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Short Review Paper

Classification of activation function and artificial neurons used in ANN

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Abstract

In this paper the role of an activation function in the Artificial Neural Network and its classification is discussed. Also on the basis of Activation function used the categorization of the Neuron is also done.

Keywords: Activation Function, Artificial and Biological Neural Network, Artificial Neuron, Continues Function.

Introduction

Human beings often recognized as intelligent creatures having their origin from nature pursue Intelligence by virtue of a special organ present in their body called brain. It is brain that enables the human being to conduct a number of special tasks. The field of Computer Science and engineering that tries to model the behavior pursued by human brain is called Artificial Neural Network. From the name itself the meaning of Artificial Neural Network comes that is the "Network of Man Made Neurons". In the field name Artificial Neural Network the word neural comes from neuron the cells from which the brain is made up of. As already discussed the field Artificial Neural Network generally focuses on the construction of something having analogy with human brain, thus the neuron will try to exhibit the behavior portrayed by biological neuron. Brain is also termed as biological neural network. When a biological neuron fires it does that because it surpasses a prescribed measure, similarly a neuron fires in Artificial Neural Network by means of Function called Activation Function and on the basis of the Activation Function used the Neuron may be categorized into various categories. It is bare fact that the three basic elements of any ANN are the individual neuron, the network topology and the learning algorithm. The first element that is the individual neuron is very much dependent on the type of activation function used in its architecture for its behavior. Thus is its bare fact that the behavior of the ANN will have some dependence on the type of the activation function used.

Some of the existing activation functions

In this section we are concerned with the specification of some of the Mapping function used in the construction of Artificial Neural Architecture. The basic properties that any Activation Function must possess are that the function must have the property of continuity and differentiability over a limit imposed. Activation function plays very vital role in the design and implementation of Artificial Neural Networks. Artificial Neural Networks are themselves very classical structures having the capability to mimic the human behavior.

Table-1: Some activation functions used for ann

Name of Activation Function	Definition of Activation Function	
	Function Definition	*Range*
Identity	x	$(-\infty, +\infty)$
Logistic	$\frac{L}{1+e^{-K(x-x_0)}}$	$(0, +1)$
Hyperbolic	$\frac{e^x - e^{-x}}{e^x + e^{-x}}$	$(-1, +1)$
Exponential	e^{-x}	$(0, +\infty)$
Softmax	$\frac{e^x}{\sum_i e^{x_i}}$	$(0, +1)$
Unit-Sum	$\frac{x}{\sum_i x_i}$	$(0, +1)$
Square Root	$\sqrt{x}$	$(0, +\infty)$
Sine	$\sin(x)$	$(0, +1)$
Ramp	$\begin{cases} -1 \; if \; x \leq -1 \\ x \; if \; -1 < x < +1 \\ +1 \; if \; x \geq +1 \end{cases}$	$(-1, +1)$
Step	$\begin{cases} 0 \; if \; x < 0 \\ +1 \; if \; x \geq 0 \end{cases}$	$(0, +1)$

Note: x is the Activation Value.

Literature survey

The research in the field of Artificial Neural Network it started with Warren and Walter's model of 1943[1]. In the model proposed it was having fixed weight values. In the year 1949 Hebbs postulate of learning arrived from the classical statement given by Donald Hebb in his book named Organization of behavior[2]. Later on in the year 1958 the perceptron model arrived. Perceptron model was a result of the observation made by Frank Rosenblatt on flies[3]. Later on in the year 1959

ADALINE network came into existence having its origination by Bernard Widrow and his student Hoff[4]. Several literatures[5-9] gave solution for the problem identified in the first generation ANN models. Previous research[7,10] also gave some solutions to the problem called the Ex-NOR problem in his work. The author of the paper showed some basic techniques used for performing learning in ANN[11]. An alternative solution for designing Logic gates using ANN was given by researcher[12]. All the work done till date in the field of Artificial Neural Network are having activation function in their structure to squash the activation value to produce the output.

