

Diagnosis Chest Diseases Using Neural Network and Genetic Hybrid Algorithm

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ABSTRACT

The back propagation algorithm is most popular algorithm in feed forward neural network with the multi-layer. It measures the output error and calculates the gradient of the error and adjusting the ANN weight moving along the descending gradient direction. Back propagation is used to learn and store by mapping relations of input-output model. A genetic algorithm is having a random probability distribution or pattern that may be analysed statistically but may not be predicted precisely. Genetic algorithm is an iterative procedure that generates new population for individual from the old one. In my paper I am proposing to implement the back propagation algorithm and genetic algorithm to compare the output accuracy percent for medical diagnosis on various chest diseases (Asthma, tuberculosis, lung cancer, pneumonia).

Keywords: - Artificial neural network, back propagation algorithm, chest diseases, genetic algorithm, medical diagnosis.

I. Introduction

1.1 Hybrid System

Hybrid system is a technology which is entwined with two different technologies to give a better solution for the application result. One technology is not enough to solve a problem then it use another technology to solve a problem.

As our project title is showing that we are using two different technologies that are artificial neural network and the genetic algorithm. These two technologies belong to two different fields which are entwined/embedded which are called hybrid technology. Back propagation is the most popular in learning techniques with the multi-layer network. In these techniques the information flows from the direction of the input layer towards output layer. The learning is achieved by adjusting the connection weight in artificial neural network iteratively so that trained. The number of iteration of the training algorithm and the convergence time will vary depending diagnosis problem their various data set. Genetic algorithm is a computational model which is a stochastic general search method. It proceeds in an iterative way by generating new chromosomes to get the best solution and work on the best fit probability.

In hybrid system the artificial neural network (ANN) is used to create network and the genetic algorithm is used to get the best fit probability to reduce the number of iteration by adjusting the weight.

1.2 About Chest Disease

The chest is the most important part of the body for function the respiratory system. Now a day's

millions of people are suffering with a chest disease in the world.

Acute bronchitis is the type of bronchitis by adding the cold and flu to an inflammation of the bronchial tube (bronchial tube is that which passes the air to lung) bronchitis converted into acute bronchitis. It is spread through the cough people or with the unwashed hands shortness of breath, wheezing and chest tightness this are also a symptoms of acute bronchitis.

ARDS (Acute Respiratory Distress System) is occurred in the lungs when the oxygen level is low in the blood stream. It caused by direct or indirect injury to the lungs. These injuries can be breathing vomit into the lungs, inhaling chemicals lung transplant etc.

Asbestosis is causes the lung tissues and the chest wall get thicken and harden. By harden it makes it hard to breathe and for oxygen to get into the blood.

Asthma is a chronic disease which is occurred when the airway is swollen. The airway is narrowed and it difficult to move the air in and out of the lungs. Asthma can be inherited by genetic.

II. Neural Network

An artificial neural network is an information processing paradigm that is inspired by the way human brain process information. The neural network applications are pattern recognition, forecasting clustering data classification, medical, biological etc. artificial neural network is an interconnected groups of artificial neurons that user a mathematical model or computational modal for information processing based on a connectionist approach to computation.

Artificial neural network is a network of processing element which displays the complexity in global behavior, which determined by the connections between the processing neurons and neurons parameters. It is made of interconnecting artificial neurons which may share some properties of biological neural networks. Artificial neural network is used to solve the real world problems. Artificial neural networks provide a tool to help doctors to analyze and make sense of complex clinical data of medical applications.

