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Demonstration of Artificial Neural Network

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Abstract

Artificial neural networks (ANN) is referred as the neural networks are the signal processing and in information model which is based on the biological neuron. An artificial neural network (ANN) consists of a bundle of simple processing units which communicate by sending signals to each other over a large number of weighted connections. A set of processing unit is called as neuron. A neural network is made up of an interconnection of nonlinear neuron. The purpose of this work is to examine Neural Networks (NN) and their emerging applications in the field of engineering.The paper presented the basic study of the artificial neural network and its characteristics and its applications.

Keywords: *Artificial Neural Network, Pattern recognition*

INTRODUCTION

There are two types of neural network such as artificial neural network and biological neural network .Artificial neural network is inspired by biological nervous system like brain and process information. The element of this sample is the novel structure of the information processing system. It is tranquil of a larger number of highly interconnected processing elements working in unison to solve problems.An Artificial Neural Network is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the connections that exist between the neurons.

ANN usually involves a big number of processors operating in parallel and arranged in tiers. The first tier receives the crude input information eternal to optic nerves in human visual processing.Each successive tier receives the output from the tier preceding it, rather than from the raw input in the same way neurons further from the optic nerve receive signals from those closer to it. The last tier produces the output of the system.

Artificial neural network achieves large connection units that are interconnected in some pattern to aloe communication between the units. These units, also referred as neurons, are simple processors which operate in parallel. The most basic learning model is centered on weighting the input stream, which is how each node weights the importance of input from each of its predecessors. Inputs that contribute to getting right answers are weighted higher.

Neural Networks are sometimes described in terms of their depth, including how many layers they have between input and output, or the models so called hidden layers. They can also be described by the number of hidden nodes. In the neural network there are two types of propagation such as forward and backward propagation. An MLP with single hidden layer can be represented graphically as follows:

Input layer Hidden Layer Output Layer

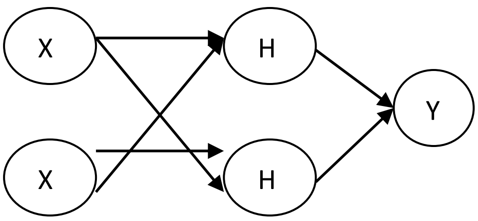

***Fig1:** Multilayer Artificial Neural Network*

RESULTS

Multilayer Perceptron:

Multilayer Perceptron is feed forward neural network with one or more layers between input and output layer. Feed forward means that data flows in one direction from input to output layer (forward).This type of network is trained with the back propagation learning algorithm. MLPs are widely used for pattern classification, recognition, prediction, and approximation.

***Table 1:** Case Processing Summary*

		N	Percent
Sample	Training	22	73.3%
	Testing	8	26.7%
Valid		30	100.0%
Excluded		0	
Total		30	

***Table 2**-Network Information*

Network Information

Input Layer	Factors	1	Y
	Covariates	1	X1
		2	X2
	Number of Units[a]		7
	Rescaling Method for Covariates		Standardized
Hidden Layer(s)	Number of Hidden Layers		1
	Number of Units in Hidden Layer 1[a]		3
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables	1	H2
		2	H1
	Number of Units		6
	Rescaling Method for Scale Dependents		Standardized
	Activation Function		Identity
	Error Function		Sum of Squares

a. Excluding the bias unit

Network Diagram

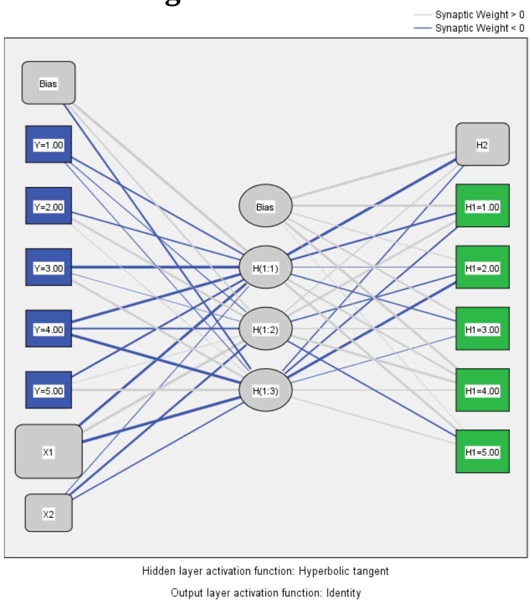

***Fig 2:** Network Diagram*

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

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 two input layer s, two hidden layers and one output layer. Multilayer perceptron is feed forward artificial neural network.

