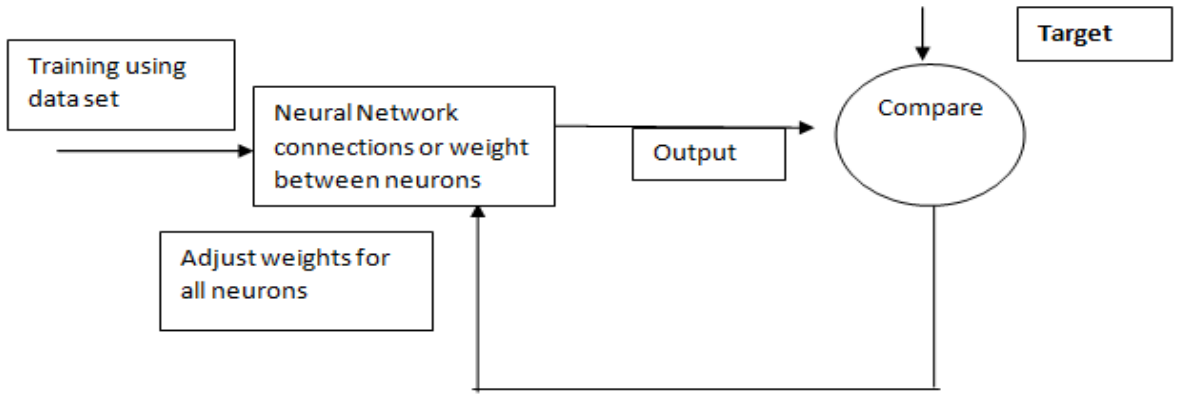

Fig.1.Neural Network Model

Some of the prime advantages of using ANN models are their ability to learn based on optimization of an appropriate error function and their excellent performance for approximation of nonlinear function. The ANN is capable of performing nonlinear mapping between the input and output space due to its large parallel interconnection between different layers and nonlinear processing characteristics. An artificial neuron basically consists of a computing element that performs the weighted sum of the input signal and the connecting weight. The sum is added with the bias or threshold and the resultant signal is then passed through a nonlinear function of sigmoid or hyperbolic tangent type. Each neuron is associated with three parameters whose learning can be adjusted; these are the connecting weights, the bias and the slope of the nonlinear function. For the structural point of view a NN may be single layer or it may be multilayer. In multilayer structure, there is one or many artificial neurons in each layer and for a practical case there may be number of layers. Each neuron of the one layer is connected to each and every neuron of the next layer. The functional link ANN is another type of signal layer NN. In this type of network the input data is allowed to pass through a functional expansion block where the input data are nonlinearly mapped to more number of points. This is achieved by using trigonometric functions, tensor products or power terms of the input. The output of the functional expansion is then passed through a single neuron. The learning of the NN may be supervised in the presence of the desired signal or it may be unsupervised when the desired signal is not accessible. Here is this thesis ANN is supervised learning. The liver is the second largest organ in the body. The liver's function is to process everything we eat or drink and filter any harmful substances from the blood. This process is interrupted if too much fat is in the liver. The liver commonly repairs itself by rebuilding new liver cells when the old ones are damaged. When there's repeated damage to the liver, permanent scarring takes place. This is called cirrhosis.

4. IMAGE PROCESSING

The first step in the process is image acquisition by an imaging sensor in conjunction with a digitizer to digitize the image. The next step is the preprocessing step where the image is improved being fed as an input to the other processes.

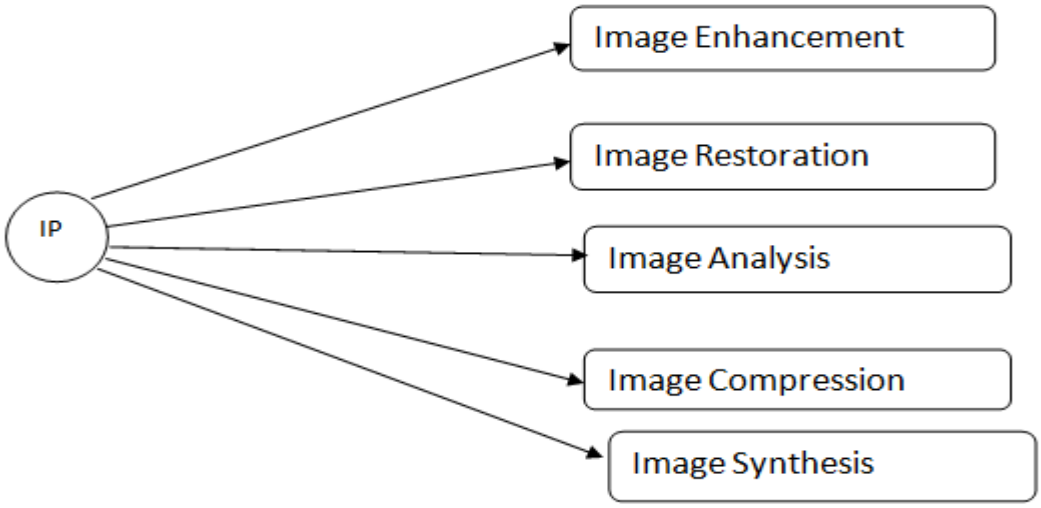

Fig.2.Image processing

Preprocessing typically deals with enhancing, removing noise, isolating regions, etc. Segmentation partitions an image into its constituent parts or objects. The output of segmentation is usually raw pixel data, which consists of either the boundary of the region or the pixels in the region themselves. Representation is the process of transforming the raw pixel data into a form useful for subsequent processing by the computer. Description deals with extracting features that are basic in differentiating one class of objects from another. Recognition assigns a label to an object based on the information provided by its descriptors. Interpretation involves assigning meaning to an ensemble of recognized objects. The knowledge about a problem domain is incorporated into the knowledge base.

