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Multilayer Perceptron and Neural Networks

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Abstract

Neural networks have greatly improved the performance of form of programs like photograph processing, herbal language processing, bioinformatics and speech reputation. synthetic neural community is an sample or paradigm that is stimulated via the manner biological nervous systems, such as the mind, procedure information. gaining knowledge of in organic structures entails adjustments to the synaptic connections that exist among two or more neurons. The neural network (NN) is basically introduced from the subject of biology where neural network plays important and key role in human body. A neural network (NN) is complex structure which consists of a group of interconnected neurons which provides alternatives for complex problem solving and other application which can play important role in today's computer science trade.

Keywords: *Nodes, weights, multilayer perceptron.*

I. Introduction

The study of the human brain is thousands of year old and with the advent of modern electronics. The first step toward artificial neural networks (ANN) came in 1943 when McCulloch a neurophysiologist and mathematician Walter Pitts gave idea about how neurons might work. They modeled a simple neural network with electrical circuits. Neural networks take a different approach to problem solving than that of computers. Conventional computers use the algorithmic side i.e. the computer follows a set of problem of instructions. Computer cannot solve these types of problems. That restricts the problem solving capability of conventional computers. However computers might be a lot beneficial if they might do element that will not do easily. The neural community process information in a similar way the human's mind does. The neural community consists massive numbers of nodes i.e. enter nodes, output nodes and hidden nodes. In some device hidden nodes aren't gift. The operations of neural network are unpredictable because the community finds out a way to solve the trouble by way of itself.

The concept of neural network is introduced from the subject of biology where neural network plays important role. Neural network is just a web of inter-connection of millions or millions neurons. The human body is best example of neural network. A neuron is a biological cell that process information from one neuron to other neurons with the help of chemical and electrical changes. It consists of cell body or soma and two types of tree like out reaching branching structure axons and the dendrites. The cell body has nucleus at the centre and this nucleus contains all the information about the hereditary traits and plasma that holds the molecular equipments or producing material needed to the neurons. The whole process of

receiving and sending is done in particular manner in neural networks. The neuron sends signal at spikes of electrical activity through a long thin stand known as an axon and an axon splits this signals through synapse and send it to another neurons.

Computational methods are used to solve the unanticipated problems in developed behavioral systems during the time period In neural network activation functions are present, activation function means the function takes input and produces an output for node given an threshold. The Perceptron is single layer feed forward neural network. The figure shows the simple neural network.

II. Multilayer neural network

Multilayer network shown is based on three inputs i.e. Input layer, three hidden layers H1, H2 and H3 and one output layer. Total % layer neural network.

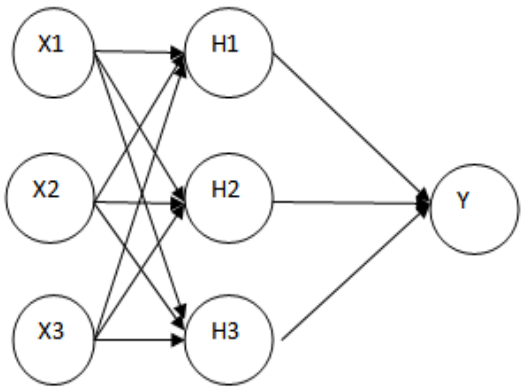

Fig1: *Multilayer Neural Network*

III. Multilayer Perceptron

A multilayer perceptron(MLP) is a feed forward artificial network. An MLP consists of at least three layers of nodes. Except for the input nodes, each node is a neuron that uses a nonlinear activation function. The MLP consists of three or more layers i.e. input layer, output layer or hidden layer.

