International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

# Artificial Neural Network

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**Abstract:** ***An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the biological nervous systems, such as the brain, which process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working together to solve specific problems. Artificial Neural Network was used in following Application Areas:*** *Handwriting Recognition,* ***Image Compression, Stock Exchange Predictions etc.***

**Keywords:** ANN (Artificial Neural Network), Neurons, pattern recognition

## 1. Introduction

The study of the human brain is thousands of years old. With the advent of modern electronics, it was only natural to try to discover this thinking process. The first step toward artificial neural networks came in 1943 when Warren McCulloch and Walter Pitts, wrote a paper on how neurons might work. They modeled a simple neural network with electrical circuits. Neural networks, with their remarkable ability to get meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyse.

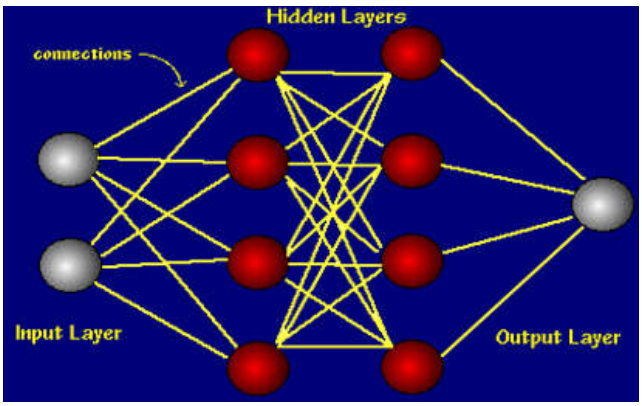
Neural networks take a different approach to problem solving than that of conventional computers. Conventional computers use an algorithmic approach i.e. the computer follows a set of instructions in order to solve a problem. Unless the specific steps that the computer needs to follow are known the computer cannot solve the problem. Neural networks process information in a similar way the human brain does. The network is composed of a large number of highly interconnected processing elements (neurons) working in parallel to solve a specific problem. Neural networks learn by example. They cannot be programmed to perform a specific task. The examples must be selected carefully otherwise useful time is wasted or even worse the network might be functioning incorrectly. The disadvantage is that because the network finds out how to solve the problem by itself, its operation can be unpredictable.

Other advantages of Artificial Neural Network include:

1) Adaptive learning: An ability to learn how to do tasks based on the data given for training or initial experience.
2) Self-Organization: An ANN can create its own organization or representation of the information it receives during learning time.
3) Real Time Operation: ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantages of this capability.

**Working of Artificial Neural Network**

- Neural networks are typically organized in layers.
- Layers are made up of a number of interconnected 'nodes' which contain an 'activation function'.
- Patterns are presented to the network via the 'input layer', which communicates to one or more 'hidden layers' where the actual processing is done via a system of weighted 'connections'.
- The hidden layers then link to an 'output layer' where the answer is output as shown in the graphic.




## 2. Result and Discussion

ANN is implemented with self-edited program using the Neural-Network-Toolbox in MATLAB 7.0. The artificial neural network is a multi-layered multi level forward feed network for the weight training of non-linear differentiable functions. Artificial neural network describe shape level and texture level descriptors. Shape level descriptors contain 6 inputs and 2 outputs forming a combination of [6, 2] layer with no hidden layers in it. Texture level contain 128 features as input neurons, and 2 outputs neurons and 2 hidden layers with [40, 10] neurons. Shape and texture features are very much important in classifying a TB-patient or a NON-TB Patient. Hence a dominant priority or weight age has to be placed on shape and texture analysis. In the proposed case, reserving a weightage value of 0.6 is acceptable. On the other way round sputum (smear negative pulmonary tuberculosis) weightage is also prolonged simultaneously along with the shape and texture analysis weightage which results in five zones of TB levels to classify ranging from 1 to 5 which are shown in below table.

| Level no | TB Severity | Range |
|---|---|---|
| 1 | high | >=0.75 |
| 2 | middle | 0.5-0.75 |
| 3 and 4 | low | 0.25-0.5 |
| 5 | none | <0.25 |

For the severity check in medical terms a table has been given. That table is related with the Table technically. Sputum smear microscopy as a test for TB Figure 1.

