



NEURAL NETWORKS BASED PATTERN RECOGNITION USING PERCEPTRON MODEL

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Abstract: A neural network is a processing device, in which its design is inspired by the design and functioning of human brain and their components. There is no idle memory containing data and programmed, but each neuron is programmed and continuously active. The objective of this paper is to present identification and recognition of data for Pattern recognition using Perceptron Algorithmic Approaches. Pattern recognition techniques are associated in symbolic identity with the image of the pattern. In this work, analyzed different neural network methods in pattern recognition, from several data sets within some set of data's are used for training the network, and other sets of data are used to test the network. The testing will result in the approximate identification of the data patterns with tag value of 0 to 1. Various techniques used in this Perceptron Model are creating the pattern files, normalizing the files, training the neural network, adjustment of weights and parameters, network file creation and finally testing of the data for the pattern identification.

Keywords: Neural Networks, Perceptron model, pattern recognition, clustering, linear Vector Classifier.

I. INTRODUCTION

A neural network is a processing device, its design is inspired by the design and functioning of human brain and their components. Neural network has many applications, the most likely applications for the neural networks are (1) Classification (2) Association and (3) Reasoning. One of the applications of neural networks is in the field of pattern recognition.

Pattern recognition [PR] is concerned with the classification or description of observations. It aims to classify patterns based on either a priori knowledge or the features extracted from the patterns, recognition or separation in any particular sequence of bits or pattern from other patterns. Pattern recognition [PR] applications have been varied, and also the associated data structures and processing paradigms [1].

Knowledge-based pattern recognition: This approach to Pattern Recognition [PR] [6] which is evolved from advances in rule-based system in Artificial Intelligence (AI). Each and Every rule is in the form of a clause that reflects evidence about the presence of a particular class. The sub-problems spawned by the methodology's are:-

1. How the rule-based may be constructed, a
2. What mechanism might be used to integrate the evidence yielded by the invoked rules?

Neural Pattern Recognition: Artificial Neural Network (ANN) provides an emerging paradigm in pattern recognition. ANN encompasses a large variety of models [2], all of them which have two important characteristics:

1. They are composed of a large number of structurally and functionally similar units called neurons usually connected various configurations by weighted links.
2. The Ann's model parameters are derived from supplied I/O paired data sets by an estimation process called training.

In Pattern recognition the data is segregated into various clusters which are characterized into a number, which specifies the pattern of single specific value. These values are gathered into the file which we called as "original file". This file is processed through manual approach to make it into normalized approach.

II. METHODOLOGY

There are many neural network algorithms for the pattern recognition. The Various algorithms differ in their learning mechanism and Learning can be either supervised or unsupervised. In supervised learning, the training set contains both inputs and required responses. After training the network, and get the result of response that is equal to target response. Unsupervised classification learning is based on clustering of input data. There is no prior information about input's membership in a particular class. The Image as the patterns and a history of training is used to assist the network in defining classes. This unsupervised classification is called clustering.

The Image as a pattern of neurons and initial weights are specified based upon the training method of the network. The pattern sets is applied to the network during the training [7]. The pattern is to be recognized in the form of vector, whose elements is obtained from a pattern grid. The elements are either binary values 0 and 1 or

bipolar values -1 and 1. In some of the algorithms, weights are calculated from the pattern presented to the network and in some algorithms weights are initialized. The network acquires the knowledge from the environment. The network stores the patterns presented during the training in another way it extracts the features of pattern. Neural networks have demonstrated its capability for solving complex pattern recognition problems [9]. Commonly solved problems of pattern have limited scope. Single neural network architecture can recognize only few patterns. Various neural network algorithms with their implementation details for solving pattern recognition problems. The relative performance evaluation of these algorithms has been carried out.

III. PROPOSED MODEL

The objective of this paper is Relative performance of various neural network algorithms have not been reported in the literature. This paper extract the issues on various neural network algorithms with their implementation details for solving pattern recognition problems. The relative performance evaluation of these algorithms has been carried out.

Rosenblatt's Perceptron

The perceptron occupies a special place in the historical development of neural networks, and it is the first algorithmically described neural network, invented by Rosenblatt, a psychologist, who inspired engineers, physicists, and mathematicians like to devote their research effort to different aspects of neural networks in the 1960s and the 1970s. Now, recently computer science developers also devote their research effort to different aspects of neural networks. Moreover, it is truly remarkable to find that the perceptron is as valid today as it was in 1958 when Rosenblatt's paper on the perceptron was first published [8].