Table 1 *Case Processing Summary*

		N	Percent
Sample	Training	38	67.9%
	Testing	18	32.1%
Valid		56	100.0%
Excluded		2	
Total		58	

Table 2*-Network Information*

Network Information			
Input Layer	Factors	1	y
	Covariates	1	x1
		2	x2
	Number of Units[a]		8
	Rescaling Method for Covariates		Standardized
Hidden Layer(s)	Number of Hidden Layers		1
	Number of Units in Hidden Layer 1[a]		2
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables	1	h1
		2	h2
		3	h3
	Number of Units		7
	Rescaling Method for Scale Dependents		Standardized
	Activation Function		Identity
	Error Function		Sum of Squares

a. Excluding the bias unit

IV. Network Diagram

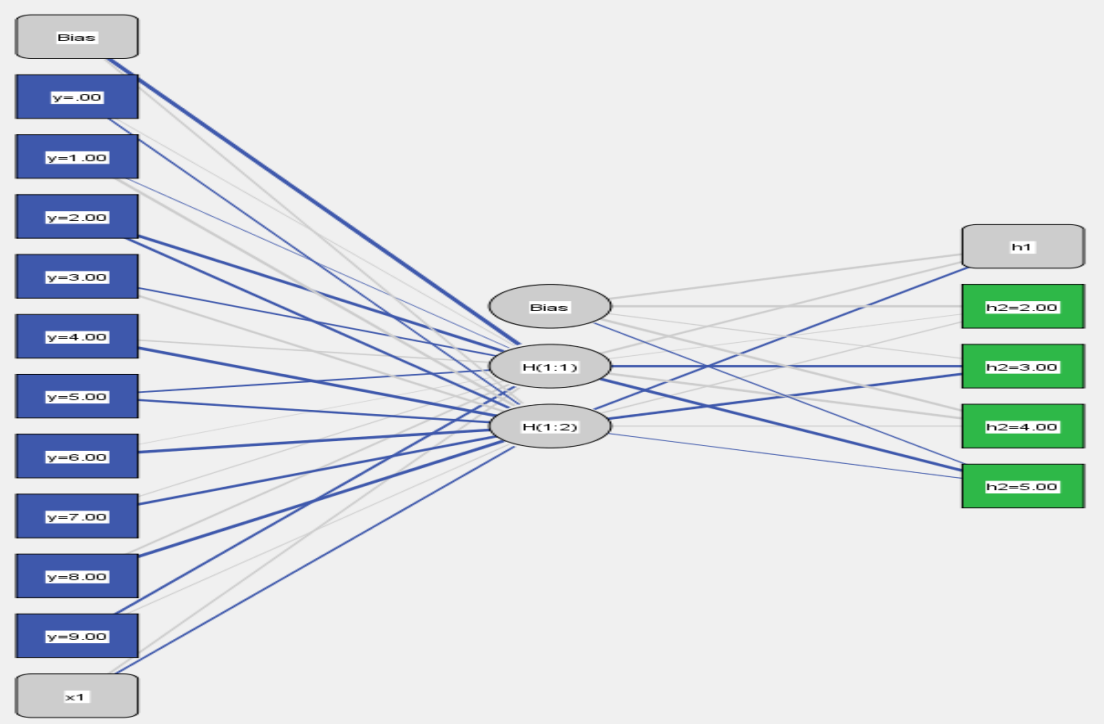

Fig 2: *Network diagram*

This network diagram shows the hidden layer activation function is hyperbolic tangent and output layer activation function is identity.

For hyperbolic tangent function produces output in between [-1, +1]. This above network diagram shows three input layers, three hidden layers and one output layer. Multilayer perceptron is generally feed forward artificial neural network. Multilayer perceptron utilizes a supervised learning technique called as back propagation for training.

Table 2 shows network information for input, hidden and output layer.

Table3 :*Model summary*

Training	Sum of Squares Error		52.887
	Average Overall Relative Error		1.069
	Percent Incorrect Predictions for Categorical Dependents	h2	65.8%
	Relative Error for Scale Dependents	h1	1.085
		h3	.998
	Stopping Rule Used		1 consecutive step (s) with no decrease in error[a]
	Training Time		00:00:00.000
Testing	Sum of Squares Error		23.513
	Average Overall Relative Error		1.083
	Percent Incorrect Predictions for Categorical Dependents	h2	55.0%
	Relative Error for Scale Dependents	h1	.938
		h3	1.203

a. Error computations are based on the testing sample.