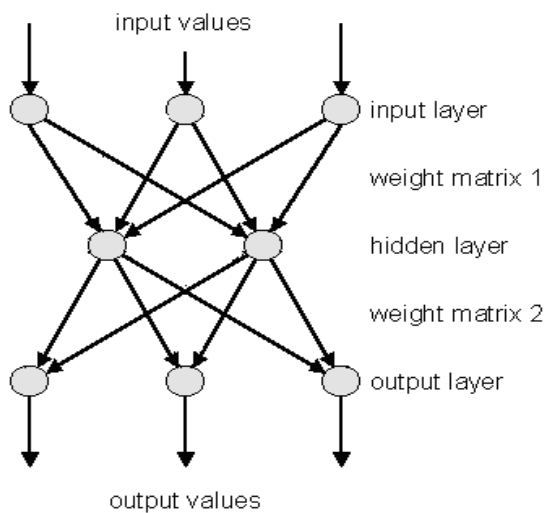


Fig 1

2.3.1 TYPES OF NEURAL NETWORKS

2.3.1.1 Feed forward neural network

2.3.1.2 Feed backward neural network

2.3.1.1 FEED FORWARD NEURAL NETWORK

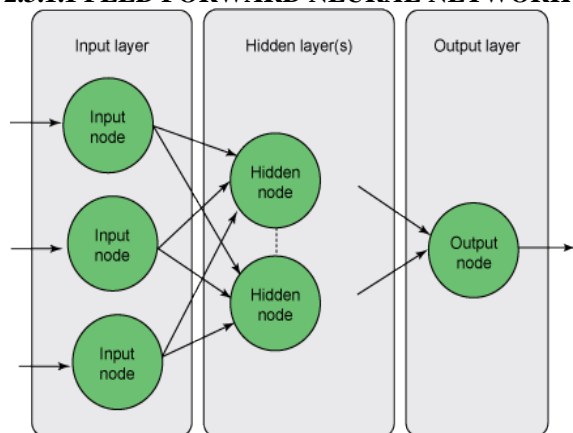


Fig 2

The construction of the neural network involves three different layers with feed forward architecture. In this network the input layer contains the set of input neurons, which accept the elements of input feature vectors. The input neurons are fully connected to the hidden layer neurons and the hidden

layer neurons are fully connected with the output layer neurons the output layer sends the response of neural network to the activation which is applied to the input layer. The information given to a neural network is propagated layer by layer from input layer to output layer through one or more hidden layers.

2.3.1.2 FEED BACKWARD NEURAL NETWORK

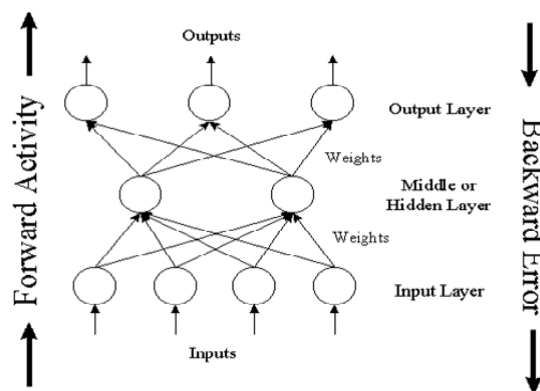


Fig 3

III. BACK PROPAGATION ALGORITHM

The artificial neural network has been trained by exposing it to sets existing data where the outcome is known. Multi layer networks use a variety of learning techniques; the most popular is back propagation algorithm. It is one of the most effective approaches to machine learning algorithm developed by david ruelhart and Robert McLelland(1994). Information flows from the direction of the input layer towards the output layer. A network is trained rather than programmed. Learning in artificial neural networks is typically accomplished using examples. This is also called “training” in artificial neural networks because the learning is achieved by adjusting the connection weights in artificial neural networks iteratively so that trained. The number of iterations of the training algorithm and the convergence time will vary depending on the weight initialization. After repeating this process for a sufficiently large number of training cycles the network will usually techniques are divided into supervised, unsupervised and reinforcement learning.

3.1 Algorithm

Step 1:- first apply the inputs to the network and calculate for output. The initial output can be anything as the initial weights were random numbers.