The perceptron is the simplest form of a neural network used for the classification of patterns. The perceptron is a computational model of the **retina of the eye** and hence, is named **Perceptron**. Basically, it consists of a single neuron with adjustable synaptic weights and bias. The algorithm used to adjust the free parameters of this neural network first appeared in a learning procedure developed by Rosenblatt (1958, 1962) for his perceptron brain model [8]. Rosenblatt proved that if the patterns (vectors) used to train the perceptron. The perceptron built around a single neuron is limited to performing pattern classification with only two classes (hypotheses). By expanding the output (computation) layer of the perceptron to include more than one neuron, we may correspondingly perform classifications.

The perceptron network comprises three units (*Fig. 1*)

- Sensory Unit S,
- Association Unit A,
- Response Unit R.

The Sensory Unit(S) Comprising 400 photodetectors receives input of images. and they provides a 0/1 electric signal as an output. If the input signals exceed a threshold, then the photodetectors outputs 1 else 0. The photodetectors are randomly connected to the Association unit (A). The Association unit Comprises **feature demons or predicates**. The predicates examine the output of the Sensory unit(S) for the specific features of the image. The third unit Response unit(R) Comprises **pattern recognizers or perceptron**, which receives the results of the predicates, also in binary form. While the weights of the Sensory unit(S) and Association Unit (A) are Fixed, and the Response unit(R) weights are adjustable

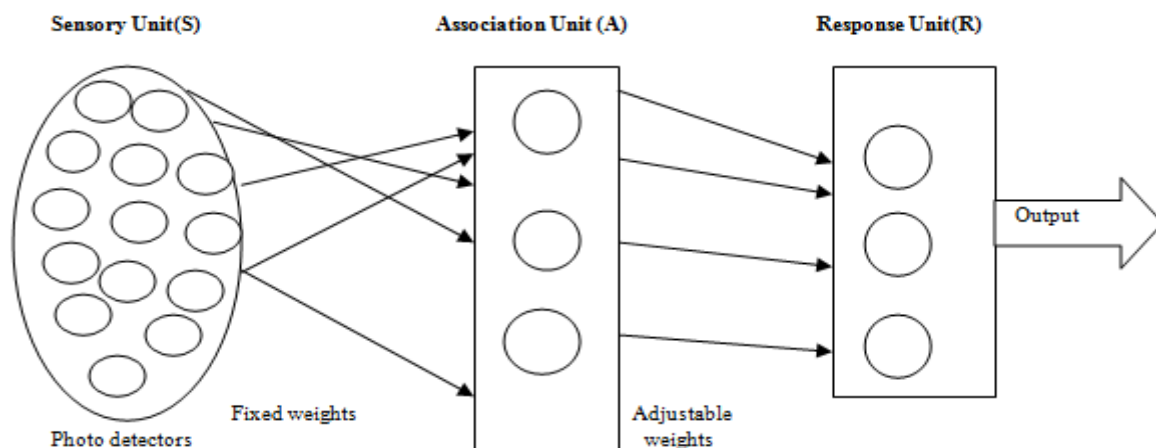


Fig. 1: Rosenblatt's original Perceptron model

The output of the Response unit (R) could be such that, if the weighted sum of its inputs is less than or equal to 0 and then the output is 0 otherwise it is weighted sum itself. It could also be determined by a step function with binary values (0/1) or bipolar values (-1/1). Thus, in the case of a step function yielding 0/1 output values, it is defined as $Y_j = f(\text{net}_j) = 1, \text{net}_j > 0$

=0, otherwise.

Where,

$$\text{net}_j = \sum_{i=1}^n x_i w_{ij}$$

Here, x_i is the input, w_{ij} is the weight on the connection leading to the output units (R unit), and Y_j is the output. The training algorithm of the perceptron is a supervised learning algorithm where the weights are adjusted to minimize error whenever the output does not match the target output.