5. RESULT ANALYSIS

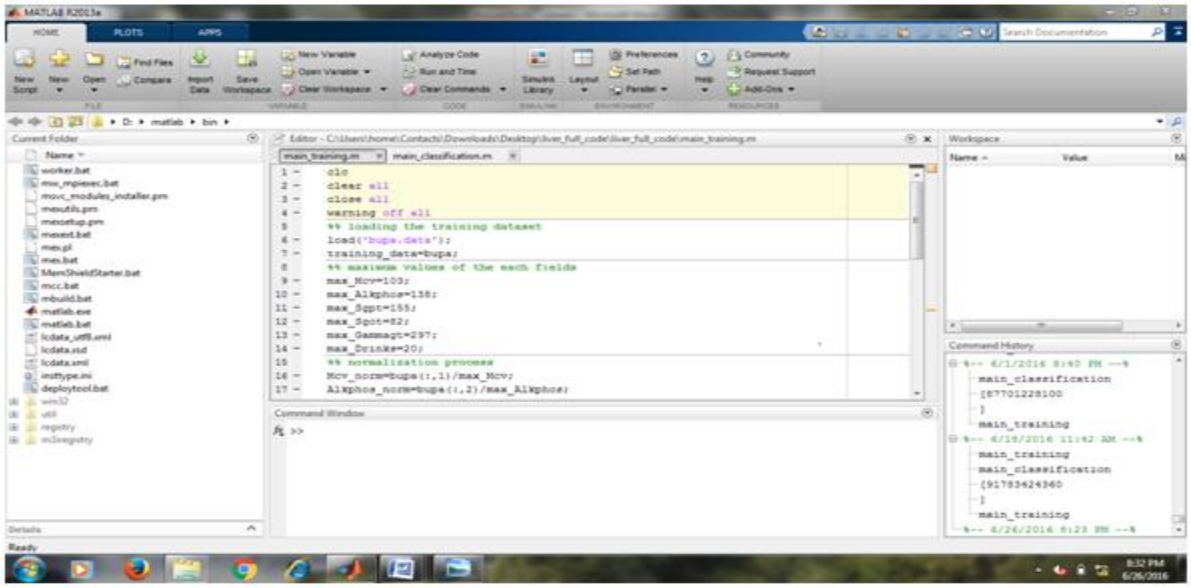

Fig.3.Input

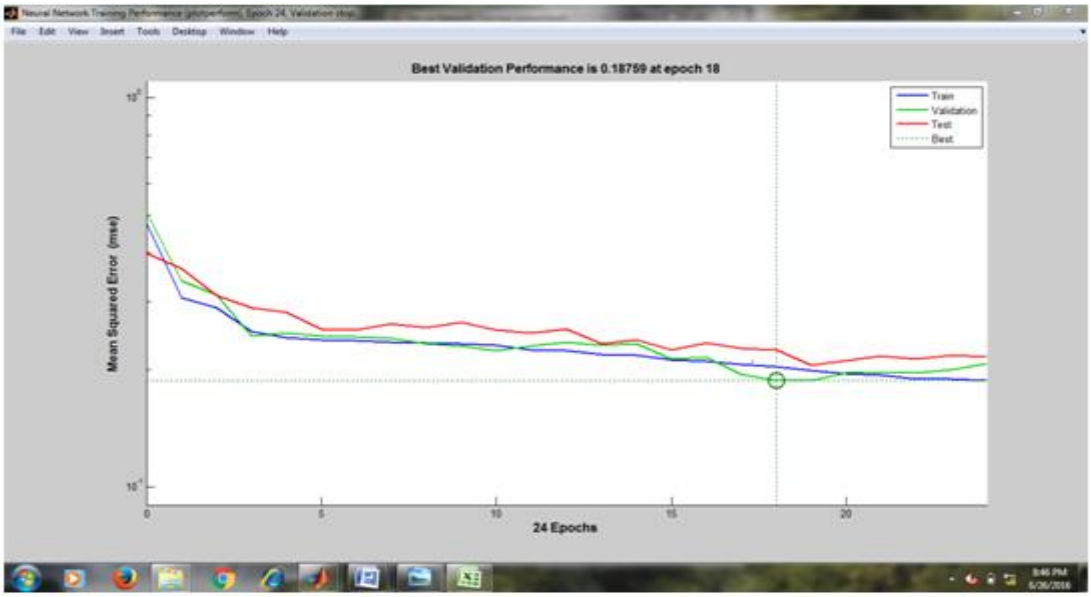

Fig.4.Liver validation performance

The knowledge base guides the operation of each processing module and also controls the interaction between the modules. Not all modules need be necessarily present for a specific function. The composition of the image processing system depends on its application. The frame rate of the image processor is normally around 25 frames per second.Image compression and decompression reduce the data content necessary to describe the image. Most of the images contain lot of redundant information, compression removes all the redundancies. Because of the compression the size is reduced, so efficiently stored or transported. The compressed image is decompressed when displayed. Lossless compression preserves the exact data in the original image, but Loss compression does not represent the original image but provide excellent compression.

CONCLUSION

Liver disease diagnosis compared the two models have been developed to diagnose liver disorder in a patient. It has been discovered that the feed forward neural network has the optimal recognition rate in diagnoses of the liver disorder than radial basis function network. The feed forward neural network has a recognition rate of 85% which has proved more accurate and efficient than the other algorithms. Comparing this work with the previous research works, it was discovered that the feed forward algorithm also proved efficient.

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