

Application of Multi Layer Artificial Neural Network in the Diagnosis System: A Systematic Review

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ABSTRACT

Basic hardware comprehension of an artificial neural network (ANN), to a major scale depends on the proficient realization of a distinct neuron. For hardware execution of NNs, mostly FPGA-designed reconfigurable computing systems are favorable. FPGA comprehension of ANNs through a huge amount of neurons is mainly an exigent assignment. This work converses the reviews on various research articles of neural networks whose concerns focused in execution of more than one input neuron and multilayer with or without linearity property by using FPGA. An execution technique through reserve substitution is projected to adjust signed decimal facts. A detailed review of many research papers have been done for the proposed work.

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1. INTRODUCTION

Today, neural networks (NNs) area unit usually used in many fields and also back -propagation (BP) has been broadly accepted as flourishing knowledge rules to seek out the appropriate values of the weights for neural networks. Due to the advance architecture and ease of implementations, they're going to be applied during a very wide selection of medical fields. In lung disease like asthma, a person's airways turn into inflamed, thin and swell due to extra mucus, resulting difficult to breathe.

2. ARTIFICIAL NEURAL NETWORK

Artificial neural networks area unit extended within the basis of brain structure. Like the brain, ANNs will acknowledge patterns, handle facts and figures and be trained. They're ready by artificial neurons that employ the quintessence of genetic neurons. It acquires an amount of inputs (from distinctive knowledge or from output of erstwhile related to neurons). Every input approaches through an affiliation, that is named synapses and that features a weight. A nerve cell conjointly features a threshold worth. If the summation of the weights is beyond this worth, than the nerve cell is stirred up.

The stimulation indication constructs the output of the nerve cell. This output is often the results of the matter or are often measured AN input for an additional nerve cell. To construct a synthetic neural network is needed to place conjointly variety of neurons. They're organized on layers. A network has AN input layer (which holds the values of outdoor capricious) And an output layer (the forecasts or the ultimate outcomes). Inputs and outputs communicate to sensory and motor nerves from physique. The network conjointly consist one hidden layer(s) of neurons, that performs an inside perform within the network. An Artificial Neural

Network can be represented as an arithmetical interpretation of the individual neural design, reflective of its “learning” and “generalization” capabilities. Therefore, ANNs relate to the world of computer science and advance artificial intelligence.

3. MATHEMATICAL BACKGROUND

Basically a neural network is formed by a systematic arrangement of “neurons” and again these arrangements are structured in the no. of layers. All the neurons of a layer are related to the next layers of neurons with some weighted fashion. The number of the burden w_{ij} mere the force of the link among the i^{th} vegetative cell in a very layer and also the j -th vegetative cell in subsequent one. The formation of a neural network is created by an “input” layer, one or quite one “hidden” layer(s), and also the “output” layer. The final methodology of a particular three-layered neural network design is given in Figure 1.

Here, the info area unit mathematically developed and also the result's settled to the neurons within the next layer. Eventually, the neurons within the final layer of network give the network's output. Mathematically it is observed that j -th neuron of a hidden layer observes the inward bound data (x_i) by following three calculations:

1. Weighted estimation can be calculated and addition of a “bias” term (θ_j) according to Equation 1:

$$net_j = \sum_{i=1}^m (x_i * W_{ij} + \theta_j) \quad j = 1, 2, \dots, n \dots \quad (1)$$

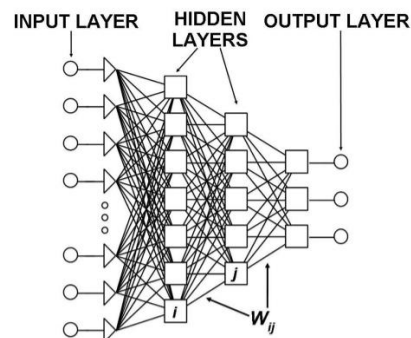


Figure 1. Conventional Formation of Neural Network with 2- hidden Layers

2. Transformation of net_j via appropriate mathematical “transfer function”
3. Transferring the concluding results to neurons in the upcoming layer. For the activation of a neuron many transfer function can be used but sigmoid function is used the most frequently.