Table 4: Classification

Classification

Sample	Observed	Predicted 1	2	3	Percent Correct
Training	1	8	0	7	53.3%
	2	1	1	3	20.0%
	3	0	0	4	100.0%
	Overall Percent	37.5%	4.2%	58.3%	54.2%
Testing	1	1	0	3	25.0%
	2	0	0	0	.0%
	3	0	0	4	100.0%
	Overall Percent	12.5%	.0%	87.5%	62.5%

Dependent Variable: h3

This classification table shows that the classification of predicted values. The overall percent for training is 54.2% and the overall percent for testing is 62.5%.

V. Results

Predicted by Observed

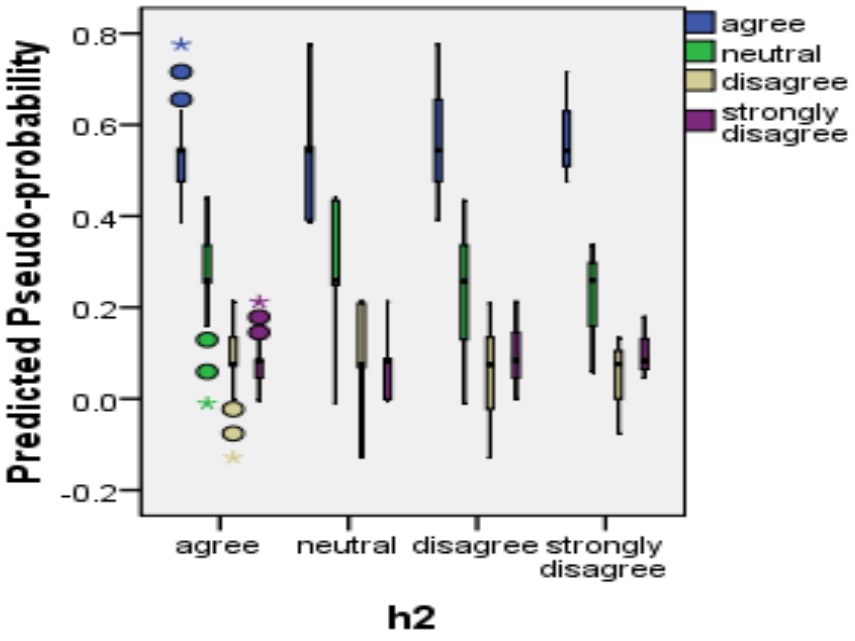

Fig 3: *Predicted by observed figure for h2*

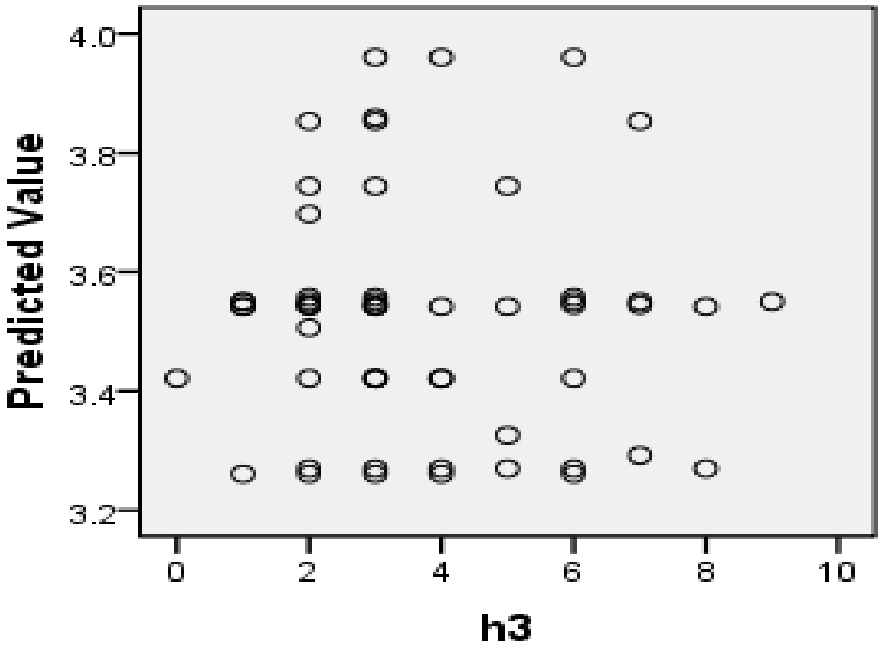

Fig 4: *Predicted by observed figure for h3*

The is the diagram for predicted value for hidden layers h2 and h3.

