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PROPOSING EFFICIENT NEURAL NETWORK TRAINING MODEL FOR THYROID DISEASE DIAGNOSIS

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Abstract: Artificial neural networks are increasingly popular in today's business fields. Artificial Neural networks are often used as a powerful discriminating classifier for tasks in medical diagnosis for early detection of diseases. One of the major challenges in giving proper treatment is always fast and accurate diagnosis of the disease. A lot of works have been done in medical diagnosis using different neural network techniques. But it had always been a tough task to identify the best technique for any diagnosis. The aim of this work is to propose an efficient neural network training model for thyroid disease diagnosis. It presents general model for diagnosing any disease The objective of this paper is to diagnose thyroid disease by using three different neural network algorithms which have different architecture and characteristics.
Keywords: Artificial neural networks; Diagnosis; Radial basis function; Learning methods; Multilayer Perceptrons; Support vector machine.

I. INTRODUCTION

Thyroid is a butterfly shaped gland found just below the Adam's apple of our neck. It is responsible for the metabolism activities of our body. When it functions properly it produces two hormones called triiodiothrinine (T3) and thyroxin (T4). A hormone called Thyroid Stimulating Hormone (TSH) which is secreted by pituitary gland is also responsible for T3 and T4 hormones. TSH, T3 and T4 decide the health of a person. Over activity of thyroid hormones results in hyperthyroidism where us the under activity of the same results in hypothyroidism. Thyroid disease can be diagnosed using the following tests (i) Radioimmunoassay test for TSH, T3 and T4. (ii) Scanning for goiter or nodules etc. thyroid diseases are found in KERALA based people because the iodine content problem. More than 20% of the Americans are said to have thyroid problems [9]. People in the age group of 20 to 40 are mostly affected by thyroid disorders. Women are having more risk than men in developing thyroid disorders. They can develop thyroid disorders during their pregnancy also. Thyroid disease is caused by the following factors which can be classified as controllable and contributing factors.

1. Age
2. Sex
3. T3
4. T4
5. TSH
6. Iodine Intake
7. Medication for thyroid problems
8. Thyroid cancer
9. Thyroid Supplement

Normal thyroid level chart

Hormones	Normal range	Interpretation
T3(Serum triiodothyronine)	80 - 220	T3<80 indicates hypothyroidism.
Total T4 (Serum thyroxine)	4.5 to 12.5	T4<4.5 with elevated TSH indicates under-active thyroid. T4>12.5 indicates hyperthyroidism. T4<4.5 with low TSH suggests a pituitary problem.
TSH	0.3 to 3.0	TSH<0.3 indicate hyperthyroidism and TSH>3.0 indicate hypothyroidism.

II. TECHNIQUES USED FOR THYROID DIAGNOSIS IN THIS PAPER

A. Back propagation network

Back propagation is a supervised learning network. It requires a dataset of the desired output for many inputs, for creating the training set. There are two type of transfer function can be used by the back propagation algorithm is sigmoid and log sigmoid. Back propagation algorithm is also known as multilayered feed forward network. The performance function used was mean sum- squared error (MSE) Back propagation is a form of supervised learning for multi-layer nets, also known as the generalized delta rule. Error data at the output layer is "back propagated" to earlier ones, allowing incoming weights to these layers to be updated**.** The back propagation algorithm was developed by Paul werbos in 1974 and rediscovered independently by Rumelhart and parker.

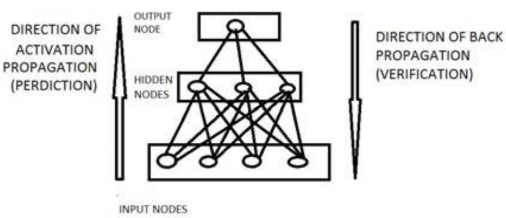

Fig 1: Architecture of back propagation

B. Radial basis network

Radial basis function network is an artificial neural network that uses the radial basis function as an activation functions. A Radial Basis Function (RBF) neural network has an input layer, a hidden layer and an output layer. The neurons in the hidden layer contain Gaussian transfer functions whose outputs are inversely proportional to the distance from the centre of the neuron. The Gaussian function responds only to a small region of the input space where the Gaussian is centered**.** Radial Basis Functions (RBFs) have their *o*rigins in approximation theory, where they are used to produce approximations to unknown functions, based on sets of input-output. Data representing the unknown function Gaussian RBF are said to be local processing networks because the effect of a hidden unit is usually concentrated on a local area centered at the weight vector. The architecture of RBF network is shown in fig 2.