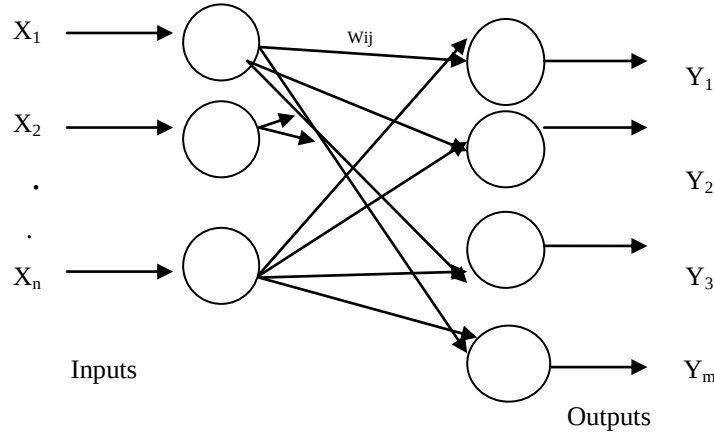


Fig. 2: Single Layer perceptron Network Model

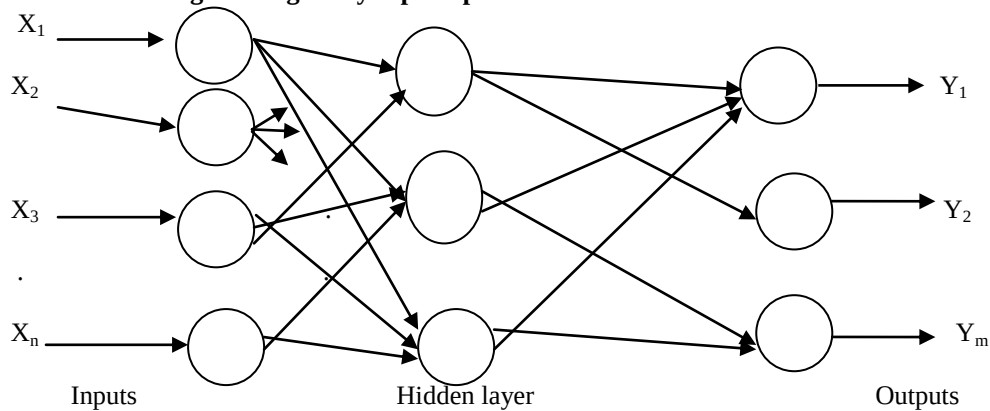


Fig. 3: Multilayer feed forward Perceptron Network Model

A basic learning algorithm for training the perceptron is as follows:

- If the output is correct then no adjustment of weights is done
(i.e) $w_{ij}^{(k+1)} = w_{ij}^{(k)}$
- If the output is 1 but should have been 0 then the weights are decreased on the active input links.
(i.e) $w_{ij}^{(k+1)} = w_{ij}^{(k)} - \alpha \cdot x_i$
- If the output is 0 but should have been 1 then the weights are increased on the active input links.
(i.e) $w_{ij}^{(k+1)} = w_{ij}^{(k)} + \alpha \cdot x_i$

Here, $w_{ij}^{(k+1)}$ is the new adjusted weight, $w_{ij}^{(k)}$ are the old weights, x_i is the input and α is the learning rate parameter. Also small α leads to slow learning and Large α leads to fast learning. However, large α also runs the risk of allowing weights to oscillate about values which would result in the correct outputs. For a constant α , the learning algorithm is termed **fixed increment algorithm**.

Fixed increment perceptron learning algorithm for classification problem with n input features ($x_1, x_2, x_3, \dots, x_n$)

Perceptron algorithm

Fixed-Incre-Percept-Lrng ($\bar{X}_j, \bar{Y}_j, \bar{W}$)

Step 1: Create a Perceptron with $(n+1)$ input neurons $x_0, x_1, x_2, \dots, x_n$, where $x_0=1$ is the bias input. Let 0 be the output neuron.

Step 2: Initialize $\bar{W} = (w_0, w_1, \dots, w_n)$ to random weights.

Step 3: Iterate through the input patterns $\bar{X}_j$ of the training set using the weight set, That is Computes the weighted sum of $\text{net}_j = \sum_{i=0}^n x_i w_i$ for each input pattern j.

Step 4: Compute the output Y_j using the step function

$$Y_j = f(\text{net}_j) = 1, \text{net}_j > 0 \\ = 0, \text{otherwise.}$$

Step 5: Compare the Computed output Y_j with the target output Y_j for each input pattern j .
if all the input patterns have been classified correctly, output the weights and exit.

Step 6: Otherwise, update the weights as given below:

If the computed output Y_j is 1 but should have been 0, $w_i = w_i - \alpha x_i$, $i=0,1,...,n$.

