A machine doctor that diagnosing ophthalmology problems using Neural Networks

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Abstract— **Ophthalmology is the branch of medicine it deals with eye and its problems. Expert System contains the knowledge about particular diseases. Machine doctor is one without any human doctor machine can cure ophthalmology problems by using expert system. Our machine doctor provides both advice about diseases and the information about diseases by using the expert's system. The machine doctor gets the input as queries, data, and voice etc. And provide the output as data can be taken either by printed statement or by using any electronic devices. The Neural Networks concept is used to get the input Using back propagation algorithm. The main aim is to give advice to rural people and make our machine doctor as user friendly one and cost effective one.**

Index Terms — **Back propagation, expert System, machine learning, neural network, Machine Doctor.**

I. INTRODUCTION

Machine doctor cure all eye problems by using knowledge base system .It contain three modules registration system, information system and advisory system to provide suitable information and advice to the patients according to user queries [1]. A scanning machine is used to scan the pressure of the eye but we not yet implemented in these paper, suppose if we are implementing means it is more efficient one. Learning in neural network concepts used to learn input and output by using supervised & unsupervised Learning. Back propagation algorithm used to find error between resultant output and the target output. Machine Doctor provides the output and makes this approach as user friendly one and cost effective. Here we are using back propagation algorithm to train the network and also we are using genetic algorithm to compare user current input with existing input so that our Machine Doctor provide accurate output.

II. PROPOSED SYSTEM

The proposed system infrastructure for this research would consist of Machine doctor gets the input as queries, data, and voice etc. And provide the output as data can be taken either by printed statement or by using any electronic devices. The Neural Networks concept is used to get the input Using back propagation algorithm [1]. The main aim is to give advice to rural people and make our machine doctor as user friendly one and cost effective one. Suppose if we are going hospital means we need to spend half day to check our eye, but with the help of Machine Doctor we can easily cure Ophthalmology problems by simply giving our input, it will immediately compare that input with database and provide output according to user queries.

III. ABOUT OPHTHALMOLOGY

 Most visual impairments are caused by disease and malnutrition. The World Health Organization (WHO) estimates that more than 42 million people in the world are currently blind [International Council of Ophthalmology].

A. *Normal eye*

The eye works like a camera. Light rays, reflected by the objects enter the eye through the cornea, acts like a window in the white of the eye and provide the focusing. The main function of the iris is to control the quantity of light entering the eye by either becoming smaller in size in bright light or larger in dim light.

B. *Problems in ophthalmology*
1. Myopia

Myopia, better known as *nearsightedness* or short-sightedness, is the most common type of *refractive error* and is a condition that results in blurred distance vision. This occurs when the eyeball is too long or the cornea has too much curvature[18].

2. Hyperopia

Hyperopia sometimes referred to as *farsightedness* or long-sightedness, results when structural defects in the eye cause vision to be blurry..

   3. Astigmatism

Astigmatism is also a very common *refractive error* responsible for blurry vision and often occurs in combination with myopia or hyperopia [18].

   4. Presbyopia

Presbyopia is the normal worsening of near vision with age. As middle age approaches, the eyes' lenses tend to thicken and lose flexibility. The ability of the lens to bend allows your eyes to focus on objects at varying distances [18].

   5. Cataract

Cataract is clouding of the natural lens, the part of the eye responsible for focusing light and producing clear, sharp images [18].

IV. ALGORITHM

A. *Back-propagation algorithm*

   The back-propagation algorithm can be employed effectively to train neural networks.

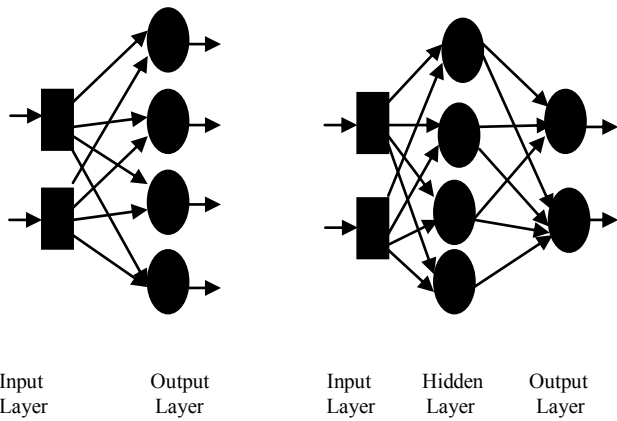| Input Layer | Output Layer | | Input Layer | Hidden Layer | Output Layer |