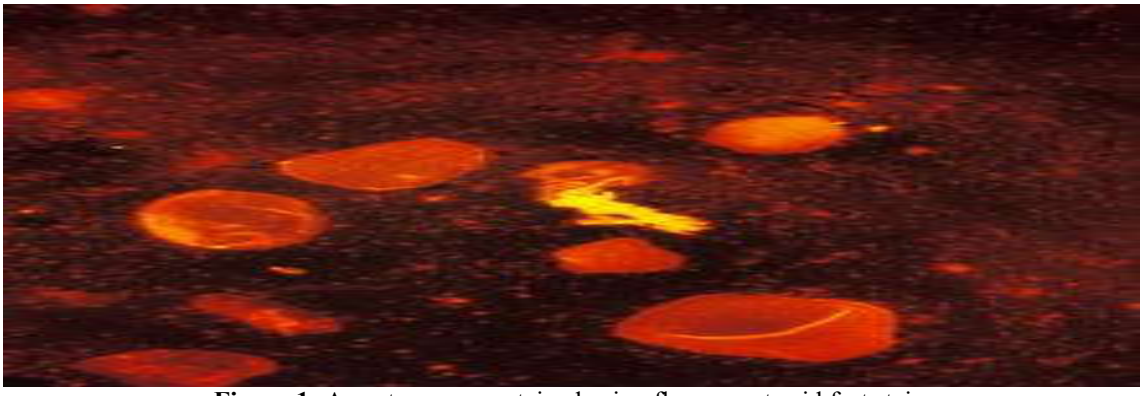


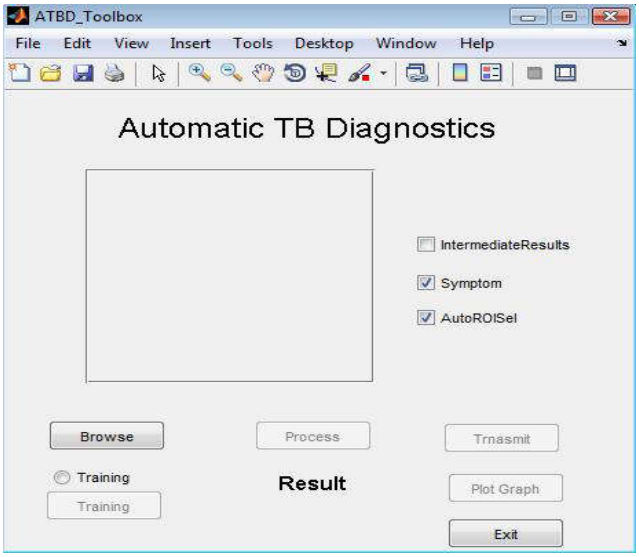
**Figure 1:** A sputum smear stained using fluorescent acid fast stain

Smear microscopy of sputum is often the first TB test to be used in countries with a high rate of TB infection. Sputum is a thick fluid that is produced in the lungs and the airways leading to the lungs, and a sample of sputum is usually collected by the person coughing. For the diagnosis of TB several samples of sputum will normally be collected. Historically it has been recommended that three sputum specimens are collected on two consecutive days, but in 2007 the World Health Organisation (WHO) recommended that just two specimens could be examined from consecutive days. Now it has been suggested that two specimens can be collected on the same day without any loss of accuracy.

## 3. Experimental

The testing process involves in all the methods that co-relates the training model. However there are aspects which vary i.e., testing always involves in comparison of the images with trained images. Initially in the process, the image is read which are followed by ll the prior operations that are involved in the training. Then the features are stored which will be used for the comparison of the images in the dataset. The selected features are used for classification which is part of the testing process. For classification of samples, the ANN, a MATLAB based Machine Learning package is employed.

**Design of Graphical user interface (GUI)** A GUI has been designed for the user sake i.e., for the display of the result. Figure given below shows the designed GUI where the information about result such as severity, intermediate results, graphs etc are available. A GUI program is a graphical based approach to execute the program in a more user friendly way. It contains components such as push buttons, text boxes, radio buttons, pop-up menus, slider etc. with proper labels for easy understanding to a less experienced user. These components help the user to easily understand how to execute or what to do to execute the program.




In the present work, the GUI which has been designed has a radiobutton, six push buttons, 3 check boxes and a space for the result and images. Initially the radio button is enabled to start the training. When the training button is pressed, training of the neural network starts with PTB and Non TB images. Once the training is over, then browse push button becomes active by pressing which selects the unknown X-ray image. Always the check boxes ROI and sputum will be kept marked (active). Another check box for intermediate results is given which is an optional button. The results of the enhancement, segmentation, compression stages are displayed if the check box intermediate results are kept active.

## 4. Conclusion

In this paper we discussed about the Artificial neural network, working of ANN. Also training phases of an ANN. There are various advantages of ANN over conventional approaches. Depending on the nature of the application and the strength of the internal data patterns you can generally expect a network to train quite well. This applies to problems where the relationships may be quite dynamic or non-linear. ANNs provide an analytical alternative to

conventional techniques which are often limited by strict assumptions of normality, linearity, variable independence etc. Because an ANN can capture many kinds of relationships it allows the user to quickly and relatively easily model phenomena which otherwise.

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