Problem statement

The only problem that which was observed in the previous classification done observed in the work done currently is with the presence of lines in the graph.

Proposed classification

The classification that we propose classifies the Activation function into two categories that is Linear and Non-Linear. But the criteria used for classification is the presence of lines. If over the interval which specifies the set of possible input only lines are present in the graph the Activation function will be categorized as Linear Activation function otherwise Non-Linear. On the basis of the above classification the presence of the Activation function in the individual neuronal architecture classifies the Neuron into two types Linear Neuron and Non-Linear Neuron.

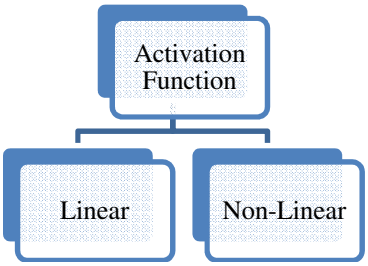

Figure-1: Classification of Activation Function Proposed.

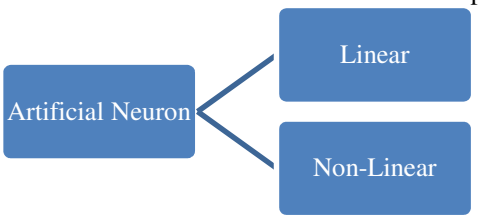

Figure-2: Classification of Artificial Neuron Proposed.

Conclusion

The categorization proposed in the current paper is going to use the human's perception capability of looking into the graph for making an analysis of selection of Activation Function in the model proposed by him for finding out a solution to the problem. The new approach will not let the Designer to bother about the theories made for the selection of the activation function. The classification will take into account human's perception capability to make a consideration of activation function.

References

1. McCulloch W.S. and Pitts W. (1943). A logical calculus of the ideas immanent in nervous activity. *Bull. Math. Biophy*., 5, 115-133.
2. Morris R.G.M. (1999). Do hebb: The organization of behavior, wiley: New york; 1949. *Brain research bulletin*, 50(5), 437.
3. Rosenblatt F. (1958). The perceptron : A probabilistic model for information storage and organization in the brain. *Psychological Review*, 65, 386-408.
4. Widrow B. and Hoff M.E. (1960). Adaptive switching circuits. IRE WESCON Conventional Record, 4, 96-104.
5. Singh V.K. (2016). Proposing Solution to XOR problem using minimum configuration MLP. ScienceDirect, International Conference on Computational Modeling and Security (CMS 2016), *Procedia Computer Science*, 85, 263-270.
6. Singh V.K. and Pandey S. (2016). Minimum Configuration MLP for Solving XOR Problem. Proceeding of the 10th INDIACom, INDIACom-2016, IEEE Conference ID : 37465, 3rd International Conference on Computing for Sustainable Global Development, 168-173, BVICAM, New Delhi, India.
7. Singh V.K. and Pandey S. (2016). Proposing an Ex-NOR Solution using ANN. *Proceeding International Conference on Information, Communication and Computing Technology*, JIMS, New Delhi.
8. Singh V.K. (2015). Two Solution to the XOR Problem using minimum configuration MLP. *International Journal of Advanced Engineering and Technological Research*, 3(3), 16-20.
9. Singh V.K. (2015). One Solution to XOR problem using Multilayer Perceptron having Minimum Configuration. *International Journal of Science and Engineering*, 3, 32-41.
10. Singh V.K. (2016). Mathematical Explanation To Solution For Ex-NOR Problem Using MLFFN. *International Journal of Information Sciences and Techniques*, 6, 105-122.
11. Singh V.K. (2016). Mathematical Analysis for Training ANNs Using Basic Learning Algorithms. *Research Journal of Computer and Information Technology Sciences*, 4(7), 6-13.
12. Singh V.K. (2016). ANN Implementation of Constructing Logic Gates Focusing On Ex-NOR. *Research Journal of Computer and Information Technology Sciences*, 4(6), 1-11.