Step 2:- the error for neuron B.

$$\text{ErrorB} = \text{output}(1 - \text{outputB})(\text{targetB} - \text{outputB})$$

where $\text{output}(1 - \text{output})$ is sigmoid function

Step 3:- change the weight

$$W_{+AB} = W_{AB} + (\text{ErrorB} \times \text{outputA})$$

Where W_{+AB} are new weight

W_{AB} are initial weight

Step 4:- calculate the errors for the hidden layer neurons. For hidden layer we can't calculate error directly because we don't have a target value. By using back propagation from output layer to hidden layer by taking the error from the output neurons and back tracked through the weights to find hidden layer errors

$$\text{ErrorA} = \text{output}(1 - \text{outputA})(\text{ErrorB} \times W_{AB} + \text{ErrorC} \times W_{AC})$$

Step 5:- after getting error for the hidden layer neurons goto step 3 to change the hidden layer weights. Repeat this steps to get trained network of any number of layers

IV. GENETIC ALGORITHM

Genetic algorithm is a computational model which is having a random probability distribution or pattern that may be analysed statistically but may not be predicted precisely general search method. To generate new population it proceeds in an iterative manner which is different from the old population. Changes occur during reproduction. The chromosomes from the parents exchange randomly by a process called crossover. A rarer process called mutation also changes some traits. Chromosome is an array of bits or characters. Gene is a single bit or a set of bits. Fitness is actual solution for evaluation.

4.1 Algorithm

Step 1:- generate random chromosomes of n population.

Step 2:- the fitness of each chromosome x is evaluated with $f(x)$.

Step 3:- create new population repeat following steps upto new population creation is completed.

- a. select two best fit parent chromosomes from a population.
- b. crossover the parents to form new offspring. The same offspring is found it means the no crossover was performed.
- c. mutation probability mutate new offspring at each locus.
- d. place new offspring in the new population.

Step 4:- replace generated new population with the old population.

Step 5:- if the end condition is satisfied, return the best solution in current population.

Step 6:- goto step 2.

V. HYBRID ALGORITHM

The good properties of two different technologies by applying them to problems to solve efficiently this are exploit by the hybrid algorithm. Hybridization of different algorithms has led to creation of a trend known as soft computing. In my project I am using the neural network and genetic algorithm. Where the neural network have ability to adapt to circumstances and learn from the past experience. Genetic algorithm is a systemize and random search and genetic algorithm is inspired by biological evolution to reach optimum characteristics. These technologies have advantages and disadvantages. By hybridization of these two technologies to overcome the weaknesses of one with strength of other. How this two algorithms are hybridized are shown in following algorithm

5.1 Algorithm

STEP 1: configure the network l-m-n is taken

Where l= no of input of the neurons

m= no of hidden of the neurons

n= no of output of the neurons

STEP 2: the no of weights that the network l-m-n has calculated by using the following formula

$$w = (l+n) * m$$

STEP 3: assume number of digits in weight are d (where the d is the real number) which is find by $s = d * w$ (where s is the string)

STEP 4: choose population size p i.e. chromosomes C_i

STEP 5: for each chromosome C_i

where $i=1,2,3,\dots,p$

{
 Extract weight:- W_i form C_i Where W_i is kept as the fixed weight, train the BPN for the N input instances.

Calculate error:- E_i for each of the input instances using the formula below

$$E_i = \sum_j (T_{ji} - O_{ji})^2 \text{ where } O_{ji} \text{ is the output vector calculated by BPN.}$$

