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Dynamic Annotation System for Content Based Image Retrieval using Back Propagation Classification Technique

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Abstract **-** The CBIR tends to search, retrieve and index images on the basis of visual content of an image. The arrangement of a CBIR system depends on the peculiar image illustration, pattern, features etc. CBIR avoids many problems associated with traditional methods of retrieving images by using keywords. The interpretation of a CBIR system mainly relies on the particular image representation and matching similarity functions employed [1]. Content-Based Image Retrieval system is based on the retrieval of the identical pictures from wide database, when a query picture is feed as an input into the system. Whole functioning of Content-Based Image Retrieval (CBIR) system is to give similar matches of a query input from huge and numerous datasets. Productive enactment of a CBIR system requires categorization, classification, indexing and repossession of images.

Keywords: CBIR, retrieval, feature extraction, classifier, Back Propagation Neural Network (BPNN)

I. INTRODUCTION

Being an easy, effective and less costly image extraction method, CBIR has become interesting as well as challenging problem with numerous applications with the availability of huge video and image data sets. Term Content in CBIR might be referred to shape, colour, texture, orientation or any other information derived from the image [2]. The main discipline of depicting colour information of images in CBIR systems is by use of colour histogram [3]. A Colour histogram is a type of bar graph, in which each bar represents a specific colour being used uploaded image or the image to be tested. The bars in a colour histogram are termed to be bins and they are represented by x-axis. The number of bins lean on the number of colours present in an image. Number of pixels are indicated by y-axis. CBIR system gives top matching output to query image from huge database [4]. Effective CBIR system categorize, index and retrieve images, which depends on effective features to describe content of an image. The large contrast within a class requires alternate features and methods to maximize or improve retrieval performance of the system.

1.1 Retrieval of image

(1) **Colour based retrieval-** This feature is the most used feature and generally histograms are used to describe it. This method has advantages of speediness, low memory space requirement.

(2) **Texture based retrieval**- When there is description of the texture of image, usually texture's statistic feature and structure features are adopted**.**

(3) **Shape feature retrieval**- Shape is related to the uniqueness and description of object in the image, so shape's semantic feature is much stronger than texture.

1.2 Feature Extraction (SIFT Algorithm)

This mechanism was proposed by David Lowe [5] that has the capacity to differentiate and describe neighborhood elements of picture successfully. The SIFT includes five stages. First stage searches for extreme points of image. Localization of key points is done at second stage to figure out exact shape of image. Orientation around each key point is done with the help of histograms. Estimated key points describes the gradient and magnitude of image. Finally trimming of erroneous co-ordinates is done.

Image classification is basis of learning in which attributes are matched to the feature vector space as shown in figure 1.1 [6]. These algorithms are called machine learning algorithms.

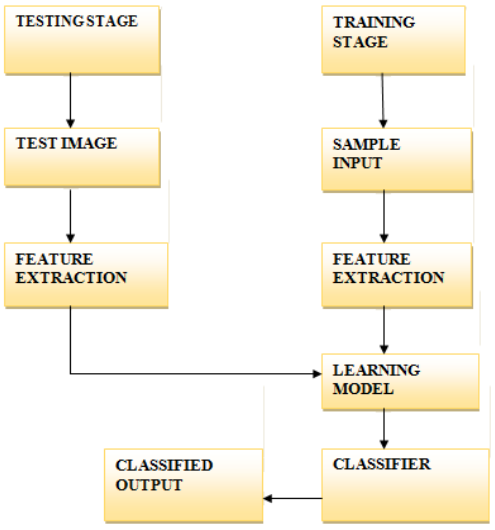

Fig.1.1 Design of Classification system

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Two stages in classification are as following:

(1) **Training stage-** In training section, classifier learns classification rules by its own.
(2) **Testing stage**- In testing phase, the feature vectors of a query input are taken as input.

1.3 Use of Multi layer Back Propagation Neural Network

BPNN is artificial neural network technique based on error back propagation algorithm. The Back Propagation Neural Network model consists three layers: input layer, some hidden layers & an output layer. Neuron at every layer has a distinctive weight. Input neurons obtain input information from exterior sources, and then go to hidden layer which is an interior info processing layer & is answerable [7] for the information conversion, and then the nodes in the production layer supply the required output substantial. Every weight is reviewed and back propagated layer by layer from output layer to hidden layer & input layer. This procedure will be sustained until the output error of network is reduced to tolerable level.

