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Pattern Retrieval by Using Back Propagation Method on Basis of Non Primitive Features

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Abstract: ***The main objective of this paper is to perform Pattern Retrieval By using Back Propagation Method on basis of Non Primitive Features. We applied Back Propagation Method Technique for Optimization of Retrieved Results along with minimization of error rate also. This method provides better retrieval results as compare to existing methods on basis of Primitive Features. To make pattern retrieval faster, we have used Multi-Layer Neural Network as trainer with KNN Method. Applications for Back Propagation Learning are Classification, Function Approximation, Time-Series Prediction, and Statistical Classification.***

Keywords: ***Non Primitive Features, BPN, Supervised, ANN, Neural Network, Pattern Recognition, KNN, Back Propagation in Neural Network***

I. INTRODUCTION

Back Propagation Network is Multi-Layer Perceptron Neural Network which consists of three layers; including Input Layer, Hidden Layers and Output Layer. It is a common method for training a Neural Network. The objective of back propagation is to optimize the weights so that the neural network can learn how to correctly map arbitrary inputs to outputs. The neural network is viewed as network structure which is a sequence of linear/nonlinear transforms (Biased Linearity, Sigmoid). In first paper two different variants of steepest descent-based back propagation algorithm and four different variants of conjugate gradient algorithm are tested. In second paper, various normalization methods used to enhance the reliability of the trained network. In third paper various methods used in different stages of a pattern recognition system and identify the best suitable technique with its advantages over other techniques to recognize the complex patterns along with other real-life applications. In fourth paper, the adaptation of network weights using Particle Swarm Optimization (PSO) was proposed as a mechanism in classification of IRIS dataset. In fifth paper Back Propagation Neural Network is developed for Bangla Speech Recognition. In sixth paper a literature survey is conducted for the applications of Neural Networks in control system. In seventh paper by using Neural Network Image Classification has performed. In eight paper studies of Artificial Neural Networks based forecasting of Indian gold prices has done. In ninth paper, the use of mat lab coding for simulation of back propagation neural network for classification of Iris dataset is demonstrated. In tenth paper ,a comparative study for prediction for 28-days compressive strength of Ready Mix Concrete(RMC) have been carried out using Feed forward back propagation and Cascade forward back propagation algorithms. The study is based on by processing the number of neurons in the intermediate layer using tansigmoidal transfer function. Various models have been developed for different input scenarios, non-dimensional ratios have used for modeling and the ratios such that their changes resulted in corresponding changes in the output.

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II. OBJECTIVE

The main objective is to compare and explore the feasibility of feed forward back propagation network and to train the Multi-Layer Neural Network for better retrieval results with minimum error rate using KNN Clustering method. To validate accuracy of retrieval outputs, BPN works in both Forward manner and Backward Manner among different layers.

III. THEORY AND TECHNIQUES

The drawbacks of existing retrieval techniques for primitive information of a pattern by using basic methods as, Sequence, Index Sequence, Index, Hashing methods are not applicable for extracting non primitive information of a pattern, in addition to that for reducing high noise ratio problem, very difficult to handle by using such methods. In this paper we have applied, back-propagation neural network technique as a solution to the problem of Pattern Retrieval on basis of non-primitive features. BPN method is useful to train multilayer Neural Network The main characteristic of BPN is the inclusion of a differentiable activation function at each node of the network and the use of error back-propagation to train the internal network after each training phase. Training of Network has provided adjustment of weights for finding better retrieval results on basis of misclassification ratio Error. The BPN was selected as a classifier because of its ability to generate decision boundaries in the feature space. Along with Neural Network as classifier provides the best performance possible (i.e., lowest error rate) for a given distribution of the feature data in comparison with other non-parametric techniques to pattern classification, Furthermore, there are several parameters of the BPN that must be selected, including the number of training data sets, the number of intermediate nodes, and the learning rate parameter. BPN structure is as given below along with sample pseudo code for computing error rate for maximum epochs:-

