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Recognition of Alphanumeric Patterns Using Backpropagation Algorithm for Design and Implementation With ANN

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ABSTRACT

The artificial neural network has been called for its application as alphanumeric characters recognizing the network. The idea is to maintain the obsolete data available in hard copy form and to convert that data into digital form. Some specific bit patterns that correspond to the character are trained using the network. The numbers of input and output layer neurons are chosen. In this, the algorithm used for training the network is called the backpropagation algorithm using the delta rule. The testing and training patterns are provided for which weights are calculated in the program and patterns are recognized and analysis is done. The effect of variations in the hidden layers is also observed with pattern matrices.

KEYWORDS

Artificial Neural Networks, Backpropagation, Character Recognition

1. INTRODUCTION

The basic functional outline aforementioned has a lot of complexity and exceptions; rather ANN models have simple characteristics and consist of thousands of processing units when wired together in a composite network. Each node is a form of a simple neuron in the network that will fire when an input signal from another node is received. Such nodes collected into different layers of processing elements make self-regulating decisions and pass on the results to other layers (McCulloch, W. S., & Pitts, W., 1943). The next layer neuron makes calculations on data and again moves output to a new layer. Every processing element computes based on the weighted sum of its inputs. The layers are the input layer, hidden layer, and the output layer; hidden layers are placed between the two layers. Figure 1 represents the working of an artificial neural network works (Minsky, M. L., & Papert, S. A.,1969; Minsky, M. L., & Papert, S. A.,1988).

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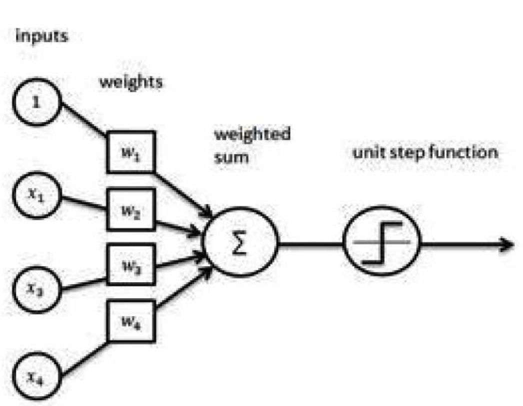
Figure 1. Weighted sum of the inputs



The input set labeled as x_1, x_2…..x_n are applied to artificial neurons and collectively referred to as vector 'X' corresponds to signals into the synapse of a biological neuron. Before applying to the summation block each signal is then multiplied by an associated weight w_1, w_2…w_n (Pitts, W., & McCulloch, W. S., 1947; Widrow, B 1961). Each weight corresponds to the strength of a single biological synaptic connection. The set of weights is referred to collectively as the vector 'W' and the summation block refers to the biological cell body which adds the weighted inputs algebraically to produce output labeled as SUM and represented as vector notation as:

SUM=X*W

or:

$$SUM=x_1*w_1+ x_2*w_2+ x_3*w_3\ldots x_n*w_n \quad (1)$$

2. ACTIVATION FUNCTIONS

The activation function in artificial neural networks is that node that produces the output of that node to which set of inputs was submitted. It can be similar to a standard integrated circuit activation function that is "ON" i.e "1" or "OFF" i.e "0" according to the input. It is also alike to linear perceptron in neural networks but only nonlinear activation functions allow networks to compute non-trivial areas use only a small number of nodes such activation functions introduce nonlinearities in the network.

2.1 Sigmoid Function

Here F is called the Squashing function which is a logistic function or sigmoid function represented in figure 2. The function F is expressed mathematically as:

$$F(x) =1/ (1+e^{-x}) \quad (2)$$

The activation function used for a non-linear gain for the artificial neuron is calculated by finding the ratio of the change in F(X) to a small change in X. Thus the gain is the slope of the wave at a specific excitations level. Here a specific activation function is used. Figure 4 describes the summation function that accepts the SUM created by activation function F and produces the output

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