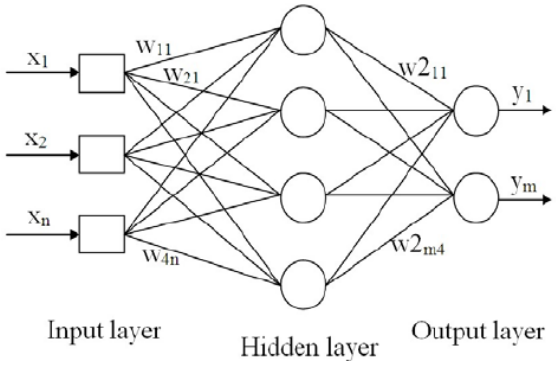

Fig.1.2: Multi layer Neural Network

II. LITERATURE REVIEW

In paper [8] strategy for figure matching is purposed. For this purpose SURF Algorithm utilizing SVM Classifier, Neural Network nourish forward and colour histogram are used. Numerous CBIR procedures have been proposed before yet they were sufficiently bad and can be briefly messed with. So the work was not satisfied with this methodology. CBIR alone with Surf and SVM Method couldn't give better results. Consequently utilize CBIR with Surf, SVM, NN and colour histogram giving improve results. In this paper [9] Scale Invariant Feature Transform (SIFT) is implemented for Content-based Image Retrieval. Research scholar displayed the expanding disagreeability of CBIR and SIFT innovation which ended up being the most proficient strategy among all other strategies implemented by the scientists in related field of image processing. Paper [10] named Duplicate Retrieval by Using Colour, Texture & Shape Features explains about the consolidating of the colour, shape, and surface data in CBIR to deliver effective recovery results. Certain strategies are prepared like careful calculation to a certain highlight vector for shape and co-event lattice to figure highlight vector for composition. Hence we can conclude that colour, surface, shape intertwined elements are much stronger then colour shape composition highlight based picture recovery strategy. Paper [11] discovered an optional approach for Content Based Image Retrieval (CBIR) using Scale Invariant Feature Transform (SIFT) calculation for parallel and dim scale images. The inspiration to utilize SIFT calculations for CBIR was because of the method that SIFT was invariant to scale, resolution, orientation and interpretation and in addition part of the way invariant to relative bending and light changes. In paper [12] named A Comparative Study of SIFT and its Variant. This paper portrays the properties of the SIFT and its correlation with alternate innovations of SIFT family. All procedures are tried in distinctive circumstance to know which calculation gives better result in diverse circumstance. SIFT perform best under scaling and pivot change but on the other hand SURF performs the most exceedingly awful in the distinct circumstances hence runs the quickest.

III. PROBLEM FORMULATION

There is semantic gap in result image due to lack of coincidence between the data that one can excerpt from the visual information and the understanding that the same data have for user in a given situation. Sometimes there are several kinds of variations in a picture that affect the classification. The semantic gap between the client requirement and the capability of CBIR algorithms remains significant. Significant efforts have been put into low-level image properties such as colour and texture. To handle the problem of semantic gap faced by CBIR, learning semantics from training data input and developing retrieval mechanisms to correctly leverage semantic estimation are important directions. Most methods use them as part of histograms over the whole segmented image. Lighting reasons important variations in the strength of the pixels. Lighting alteration in picture have a key ascendancy on its aspect. Illumination and the existence of shadows is also problem in CBIR. Several number of times altered appearance of objects which makes the recognition of image difficult for system to compare it with test image for accurate results. The major drawback of CBIR approach is that do not heed another lesson from Pattern Noisy background may hinder the performance. This problematic increases false-positive results in result image retrieval. Image retrieval is very hard as compared to text retrieval. The reason for such difficulty is that the image data (pixels stored in bytes) are very far from the interpretation of images by human observers.

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IV. OBJECTIVES

The set objectives of set to be achieved in proposed model are as following:

1. To study the various CBIR system development techniques.
2. To extract the features of the database [13] using SIFT algorithm and to train the system using the extracted feature set , also to set the target of the extracted features for the Multi Layer Neural Network.
3. To evaluate the test image over the targeted dataset (using BPNN).
4. To evaluate the performance parameters like FAR, FRR, Accuracy, Mean Square Error, Precision and Recall.
5. To compare the accuracy of the proposed model with previous implemented models.