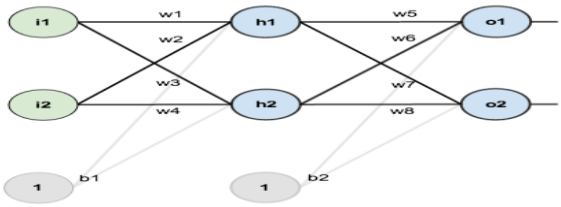

Fig.1 Basic Structure of Back Propagation Network

In Fig. 1, Basic Structure of Back propagation Network has three layers as Input Layer, Hidden Layer and Output Layer. It is based on Multi Layer Perceptron Neural Network Model in which Input Layer works as Sensory Layer, Hidden layers work as Associative Layers and Output Layer work as Response Layer. Sample Pseudo Code for Error Computation:-

initialize BPN weights (small random values)

do

for each training set s

p= neural –net- output (network, s)

a= supervisor-output(s)

Compute error (a-p) at the Response Units

Compute Δ $weight_h$ for all weights from Associative layer to Response Layer

Compute Δ $weight_i$ for all weights from Sensory layer to Associative Layer.

Update BPN weights

until maximum epoch reaches.

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return the BPN.

IV. METHODOLOGY

Order to perform it we have used sigmoid activation function for implementation of Multi- Layer feed forward Network. In our Network structure, the number of hidden layers are two with number of neurons are 2, 2 respectively in each hidden Layer respectively. The number of output layer units depends upon number of clusters. We have applied learning rate parameter η, momentum rate parameter α. After enabling Learning rate decrement, we also performed decision boundary separation for different clusters. In this approach training of network stop when maximum epochs is reached or minimum error rate is achieved within tolerance limit. In this retrieval technique we have also applied KNN Method due to its intuitive operation. First, the distances between a single test data and each of the training data are calculated. The training samples closest to that test sample are defined as its ``nearest neighbors''. The test sample is then assigned to the cluster from which a plurality of its k nearest neighbors are from, where k is an integer has value less than 10. Sample Pseudo Code for Implementation of BPN Based Retrieval to train the Neural Network with KNN method is as follows:-

```
function [net ] = nn [ feature set ]
img_names = featureset (:,end);
lbls = zeros (length (dataset) ,1);
for k=0 : length (lbls)-1
if (img_names (k+1) >=0 && img_names(k+1) <=499)
lbls (k+1) =1;
else if (img_names (k+1) > 499 && img_names(k+1) <=999)
lbls (k+1) =2;
else if (img_names (k+1) >999 && img_names(k+1) <=1499)
lbls (k+1)=3;
else if (img_names (k+1) >1499 && img_names(k+1) <=1999)
lbls (k+1)=4;
else if (img_names (k+1) >1999 && img_names(k+1) <=2499)
lbls (k+1)=5;
else if (img_names (k+1) >2499 && img_names(k+1) <=2999)
lbls (k+1)=6;
Repeat same procedure till img_names (k+1) <=9999
end
end
P=featureset (: , 1 : 190 );
P=P';
T=lbls';
rand ('seed', 491218382)
```

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```
net = newff(P,T,20);

[net , tr ] =train (net , P,T);