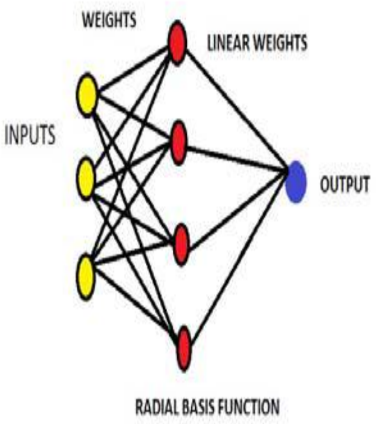

Fig 2: Architecture of radial basis network

C. Learning Vector Quantization Algorithm

Specifically, Learning Vector Quantization is an artificial neural network model used both for classification and image segmentation problems. Topologically, the network contains an input layer, a single Kohonen layer and an output layer. An example network is shown in Figure 3. The output layer has as many processing elements as there are distinct categories, or classes. The Kohonen layer has a number of processing elements grouped for each of these classes. The number of processing elements per class depends upon the complexity of the input-output relationship. Usually, each class will have the same number of elements throughout the layer. It is the Kohonen layer that learns and performs relational classifications with the aid of a training set. This network uses supervised learning rules. A Learning Vector Quantization Network (LVQ) has a first competitive layer and a second linear layer. The competitive layer learns to classify input vectors in much the same way as the competitive layers of Self-Organizing Nets.

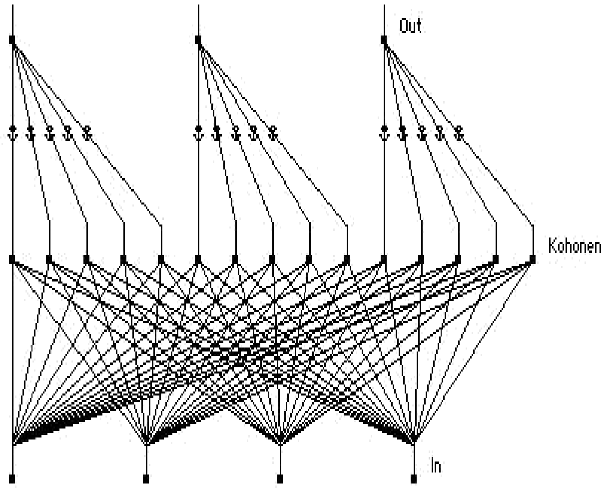

Fig 3: An Example Learning Vector Quantization Network.

III. FUNDAMENTAL STEPS IN ANNS-BASED MEDICAL DIAGNOSIS

The workflow of ANN analysis arising from the outlined clinical situations is shown in Fig. 4 which provides a brief overview of the fundamental steps that should be followed to apply ANNs for the purposes of medical diagnosis with sufficient confidence. the network receives patient's data to predict the diagnosis of a certain disease. After the target disease is established, the next step is to properly select the features (e.g., symptoms, laboratory, and instrumental data) that provide the information needed to discriminate the different health conditions of the patient. In the next step, the database is built, validated and "cleaned" of outliers. After training and verification, the network can be used in practice to predict the diagnosis.