Find the root mean square E of the errors

$$E_i \text{ where } i=1,2,3,\dots,N$$

$$\text{I.e. } E = ((\sum_i E_i) / N)^{1/2}$$

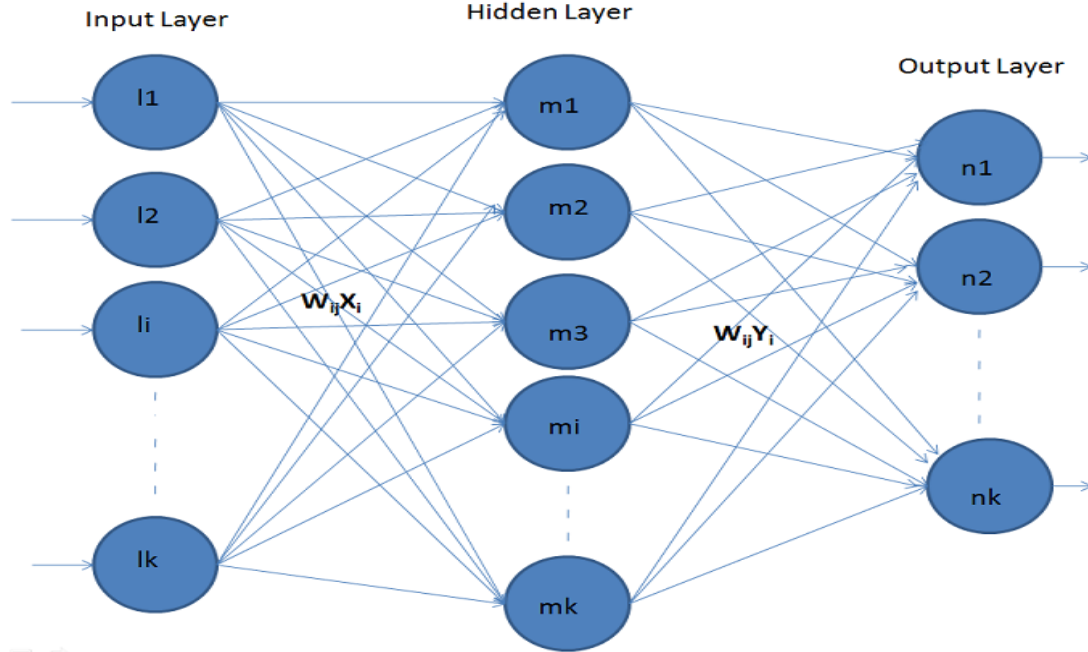
Calculate the fitness:- Value F_i for each of the individual string of the population as $F_i = 1/E$

}

STEP 6: Output F_i for each C_i ,

where $i=1,2,\dots,p$

VI. Architecture



VII. Results

Disease Calculator Based On Hybrid System

Select Symptoms

<input checked="" type="checkbox"/> Cough	<input checked="" type="checkbox"/> Wheezing	<input type="checkbox"/> Low Fever	<input type="checkbox"/> Chest Pain	<input type="checkbox"/> Confusion
<input type="checkbox"/> Rapid Breathing	<input checked="" type="checkbox"/> Breath Shortness	<input type="checkbox"/> Suffocation	<input type="checkbox"/> Cough - Fever	<input type="checkbox"/> Vomit
	<input type="checkbox"/> Nasal Congestion	<input type="checkbox"/> Extreme Tiredness	<input type="checkbox"/> Sore Throat	<input type="checkbox"/> Dry Cough
<input type="checkbox"/> Running Nose	<input type="checkbox"/> Chills	<input type="checkbox"/> Fever	<input type="checkbox"/> Chest Tightness	<input type="checkbox"/> Hips
<input type="checkbox"/> Clubbing	<input type="checkbox"/> Diffucult To Breath	<input type="checkbox"/> Loss Of Appetite	<input type="checkbox"/> Very Salty Skin	<input type="checkbox"/> Fatigue
<input type="checkbox"/> Greesy,Bulky Stools	<input type="checkbox"/> Dizziness	<input type="checkbox"/> Stomach Problems	<input type="checkbox"/> Headace	<input type="checkbox"/> Frequent Cough
<input type="checkbox"/> Low Oxygen in Blood	<input type="checkbox"/> Cough,Whezing, Short Breath	<input checked="" type="checkbox"/> Cracking Sound In Chest	<input type="checkbox"/> Smoke Or Air Pollution	
<input type="checkbox"/> Shortness Of Conscious	<input type="checkbox"/> Whopping Sound On Breath	<input type="checkbox"/> Produced High Pitched		
<input type="checkbox"/> Abnormal Chest Sounds	<input type="checkbox"/> Tiredness	<input checked="" type="checkbox"/> Ill Feeling	<input type="checkbox"/> Excess Sweat	
<input type="checkbox"/> Cough Blood	<input type="checkbox"/> Neck Stiffness	<input type="checkbox"/> Sucked In Rids And Chest	<input type="checkbox"/> Poor Posture Of Neck	
<input type="checkbox"/> Joint Ache	<input type="checkbox"/> Rashs	<input type="checkbox"/> Night Sweats	<input type="checkbox"/> Blood Clotting Problem	
<input type="checkbox"/> Anemia	<input type="checkbox"/> Pain Under Ribs	<input type="checkbox"/> Abdominal Pain	<input type="checkbox"/> Productive Cough Expels Mucu	

