Implementation of Back Propagation Algorithm (of neural networks) in VHDL

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Title: Implementation of Back Propagation Algorithm (of neural networks) in VHDL

Authors: Gupta, Charu
Sharma, Sanjay (Guide)
Bansal, Manu (Guide)

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Borrowing from biology, researchers are exploring neural networks—a new, nonalgorithmic approach to information processing. A neural network is a powerful data-modeling tool that is able to capture and represent complex input/output relationships. The motivation for the development of neural network technology stemmed from the desire to develop an artificial system that could perform "intelligent" tasks similar to those performed by the human brain. Neural networks resemble the human brain in the following two ways: A neural network acquires knowledge through learning. A neural network's knowledge is stored within inter-neuron connection strengths known as synaptic weights. Artificial Neural Networks are being counted as the wave of the future in computing. They are indeed self-learning mechanisms which don't require the traditional skills of a programmer. But unfortunately, misconceptions have arisen. Writers have hyped that these neuron-inspired processors can do almost anything. These exaggerations have created disappointments for some potential users who have tried, and failed, to solve their problems with neural networks. These application builders have often come to the conclusion that neural nets are complicated and confusing. Unfortunately, that confusion has come from the industry itself. An avalanche of articles has appeared touting a large assortment of different neural networks, all with unique claims and specific examples. Currently, only a few of these neuron-based structures, paradigms actually, are being used commercially. One particular structure, the feed forward, back-propagation network, is by far and away the most popular. Most of the other neural network structures represent models for "thinking" that are still being evolved in the laboratories. Yet, all of these networks are simply tools and as such the only real demand they make is that they require the network architect to learn how to use them. [4] The power and usefulness of artificial neural networks have been demonstrated in several applications including speech synthesis, diagnostic problems, medicine, business and finance, robotic control, signal processing, computer vision and many other problems that fall under the category of pattern recognition. For some application areas, neural models show promise in achieving human-like performance over more traditional artificial intelligence techniques.

Convolutional Neural Networks (CNN) is one kind of deep neural network. It can study concurrently. In this article, we gave a detailed analysis of the process of CNN algorithm both the forward process and back propagation. In the late 1980s, the invention of Back Propagation algorithm used in Artificial Neural Network brings hope to machine learning and creates a trend of machine learning based on statistical models. In the 1990s, a variety of Shallow Learning models have been proposed such as Support Vector Machines (SVM), Boosting, Logistic Regression (LR). 2) The difficulties of deep neural network in training can overcome by layer-wise pre-training. In this article, the implementation of layer-wise pre-training is achieved through unsupervised learning. Back propagation algorithm, probably the most popular NN algorithm is demonstrated. 2 Neural Networks Neural networks have seen an explosion of interest over the last few years and are being successfully applied across an extraordinary range of problem domains, in areas as diverse as finance, medicine, engineering, geology and physics. Statssoft.com [2010] It all started way back in 1943 when McCulloch and Pitts proved that neuron can have two states and that those states could be dependent on some threshold value. Lecture 6 Artificial Neural Networks 1 1 Artificial Neural Networks In this note we provide an overview of the key concepts that have led to the emergence of Artificial Neural Networks as a major paradigm. More information. Database description. Back-propagation Neural Network implementation. Conclusion. 1. Introduction¶. The Back-Propagation Neural Network is a feed-forward network with a quite simple arhitecture. The arhitecture of the network consists of an input layer, one or more hidden layers and an output layer. This type of network can distinguish data that is not linearly separable. We use error back-propagation algorithm to tune the network iterative. 2. Error back-propagation algorithm theory¶. The error back-propagation algorithm consists of two big steps: Feeding forward the input from the database t