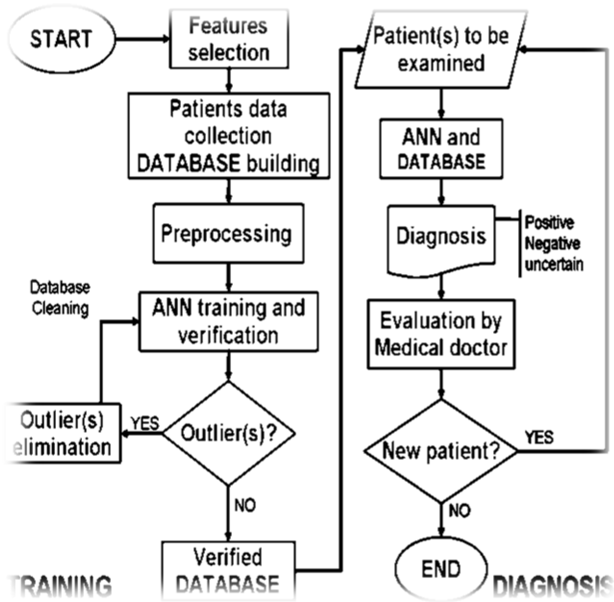

Fig 4: Diagram of fundamental steps in ANNs-based medical diagnosis.

IV. DATASET

The dataset consists of images of persons having thyroid problem. The first step involves the edge detection, then ellicpse fitted image is created. After that image normalization is done. Then it is passed to the training and testing phase for measuring the performance of various artificial neural networks.

V. TOOL USED

MATLAB ("MATrix LABoratory") is a tool for numerical computation and visualization. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows us to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar noninteractive language such as C or Fortran. It includes facilities for managing the variables in workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications. All the algorithms in this work will be implemented using MATLAB.MATLAB 2013a version will used for implementation purpose.

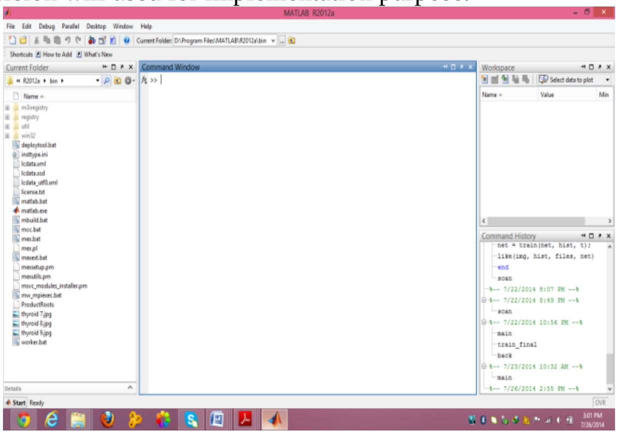

Fig 5: The main environment of the MATLAB

It shows the command window, workspace and command history. The work space shows the various combinations that can be applied on neural networks and command history shows the various commands that we apply on the particular dataset.

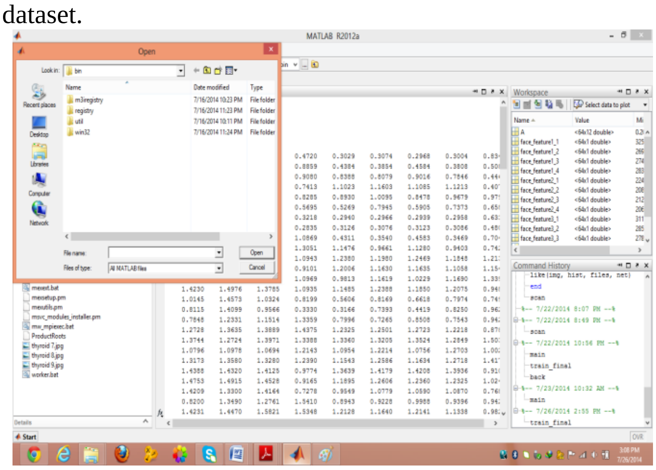

Fig 6: Opening .M file

VI. FUTURE WORK

During the research work,we will diagnose thyroid by using three neural networks algorithms which have different architecture and characteristics and will check the performance comparison of different algorithms to propose the best algorithm for thyroid diagnosis on the basis of its accuracy ,time taken to build the model and training dataset size.Different techniques have their own limitations in terms of accuracy and time.In the same we can compare different algorithms for finding the fast and accurate solution for diagnosing any disease.

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