Residual by Predicted

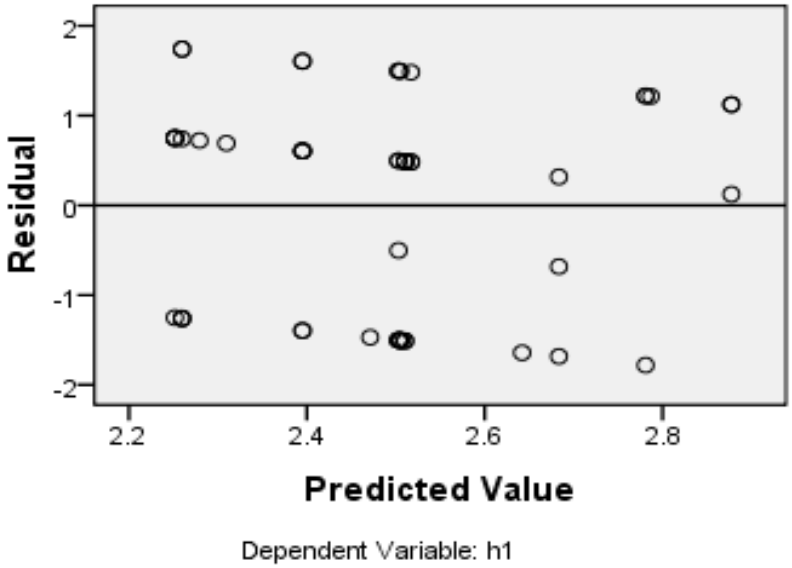

Fig 5: *Residual by predicted for dependent variable h1.*

The above diagram shows the residual by predicted for dependent variable h1. The line is use for separating hyperplane. Which is use to separate two planes. The above diagram is the graph of residual verses predicted value for h1.

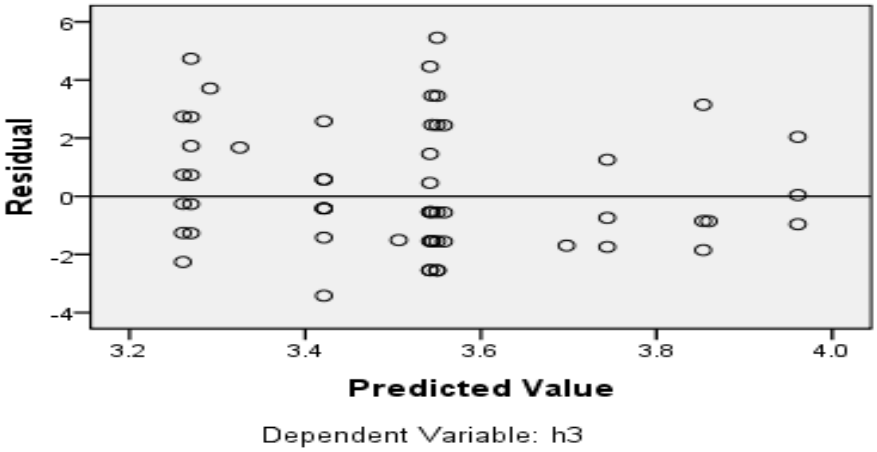

Fig 6: *Residual by predicted for dependent variable h3.*

The above diagram shows residual verses predicted value graph. The line is for separating hyperplane.