***Table 3:** Model Summary*

Model Summary

Training	Sum of Squares Error		24.689
	Average Overall Relative Error		1.312
	Percent Incorrect Predictions for Categorical Dependents	H1	72.7%
	Relative Error for Scale Dependents	H2	1.172
	Stopping Rule Used		1 consecutive step (s) with no decrease in error[a]
	Training Time		00:00:00.010
Testing	Sum of Squares Error		9.273
	Average Overall Relative Error		.955
	Percent Incorrect Predictions for Categorical Dependents	H1	75.0%
	Relative Error for Scale Dependents	H2	.827

a. Error computations are based on the testing sample.

Table 4: *Classification*

Classification

Sample	Observed	Predicted 1	2	3	4	5	Percent Correct
Training	1	3	0	0	3	0	50.0%
	2	0	1	0	2	0	33.3%
	3	2	1	0	3	0	.0%
	4	3	1	0	2	0	33.3%
	5	0	0	0	1	0	.0%
	Overall Percent	36.4%	13.6%	.0%	50.0%	.0%	27.3%
Testing	1	1	1	0	0	0	50.0%
	2	0	0	0	1	1	.0%
	3	0	0	0	1	0	.0%
	4	1	0	0	1	0	50.0%
	5	0	0	0	1	0	.0%
	Overall Percent	25.0%	12.5%	.0%	50.0%	12.5%	25.0%

Dependent Variable: H1

This classification table shows that the classification of predicted values. The overall percent for training is 27.3% and the overall percentage for testing is 25%.

Table No 5: *Parameter Estimates*

Parameter Estimates

Predictor		Predicted: Hidden Layer 1			Output Layer					
		H(1:1)	H(1:2)	H(1:3)	H2	[H1=1.00]	[H1=2.00]	[H1=3.00]	[H1=4.00]	[H1=5.00]
Input Layer	(Bias)	.500	.234	-.279						
	[Y=1.00]	-.240	-.123	-.084						
	[Y=2.00]	-.227	.337	.035						
	[Y=3.00]	-.686	.000	.347						
	[Y=4.00]	-.482	-.278	-.514						
	[Y=5.00]	-.310	.020	.367						
	X1	-.442	.391	-.577						
	X2	-.113	-.340	-.224						
Hidden Layer 1	(Bias)				.368	.358	.147	.264	.363	.015
	H(1:1)				-.486	-.308	-.020	-.175	.295	.357
	H(1:2)				.160	.326	-.223	.135	.350	-.233
	H(1:3)				-.176	-.244	-.417	-.046	.164	.163

Predicted By Observed

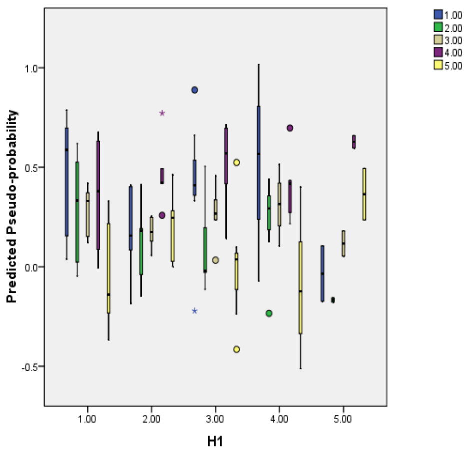

Fig 3: *Predicted By Observed*

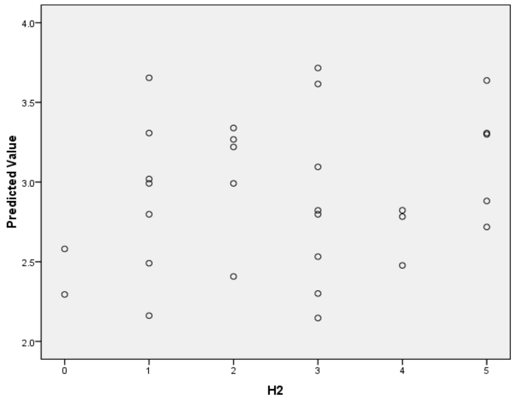

Fig 4: *Predicted by observed figure for h2*

This diagram for predicted value for hidden layer h2.