Fig 1: Neural Network

   It is widely used to get the input from user compare with database and provide output according to user queries. The BP algorithm is capable of adjusting the network weights to reduce the square sum of the difference between the given output (X) and an output values computed by the net (X'). In one -layer approach it directly provide output according to input. But in case of the two-layer approach it will pass the input into hidden layer and it finally comparing with database and provide output. By using this back propagation Algorithm we can train the network and detect ophthalmology problems. But training takes more time and also we need to correctly train the network, if it is not properly trained means it does not provide accurate output .

B. *Genetic algorithm*

In the computer science field of artificial intelligence, a genetic algorithm (GA) is a search heuristic that mimics the process of natural selection. This routinely used to generate useful solutions to optimization and search problems [12]. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization

problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover [13].Here genetic algorithm is used to compare the current data input with previous input, so that Machine Doctor will provide efficient output. The child will inherit parent character like that genetic search will inherit parent characters.

The steps for genetic algorithm is below

   1. Choose the initial population of individuals.
   2. Evaluate the fitness of each individual.
   3. Repeat above steps until find the correct output

V. NEURAL NETWORKS (ANN)

 The word *network* in the term 'artificial neural network' refers to the inter–connections between the neurons in the different layers of each system [15].

An ANN is typically defined by three types of parameters:

   1. The interconnection pattern between different layers of neurons

   2. The learning process for updating the weights of the interconnections

   3. The activation function that converts a neuron's weighted input to its output activation.
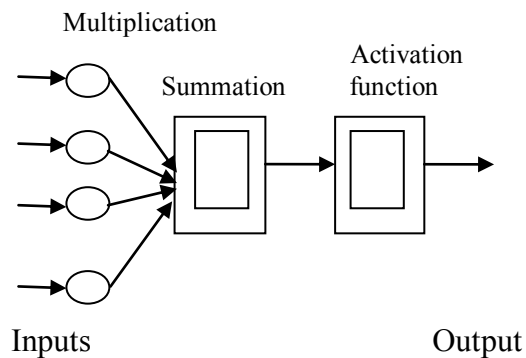
A. Artificial Neural Network

Fig 2: Artificial Neural Network

   An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. In artificial .In artificial neural network the activity of each hidden unit is determined by the activities of the input units and the connections between the input and the hidden units. The behavior of the output units depends on the activity of the hidden units and the weights between the hidden and output units. The research on neural networks has led to the development of different types of neural networks to suit the purpose. Here dendrites are the sensitive part of neuron,it will pass the information through soma, soma will calculate

and sum all values and finally pass the information through axon that is the function of artificial neural network.
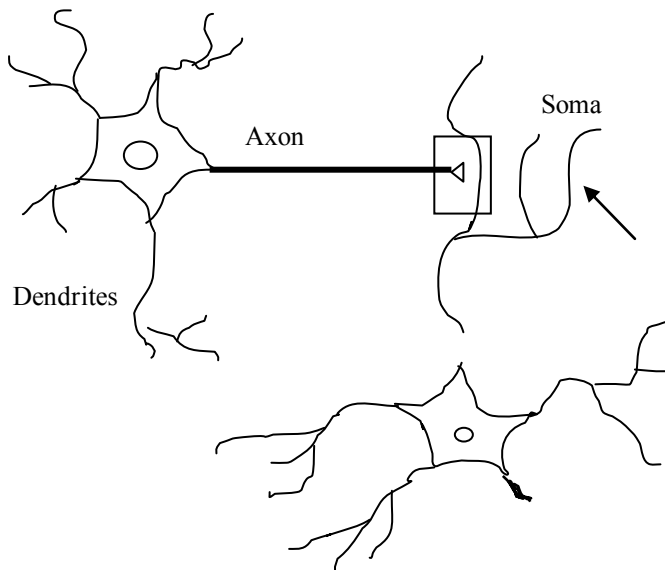

Fig 3: Biological Neuron

In figure 4 Dendrites are the sensitive part of neuron it will sense all the information, and then soma calculate sum of the signals [2]. Finally through Axon it will pass the information from one neuron to other neuron. Like these biological neuron, artificial neuron also having three function input layer, hidden layer and output layer. In input layer it will get all the information as input, and in hidden layer it will analyze the data, and finally through output layer it will provide output.