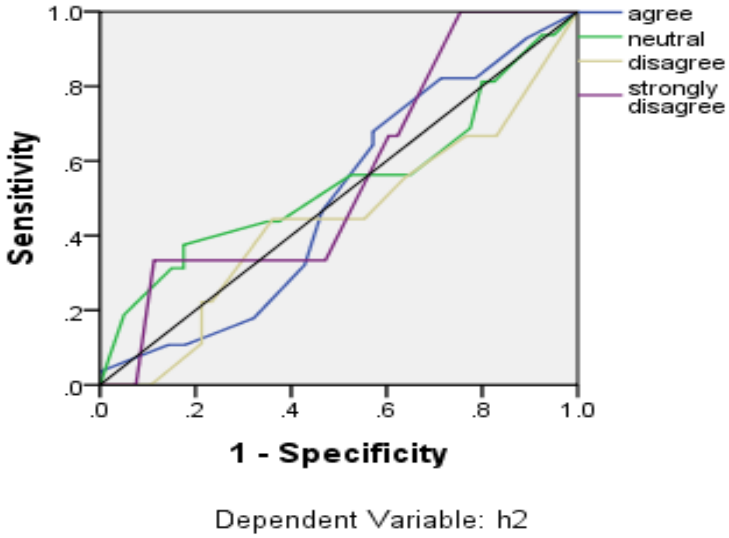

Fig 7:*Graph of sensitivity vs. specificity*

The above diagram specifies the graph of sensitivity verses specificity. This graph shows linear relationship between sensitivity and specificity.

Table 5: *Area under the curve*

		Area
h2	2.00	.497
	1.00	.541
	3.00	.443
	2.00	.560

The above table shoes area under curve for the above figure. The value of area is somewhat similar in manner.

The above area under curve is for hidden layer h2.

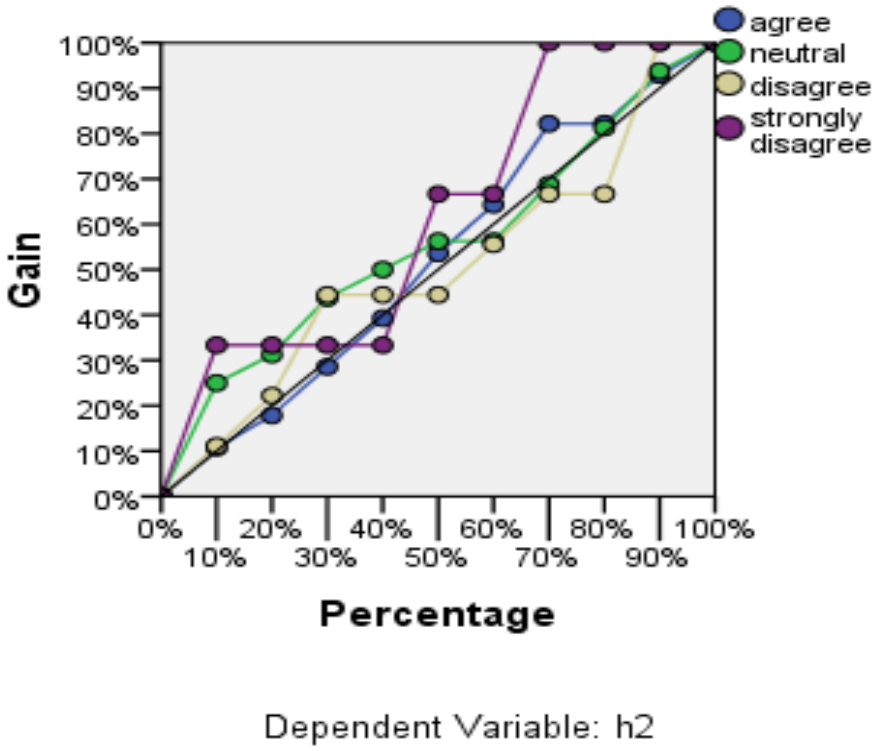

Fig 8: *Graph of gain vs. percentage*

By observing the graph, the gain and percentage are linearly propagated to each other. This graph is the gain verses percentage.