List of Disease as per The Selected Symptom

Acute Bronchitics

Asbestosis

Asthma

Bronchiectasis

Bronchopulmonary

Byssionosis

COCCI

Histoplasmosis

Human Metapneumo virus

Hypersensitivity

Lymphangiomatosis

Mesothelioma

Non Tuberculosis Mycobacterium

Highly Looks Like:

Histoplasmosis

Asbestosis

Result 1

Disease Calculator Based On Hybrid System

Select Symptoms

<input checked="" type="checkbox"/> Cough	<input type="checkbox"/> Wheezing	<input type="checkbox"/> Low Fever	<input type="checkbox"/> Chest Pain	<input type="checkbox"/> Confusion
<input type="checkbox"/> Rapid Breathing	<input checked="" type="checkbox"/> Breath Shortness	<input type="checkbox"/> Suffocation	<input type="checkbox"/> Cough - Fever	<input type="checkbox"/> Vomit
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<input type="checkbox"/> Greesy,Bulky Stools	<input type="checkbox"/> Dizziness	<input type="checkbox"/> Stomach Problems	<input type="checkbox"/> Headace	<input type="checkbox"/> Frequent Cough
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COCCI

Cystic Fibrosis

Histoplasmosis

Human Metapneumo virus

Hypersensitivity

Lymphangiomas

Mesothelioma

Non Tuberculosis Mycobacterium

Highly Looks Like:

Cystic Fibrosis

Asbestosis

Result 2

Disease Calculator Based On Hybrid System

Select Symptoms

<input type="checkbox"/> Cough	<input type="checkbox"/> Wheezing	<input type="checkbox"/> Low Fever	<input type="checkbox"/> Chest Pain	<input type="checkbox"/> Confusion
<input type="checkbox"/> Rapid Breathing	<input type="checkbox"/> Breath Shortness	<input type="checkbox"/> Suffocation	<input type="checkbox"/> Cough - Fever	<input type="checkbox"/> Vomit
	<input type="checkbox"/> Nasal Congestion	<input checked="" type="checkbox"/> Extreme Tiredness	<input checked="" type="checkbox"/> Sore Throat	<input type="checkbox"/> Dry Cough
<input type="checkbox"/> Running Nose	<input type="checkbox"/> Chills	<input type="checkbox"/> Fever	<input checked="" type="checkbox"/> Chest Tightness	<input type="checkbox"/> Hips
<input type="checkbox"/> Clubbing	<input type="checkbox"/> Difficult To Breath	<input type="checkbox"/> Loss Of Appetite	<input type="checkbox"/> Very Salty Skin	<input type="checkbox"/> Fatigue
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<input type="checkbox"/> Abnomal Chest Sounds	<input type="checkbox"/> Tiredness	<input type="checkbox"/> Ill Feeling	<input type="checkbox"/> Excess Sweat	
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List of Disease as per The Selected Symptom

Acute Bronchitics

ARDS

Asthma

Byssionosis

Human Metapneumo virus

Hypersensitivity

Highly Looks Like:

ARDS

Human Metapneumo virus

Result 3

Disease Calculator Based On Hybrid System

Select Symptoms

<input type="checkbox"/> Cough	<input type="checkbox"/> Wheezing	<input type="checkbox"/> Low Fever	<input type="checkbox"/> Chest Pain	<input type="checkbox"/> Confusion
<input type="checkbox"/> Rapid Breathing	<input type="checkbox"/> Breath Shortness	<input type="checkbox"/> Soffocation	<input type="checkbox"/> Cough - Fever	<input type="checkbox"/> Vomit
	<input type="checkbox"/> Nasal Congesion	<input checked="" type="checkbox"/> Extreme Tiredness	<input checked="" type="checkbox"/> Sore Throat	<input type="checkbox"/> Dry Cough
<input type="checkbox"/> Running Nose	<input type="checkbox"/> Chills	<input type="checkbox"/> Fever	<input checked="" type="checkbox"/> Chest Tightness	<input type="checkbox"/> Hips
<input type="checkbox"/> Clubbing	<input type="checkbox"/> Difficult To Breath	<input type="checkbox"/> Loss Of Appetite	<input type="checkbox"/> Very Salty Skin	<input type="checkbox"/> Fatigue
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List of Disease as per The Selected Symptom