B. Self-Organization:

In this work, Back propagation networks, Self organizing maps networks is implemented as classifiers. Back propagation algorithm looks for the minimum of the error functioning weight space using this method of gradient descent. And also genetic algorithm is used to detect previous state information. The combination of weights which minimizes the error, the function is considered to be a solution of the learning problem. Since this method requires computation of the gradient of the error function at each iteration step, we must guarantee the continuity and the differentiability of the error function.

VI. WORKING PRINCIPLE OF MACHINE DOCTOR

In our project Machine Doctor is used to cure ophthalmology problems by using Expert System. Totally three modules are there, they are registration system, advisory system, information system. In Registration system like Google, Yahoo account the user should have separate account, if the user already having account they can simply login to the particular site. If not means they can enter all their details and enter into site to check and detect their eye problems. Second one is information system here admin can update about various new diseases, treatments, symptoms,

test. Finally it provides details about particular diseases that provide information about particular diseases according to user queries. Third one is advisory system, here by comparing with expert system genetic search takes place and provide output according to user queries.
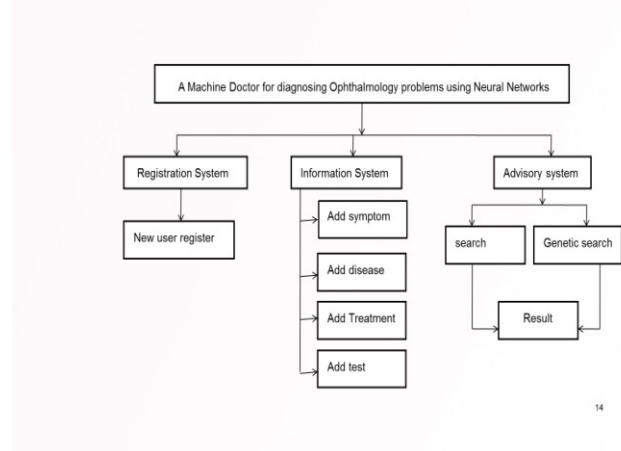

Fig 5: working Principle of Neural Network

Major features of a Neural Networks (NN) is its learning capability, they can adjust the parameters in a neural network such that the networks learns to improve its performance for a given task. Here we shall describe the use of supervised learning neural network. Using a set of training data we could generated the input-output mapping of the neural network to become more and more consistent with the training data. Therefore the error between the neural network output and the training data's target output gradually reduce. Back propagation algorithm is the best known supervised learning algorithm. Genetic Algorithm is used to analyze previous data information with current data information.

A. Registration System

1. User part
In registration system the user need to login to particular site. If suppose the user not having any account means they can register their details and need to create account, otherwise simply they can login to site.
2. Admin part
Like user login admin also can login to particular site and they can update the database without changing the coding part.

B. Information System

Already in admin part admin can add symptoms treatment, diseases and test details in database. Information systems get that input and compare the input with user input and provide necessary and accurate output according to their queries.

C. Advisory System

In advisory system we are using genetic search, it will inheriting the parent characters and providing accurate output. And also our Machine Doctor will give suitable advice according to user diseases. Suppose if we are going hospital means Doctor will give suitable advice like that our Machine doctor too provide suitable advice.

VII. RESULT ANALYSIS

Step: 1

Like Google, Yahoo account the user should have separate account for checking their eye. It is used to compare their previous information with current information. Because in hospital if we are going with previous slip means it is over advantage for us. So that in our project we included registration system, at the same time admin also can update Knowledge base system without changing the coding part about treatment, diseases, test etc. That above information is collected from human experts in such a way that our Machine Doctor is act as user friendly one.
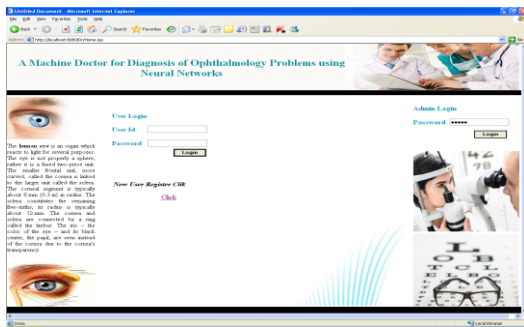