Return ;
```

V. Results and Experimental Analysis

We have used MAT LAB version r2009a. In this work, 10,000 images have taken in image database. After applying BPN including Neural Network and KNN Method, Following training and testing result are as follows:-

TABLE I Computed Feature set Values for Sample Patterns

Pattern Index	Computed Feature Set Value		
	Feature_ Value1	Feature_ Value2	Feature_ Value3
Pattern 1	0.07221	0.06630	0.01112
Pattern 2	0.06885	0.13346	0.09147
Pattern 3	0.11089	0.16133	0.05851
Pattern 4	0.23808	0.01846	0.00588
Pattern 5	0.15022	0.00235	0.00030
Pattern 6	0.03580	0.03929	0.01569
Pattern 7	0.06963	0.04979	0.10805
Pattern 8	0.18356	0.01203	0.00041
Pattern 9	0.07616	0.94935	0.04437
Pattern 10	0.21392	0.04805	0.03710

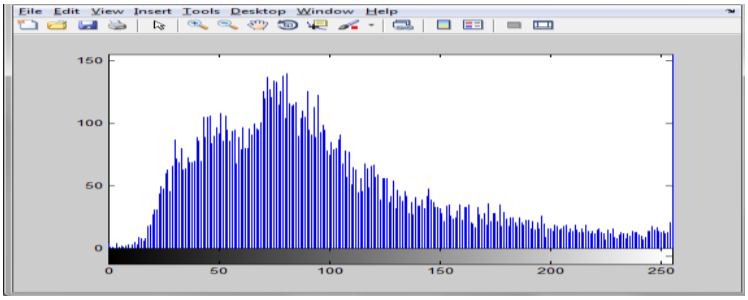

Fig.2 Histogram 1 for input Image 9900.jpg with 1*651 Cell

In Fig. 2, above colour Histogram represents number of pixel count for each 250 scales in each of 3 RGB Channels. On X axes, It represents Scale Value and On Y axes, it represents statistical distribution of the colour value of an Input Image.

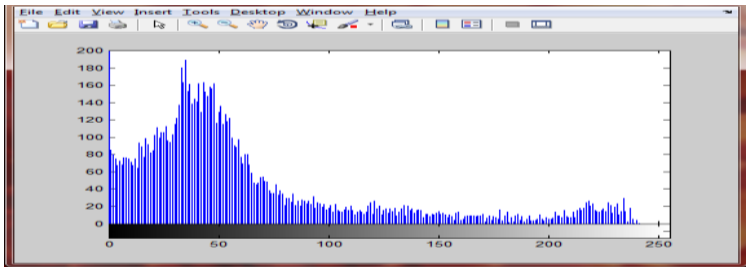

Fig. 3 Histogram 2 for input Image 999.jpg with 1*9908 Cell

In Fig. 3, above colour Histogram represents number of pixel count for each 250 scales in each of 3 RGB Channels. On X axes, It represents Scale Value and On Y axes, it represents statistical distribution of the colour value of an Input Image. In this colour histogram on X axes, as scale value increases, statistical distribution of colour value of an Input Image decreases.

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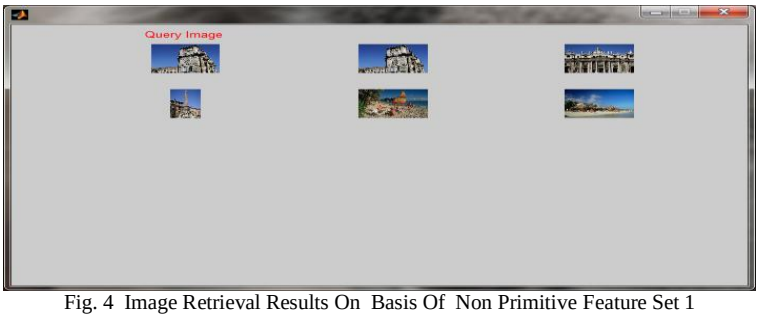

Fig. 4 Image Retrieval Results On Basis Of Non Primitive Feature Set 1

Fig. 5 Image Retrieval Results On Basis Of Non Primitive Feature Set 2

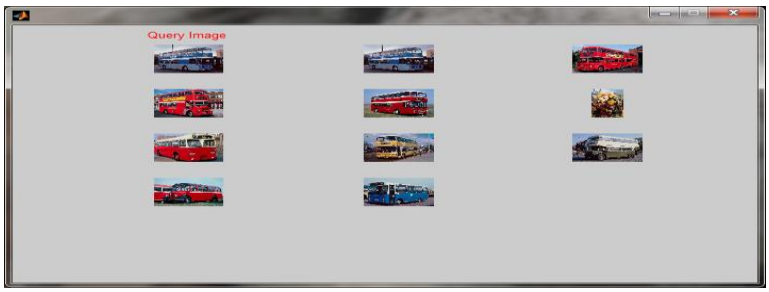

Fig. 6 Image Retrieval Results On Basis Of Non Primitive Feature Set 3

VI. Conclusion

In this paper Back propagation model is implemented for pattern Retrieval Based upon Non Primitive Features of Input Pattern. We found BPA is good technique because all the feature vectors are available in the numerical form. By using this approach, Retrieval Result has faster rate with minimum misclassification error. There is a future scope of this method when an input pattern has similar values for different clusters.

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