If the computed output Y_j is 0 but should have been 1, $w_i = w_i + \alpha x_i$, $i=0,1,...,n$.

Step7: goto step 3.

IV. EXECUTION

We demonstrated the application of this model to the image based on pattern recognition application in this work. Specifically, we have tested its performance on Pattern recognition. As a general perceptron sequential memory organization, we believe that this model can also be generalized to many real-world applications that require complex sequence learning or sequential behaviors. The network which is stabilized with the parameters is tested within new data files for clustering. The network has 49 neurons in first layer and five neurons in the second layer. With this configuration the network is capable of recognizing image patterns and clustering it.

V. RESULT AND DISCUSSION

Every day, people encounter a large amount of information and store or represent it as a data, for further analysis and management. In computers every data should be represented by using binary numbers (0,1). At the same way our human brain receiving images, that images represented as a binary manner in the neuron. An image may be received by the standard Perceptron network is intended for work with a binary input vector [1] and this fact greatly reduce a contribution of Perceptron structures in image recognition because real images represented in color format and conversion to gray scale image and then converted to black and white form of images in neuron. Assign the value of 0 and 1 as black and white respectively. A value may be 0 that means an image fully in black. So we never see a image. A value may be 1 that means an image fully in white. So we never see a image. An image contained value 0 to 1. The mid value is 0.5. The range of value 0.1 to 0.5 black occupied mostly when they increased about the value. The range of value 0.6 to 1 white occupied mostly when they increased about the value. The results of this work are carried out in several phases. The following procedure has been put in use in getting the results.