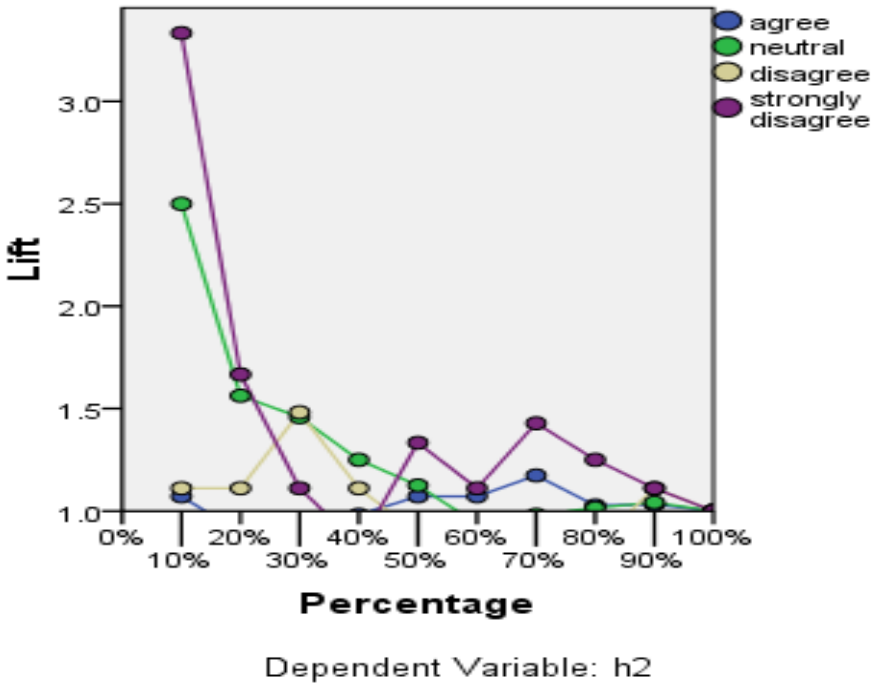

Fig 9: *Graph of lift vs. percentage*

The above graph is for lift verses percentage. For lower percentage, lift is high and for higher percentage, lift is small.

Table 6: Independent Variable Importance

	Importance	Normalized Importance
Y	.532	100.0%
x1	.371	69.8%
x2	.097	18.3%

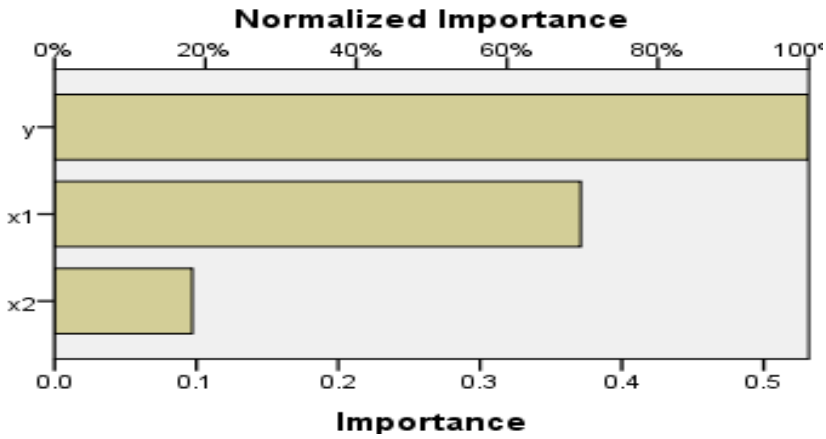

Fig 10: *Normalized importance*

The above table 6 and figure 10 shows the normalized importance of output y and inputs x1 and x2. For output y normalized importance is 100%, for x1 69.8% and for x2 18.3%.

VI. CONCLUSION

By studying neural network this paper demonstratedthat neural network have their advantages and have been used as a powerful tool in solving problems in engineering research and scientific research applications. This multilayer perceptions are the most commonly used types of neural networks. By using back propagation algorithm, they can be used for wide range of applications.

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