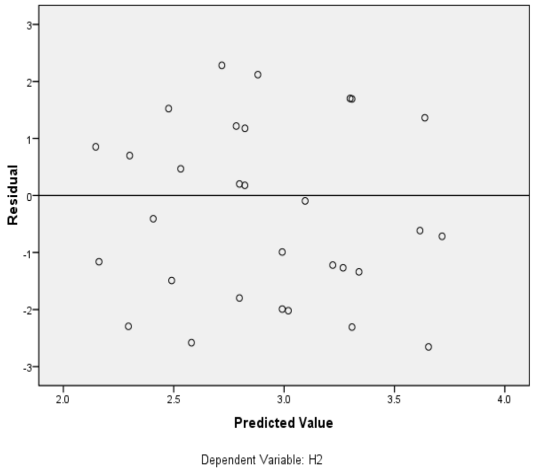

Fig 5: *Residual by predicted for dependent variable h2*

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

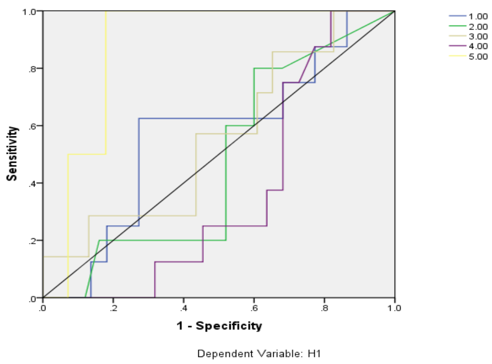

Fig 6: *Graph of Sensitivity v/s Specificity*

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

Table 6: *Area under the Curve*

		Area
H1	1	.568
	2	.476
	3	.559
	4	.372
	5	.875

The above table shows area under curve for the above figure. The value of area is somewhat similar in manner. The above area under the curve is for hidden layer h1.

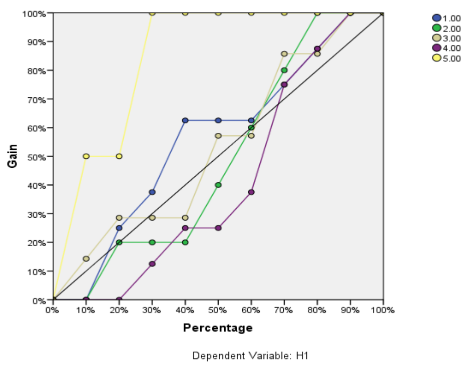

Fig7 : *Graph of Gain v/s Percentage*

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

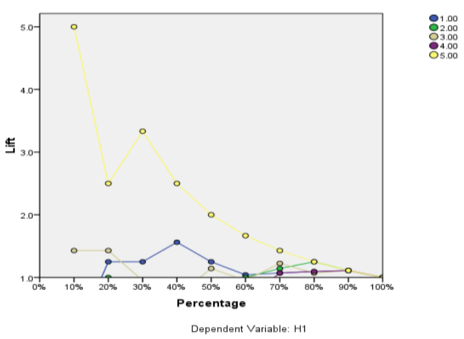

Fig8 : *Graph of Lift v/s Percentage*

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

Table No 7 :*Independent Variable Importance*

	Importance	Normalized Importance
Y	.155	23.4%
X1	.663	100.0%
X2	.182	27.4%

Normalized Importance

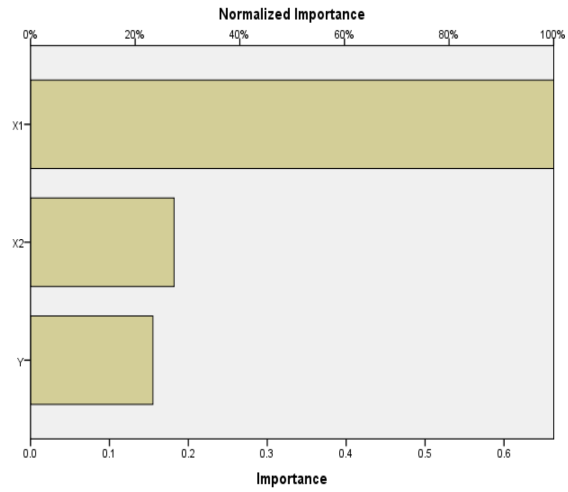

Fig 9: *Normalized Importance*

The above table 6 and figure 7 shows the normalized importance of output y and inputs x1 and x2. For output y normalized importance is 23.4%, for x1 100% and for x2 27.4%.

CONCLUSION

We discuss about the Artificial Neural Network and the working on Neural Networks in this paper. The conclusion after studying Artificial Neural Network can be given as that as the technology is increasing, the requirement of Artificial intelligence is also increasing due to the parallel processing which is enable to do more than single task at a time. Thus, parallel processing is a must in the current time as it is cost efficient and time efficient for any task related to electronics, computers.

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