$$f(x) = \frac{1}{1+e^{-x}} \dots \quad (2)$$

For the application of neural network in the various diagnosis system a systematic and deep literature survey is done. Which is as follows:

| S.No. | Paper Title/ Publication/Year | Description |
|-------|--|---|
| 1. | “Predicting Asthma Outcome Using Partial Least Square Regression and Artificial Neural Networks” E. Chatzimichail, E. Paraskakis, and A. Rigas, Hindawi Publishing Corporation Advances in Artificial Intelligence Volume 2013, Article ID 435321, 7 pages | In this paper, an advance machine intelligence methodology for the prediction of persistent respiratory disorder in youngsters is mentioned. By discrimination partial least sq. regression, nine out of forty eight extrapolative aspects related to the tenacious respiratory disorder are identified. Multilayer perceptron arrangements are found so as to urge the most effective estimate accuracy. In the results, it's delineate that the given system is ready to predict the asthma consequences with 99.77%. |
| 2. | “Neural Progenitor Cells Derived from Human Embryonic Stem Cells as an Origin of Dopaminergic Neurons” Parinya Noisa, Taneli Raivio, and Wei Cui Hindawi Publishing Corporation Stem Cells International Volume 2015, Article ID 647437, 10 pages | Human embryonic stem cells (hESCs) measures <i>in vitro</i> indeterminately while not trailing their capability to distinguish in numerous cell varieties upon exposure to acceptable signs. During this study, author segregated hESCs to dopaminergic neurons via a transitional stage, neural root cells. |
| 3. | “Artificial Neural Network Application in the Diagnosis of Disease Conditions with Liver Ultrasound Images” | The introductory study of this work shows an absolute study of assorted texture options extracted from ultrasonic images of the liver by using Multilayer Perceptron (MLP), to review the presence of sickness conditions. An echo |