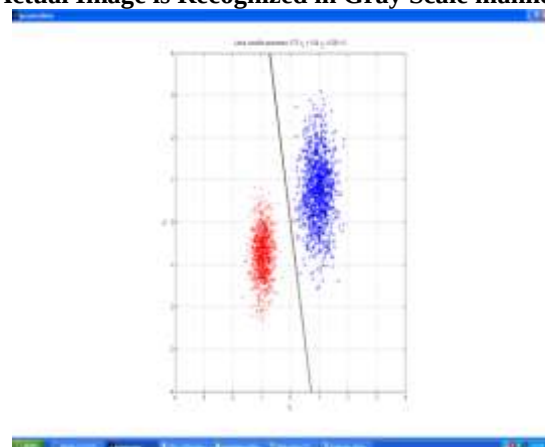
Actual Image



Actual Image is Recognized in Gray Scale manner

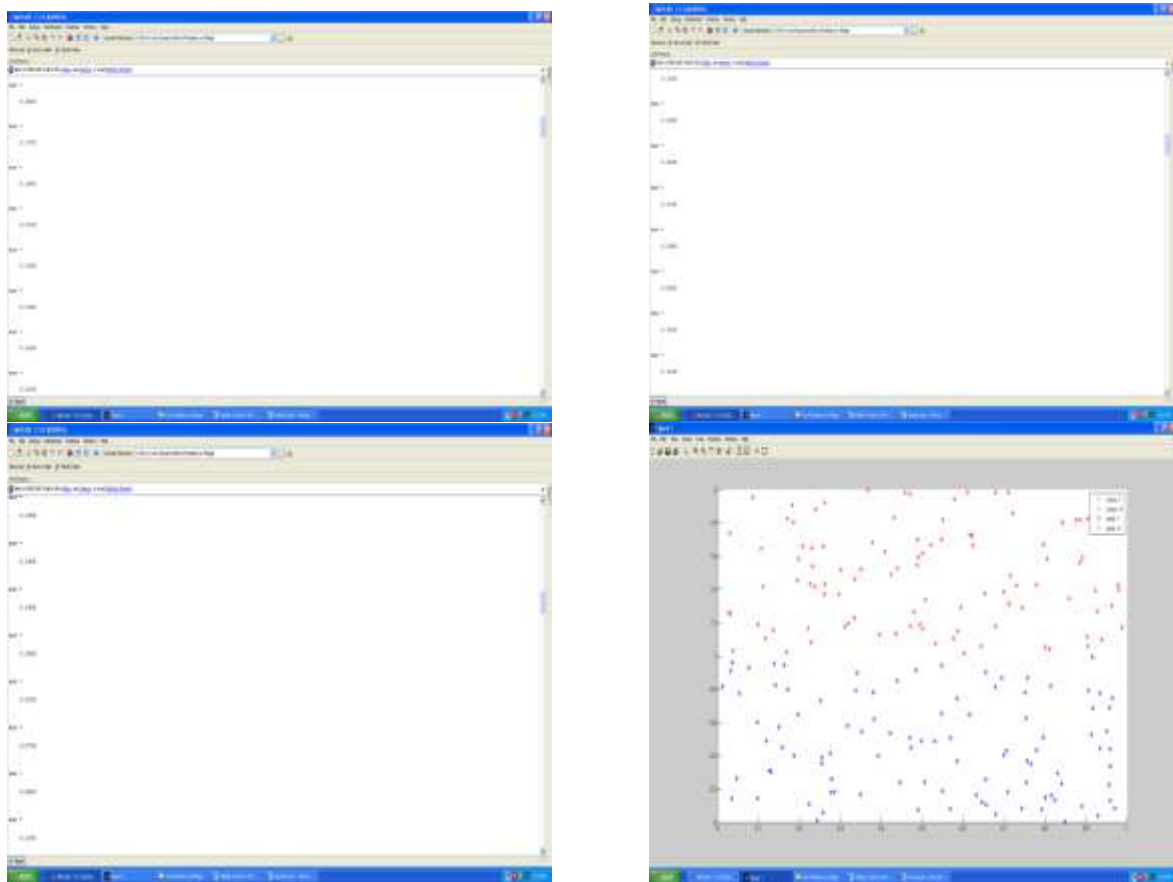


Gray Scale Image Converted into Black & white



linear Vector Classifier Parameters

The Result Shows the testing will result in the approximate identification of the data patterns with tag value of 0 to 1.



Clustering the Pattern

VI. CONCLUSION

Actually, it is the most primitive activities of human beings classification plays an important and indispensable role in the long history of human development. In order to learn a new object or to understand a new phenomenon, people always try to seek the features that can describe it, and further compare it with other known objects or phenomena, based on the similarity or dissimilarity, generalized as proximity, according to some certain standards or rules. Basically, classification systems are either supervised or unsupervised, depending on whether they assign new inputs to one of a finite number of discrete supervised classes or unsupervised categories. Binary inputs caused information loss. We have shown that by bit slicing method is possible to represent a color pixel as the set of binary numbers and use this binary sequence as input of neural network. For three bits color encoding, Perceptron neural network has interpolation ability that allow interpolating any input color to the nearest base color. We have tested ability of the network for recognition of color images that gave co-efficient of sensitivity approximately equal one in case of recognition of the objects with different forms and colors. The work stands to gain a lot of advantages namely no time delay in calculating the presence of recognizing pattern and faster computerized report generation and also helpful in data records.

REFERENCES

- [1]. V.K.Govindan and A.P. Sivaprasad, "Image Recognition- A review", Pattern recognition, Vol.23, No. 7, PP. 671-683, 1990
- [2]. J.Ufer, Direct data processing with the IBM 1287 multipurpose document reader for standard article-fresh service to Joh. Jacob and Co. Breman, IBM Nachr.(Germany) **20**, 35-40 (February 1970). (In German).
- [3]. Basit Hussain and M.R.Kabuka, "A Novel Feature Recognition Neural Network and its Application to character Recognition", IEEE Transactions on Pattern Recognition and Machine Intelligence, Vol. 16, No. 1, PP. 98-106, Jan. 1994.
- [4]. Schalkoff R.J., "Pattern Recognition: Statistical Structured and Neural; Approach", John Wiley and Sons, 1992.
- [5]. Gonzalez R.C. and Thomason M.G., "syntactic Pattern Recognition", Addisonwesley, 1978.
- [6]. H.Genchi, Data communication terminal apparatus, optical character and mark readers, Denshi Tsushin Gakkai Zasshi, **52**, 418-428 (1969) (In Japanese).
- [7]. Wenwen Wang, Budhitama Subagdja, Ah-Hwee Tan and Janusz A, Starzyk "Neural Modeling of Episodic Memory: Encoding, Retrieval, and Forgetting" IEEE transactions on neural networks and learning systems, vol. 23, no. 10, October 2012.
- [8]. Rosenblatt, Frank (1958), The perceptron: A probabilistic model for information storage and organization in the brain, Psychological Review, 65:386-408, 1958.
- [9]. Carpenter Gail A and Grossberg Stephen (1988), The ART of adaptive pattern recognition by a self organizing neural network, Computer, 21(3):pp.77-88, March.