Fig 6: Registration System

Step: 2

User can check their symptoms at the same time admin can also add diseases by using add diseases, add symptoms button etc. By entering their symptoms user can find out their eye problems. It will put all updated information in Knowledge base system that will trained by neural network concept by using back propagation algorithm. Like in hospital Machine Doctor provide Suitable advice and information about diseases.
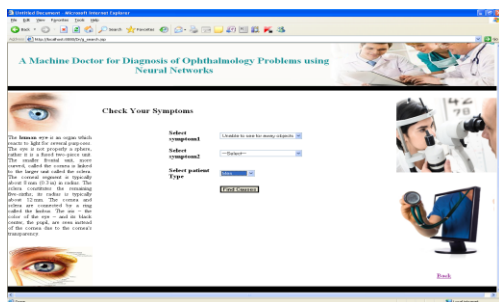

Fig 7: Information System

Step: 3

Here like in hospital initially it will display the letters in large size. if the user can able to predict particular letter size means it will decrement particular letter size ,if suppose the user cant able to predict first letter itself means from that it will identify which type of ophthalmology problems they are

having, like that problems will identify by our machine doctor by comparing with Knowledge base system.
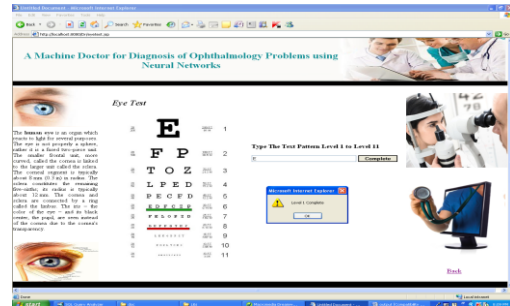

Fig 8: Eye checking Process

Step: 4

Finally after getting all input from user either as data or voice it will compare all input with database and provide suitable output according to user queries. That is it provide which type of ophthalmology problems they are having like that. So that the user can simply go to optical shop and they can buy specs as per their own problem. By using Our Machine Doctor we can save time and also money.
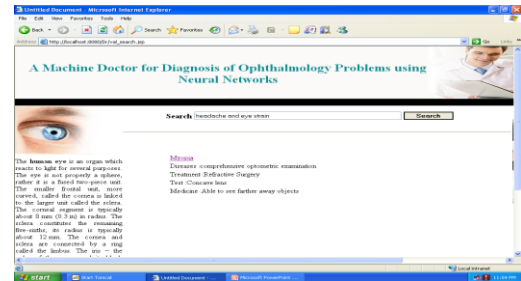

Fig 9: Advisory System

Like that we can find opthalmology problems ,suppose if we are going to hospital means it takes more time minimum we need to spend half day,but by our Machine Doctor within second we can able to detect opthalmology problems and we can simply check our eye and output can be taken either by using printed out statement or by using any electronic instrument.Such that our Machine doctor is more effective and cost effective one.

VII. DISCUSSION & FUTURE WORK

A. Salient features about scanning machine

Machine Doctor is Smart Assistance to doctors too. This tool is like an intelligent assistant to the doctors. The Doctors in large hospital have to diagnose a large dataset of images every day. This assistant will analyze all the images in the dataset and classify them as normal and abnormal. Normal

Images are scrutinized with two different algorithms to improve the accuracy on false alarms. This can be easily trained by the doctor. E.g. doctor can train it to classify what are normal and what are abnormal images. Sophisticated tools such as Neural Network, State Machines are used as the Artificial Intelligence. It can be trained to detect normal and abnormal Images, also to detect particular diseases. These scanning machine measure the pressure and level of eye so our machine doctor what it will do is it will compare the input data getting from user and also the input from scanning machine means it will be more efficient one. But we didn't implemented any scanning machine but if suppose implementing that means it is more efficient one

VIII. CONCLUSION

Our machine doctor provides information and advisory about particular diseases. It is very cost effective and user friendly one the feed forward neural network and classifiers as the diagnostic tool to aid the physician in the detection of these eye abnormalities. However, these tools are generally do not yield results with 100% accuracy. The accuracy of the tools depend on several factors, such as the size and quality of the training set, the rigor of the training imparted, and also parameters chosen to represent the input. Classification produces encouraging results. However, there is scope of further improvement in feature extraction strategies, thereby improving the robustness of the diagnostic systems.

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