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| | KarthikKalyan, BinalJakhia, RamachandraDattatrayaLele, Mukund Joshi, and AbhayChowdhary, Hindawi Publishing Corporation Advances in Bioinformatics Volume 2014, Article ID 708279, 14 pages | texture pattern can be identified by analyzing these images. . Liver infection circumstances like fatty liver, cirrhosis, and abnormality square measure recognized for producing distinguishing echo patterns throughout America imaging; although these descriptions also are known to be visually difficult for deciphering them since of their imaging grelic and spoil noise. |
| 4. | “Hardware Neural Networks Modeling for Computing Different Performance Parameters of Rectangular, Circular, and Triangular Microstrip Antennas” Taimoor Khan and AsokDe, Hindawi Publishing Corporation Chinese Journal of Engineering Volume 2014, Article ID 924927, 11 pages | FPGA based neural network is demonstrated in this work. Different parameters of rectangular, triangular and circular antenna are analyzed through FPGA based NN. This paper gives an idea to evolve a low price neural network based FPGA which is beneficial for the microwave applications. |
| 5. | “Simultaneous Perturbation Learning Rule for Recurrent Neural Networks and Its FPGA Implementation” Yutaka Maeda, Member, IEEE, and Masatoshi Wakamura, IEEE TRANSACTIONS ON NEURAL NETWORKS, VOL. 16, NO. 6, NOVEMBER 2005 | In this work, authors well thought-out associate FPGA realization of Hopfield neural network (HNN) with the encyclopedic rule through prompt agitation. Neural networks (NNs) area unit extensively worn innumerable fields. At the same time, back-propagation (BP) is extensively enforced as a triumphant encyclopedic rule to find the opposite ethics of the weights for NNs. As an example, the Hopfield neural network (HNN) could be a distinctive persistent neural network with proportioned absolutely interconnected weights. Persistent neural networks have attention-grabbing properties and might handle dynamic IP in contrast to standard feed forward neural networks. This paper shows, an algorithmic learning theme for recurrent neural networks mistreatment the synchronic perturbation technique. |
| 6. | “A Stochastic Digital Implementation of a Neural Network Controller for Small Wind Turbine Systems” Hui Li, Senior Member, IEEE, Da Zhang, Student Member, IEEE, and Simon Y. Foo, IEEE TRANSACTIONS ON POWER ELECTRONICS, VOL. 21, NO. 5, SEPTEMBER 2006 | A reconfigurable hardware execution of feed forward NNs based on stochastic methodology is presented in this paper. The nonlinear sigmoid activation signal with minimum digital logic inputs is estimated by using stochastic computation theory. |
| 7. | “Hardware Realization of Artificial Neural Network Based Intrusion Detection & Prevention System” Indraneel Mukhopadhyay, Mohuya Chakraborty, Journal of Information Security, 2014, 5, 154-165 Published Online October 2014 in SciRes. | In this research work, an advance technique is proposed for execution of Intrusion Detection and prevention system. This system is completely implemented on FPGA which can identify different networks outbreaks and prevent them from further transmission. |
| 8. | “Reference Values for Lung Function Tests in Adult Saudi Population” Nasr A. Belacy Abdullah H. Altemani, Mostafa H. Abdelsalam1, Magdi A. El-Damarawi, Basem M. Elsayy, Noha A. Nasif, Eman A. El-Bassuoni1,8, International Journal of Internal Medicine 2014, 3(3): 43-52 DOI: 10.5923/j.ijim.20140303.02 | For the diagnosis of many respiratory syndrome, Lung function testing is a quite important. In this paper, it has been discovered that reference data is very small for Saudi adults. |
| 9. | “Artificial Neural Network Modeling for Spatial and Temporal Variations of Pore-Water Pressure” M. R. Mustafa, I R. B. Rezaur, 2 H. Rahardjo, 3 M. H. Isa, 1 and A. Arif, Hindawi Publishing Corporation Advances in Meteorology Volume 2015, Article ID 273730, 12 pages | This paper shows the responses to rainfall application of ANN. It is not easy to measure the soil pore water pressure because it is tedious, time taking and expensive task. This article gives the relevance of artificial neural network (ANN) system for demonstrating soil pore-water pressure dissimilarities at several soil depths from the statistics of rainfall patterns. |
| 10. | “Feedforward Neural Network Implementation in FPGA Using Layer Multiplexing for Effective Resource Utilization” S. Himavathi, D. Anitha, and A. Muthuramalingam, IEEE TRANSACTIONS ON NEURAL NETWORKS, VOL. 18, NO. 3, MAY 2007 | Multilayer neural network with feed forward technique based FPGA is implemented in this article. Even though enhancements in FPGA bulks, the various multipliers in associate degree NN limit the scale of the network that may be enforced employing a single FPGA, therefore creating NN applications not feasible profitably. |
| 11. | “Implementation Issues of Neuro-Fuzzy Hardware: Going Toward HW/SW Codesign” Leonardo Maria Reyneri IEEE TRANSACTIONS ON NEURAL NETWORKS, VOL. 14, NO. 1, JANUARY | Glossy summary of prevailing hardware implementation of ANN and Fuzzy logic structures are presented in this article. This paper also describes restrictions, upsides and downsides of different implementation techniques. |

4. CONCLUSION

The ultimate aim of designing an efficient diagnosis system is to make best use of the classification accuracy and at the same time reduce the feature size. ANN can confidently be used to implement any diagnosis system because:-

1. It has capability to handle a huge amount of facts and figures.
2. Condensed chance of ignorable pertinent data.
3. Diminution of identification time.

The outcome that has been obtained from above research articles shows that any medical diagnosis system based on ANN can attain quite high prediction accuracy. ANNs symbolize an influential tools and technique to facilitate and help physicians to complete diagnosis and many other tests.

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