Acute Bronchitics

ARDS

Asthma

Byssionosis

Histoplasmosis

Human Metapneumo virus

Hypersensitivity

Highly Looks Like:

ARDS

Histoplasmosis

Human Metapneumo virus

Result 4

7.1 Description of result

User or doctor will select the symptoms by selecting the checkbox. This selected checkbox are taken as input symptoms. Some diseases are listed as per the selection of symptoms in a list box which shows the possibility of suffering by the patient. From this list the highly found disease in a patient body is listed in below given list box. As shown in a result 1 screen shot we have selected 5 symptoms and 13 diseases are possible to be suffered but the highly look like diseases are 2 of them. In this way we have shown some more result to understand more clearly how the results are changed depending on symptoms.

VIII. Conclusion

We have studied how the hybrid system is used for medical diagnosis in chest disease. In this software we are using Symptoms as an input which is converted into value. These values and the extracted weights (randomly selected values) are used to calculate an activation function. To get the result as a output we get the diseases. Scope of this software is to add the test report with the symptoms as inputs.

References

[1] Expert system with applications 37(2010)7648-7655”*Chest diseases diagnosis using artificial neural network*” Orhan Er, nejat Yumusak, Feyzullah Temurtas

[2] 2010 international journal of computer application (0975-8887), volume 1-no.26 “*Application of Neural Network in diagnosing cancer Disease Using Demographic Data*”

[3] International journal of computer science issues, volume-8, issue 2, March 2011 “*artificial neural networks in medical diagnosis*”

[4] International journal of computational engineering research, volume-3, issue-4 “*Study of hybrid genetic algorithm using artificial neural network in data mining for the diagnosis of stroke disease*”

[5] “*Genetic algorithm for solving simple mathematical equality problem*”, denny hermawanto, Indonesian institute of science (LIPI), Indonesia

[6] Journal of applied biomedicine, J Appl Biomed. 11: 47–58, 2013, DOI 10.2478/v10136-012-0031-x, ISSN 1214-0287 “*Artificial neural networks in medical diagnosis*”

[7] “*Neural Networks – algorithms and applications*” Fiona Nielsen 4i, 12/12-2001

[8] http://www.myreaders.info/html/soft_comp_uting.html

[9] <http://www.lung.org/lung-disease/list.html>

[10] <http://www.nlm.nih.gov/medlineplus/ency/article/000103.htm>

[11] R. Dybowski and V. Gant, Clinical Applications of Artificial Neural Networks, Cambridge University Press, 2007.

[12] R. Das, I. Turkoglu and A. Sengur, “*Effective diagnosis of heart disease through neural networks ensembles*”, Expert Systems with Applications, Vol.36, No.4, 2009, pp. 7675-7680.

[13] S. Altunay, Z. Telatar, O. Erogul and E. Aydur, “*A New Approach to urinary system dynamics problems: Evaluation and*

- classification of uroflowmeter signals using artificial neural networks", Expert Systems with Applications, Vol.36, No.3, 2009, pp. 4891-4895.*
- [14] J. A. Freeman and D. M. Skapura, *Neural networks: algorithms, applications and programming techniques*, Addison Wesley Longman, 1991.
- [15] Kohonen, T. (1990). *Improved versions of learning vector quantization*. In Proceedings of the IEEE international joint conference on neural networks (pp. 545–550). New York.
- [16] Temurtas, F. (2009). *A comparative study on thyroid disease diagnosis using neural networks*. Expert Systems with Applications, 36, 944–949.
- [17] Temurtas, H., Yumusak, N., & Temurtas, F. (2009). *A comparative study on diabetes disease diagnosis using neural networks*. Expert Systems with Applications, 36, 8610–8615.
- [18] World Health Organization, (2008). *Global tuberculosis control 2008 surveillance Planning financing*. Geneva. ISBN: 978 92 4 156354 3.
- [19] <http://www.slideshare.net/u053675/artificial-intelligence-1419854>