V. METHODOLOGY

Dynamic Annotation system for Content Based Image Retrieval is employed using SIFT and Back Propagation Neural Network. Various CBIR techniques study has been carried out. Datasets of various images are created at initial and runtime using uci learning machine. Each data set is loaded with numerous images of different type. Various categories of datasets are represented in Graphical User Interface. After image upload, histogram is generated to find maximum intensity of an image. After this step, conversion of original image is done into grey scale image in order to reduce number of pixels. Using Scale Invariant Feature Transform, features of all datasets are extracted in order to train system using extracted features of datasets. SIFT algorithm finds all the key points and identifies unique image properties.

Basic step SIFT algorithm is to to build a Gaussian scale space, which includes a adaptable scale 2-Dimensional Gaussian operator G(a1, b1, σ) with the input picture .

J (b1, c1): M(b1, c1, σ) = H (b1, c1, σ) * J (b1, c1)

Difference of Gaussian images E(b1, c1, σ) is then obtained by subtracting subsequent scales in each octave:

E(b1, b1, σ) = M (b1, c1, k σ) - M (b1, c1, σ) Where k is a constant multiplicative factor in scale space. Nearby extreme points are then identified by examining each image point in E(b; c; σ). A point is a local lowest or extreme when its value is smaller or larger than all its nearby adjoining points.

The target is set to the extracted features for the Neural Network. Test image is uploaded to system to evaluate it over targeted dataset using BPNN. Different performance parameters are evaluated like False Acceptance Rate, False Acceptance Rate, Accuracy, Mean Square Error, Precision, Recall and comparisons are done between results of proposed and existing parameters.

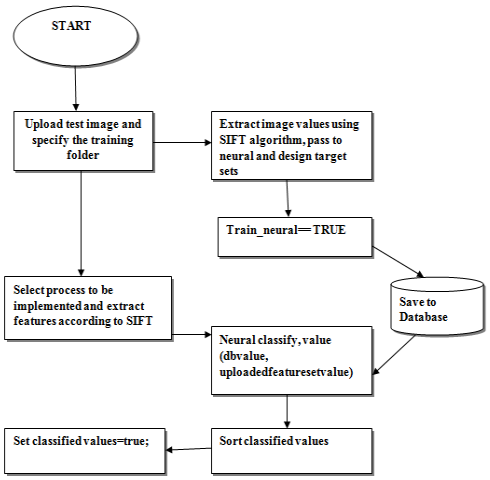

Fig.5.1: Flowchart of Methodology

VI. EXPERIMENTAL RESULTS

In this section, results are described as below:

As shown in Figure 6.1, an image from one dataset is uploaded as an input image. Histogram is generated to calculate intensity of pixels of image.

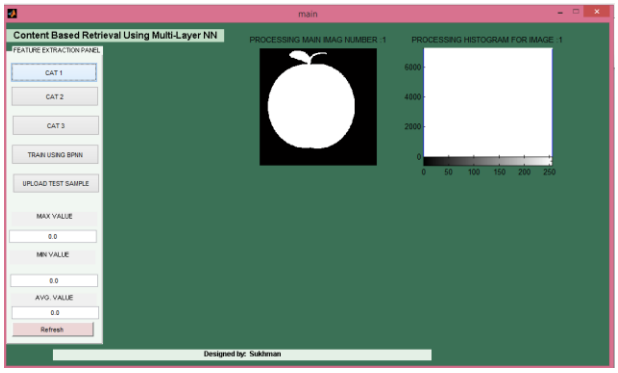

Fig.6.1: Uploaded image

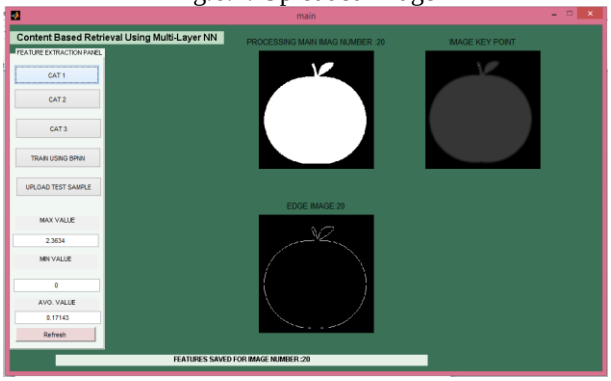

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Fig.6.2: SIFT algorithm

Input image is converted into greyscale image after which its key points and edges are detected using SIFT algorithm as shown below in figure 6.2. Descriptor is recorded at each key-point. The picture gradient, magnitudes and overviews, with respect to the significant overview of the key factors are computed.

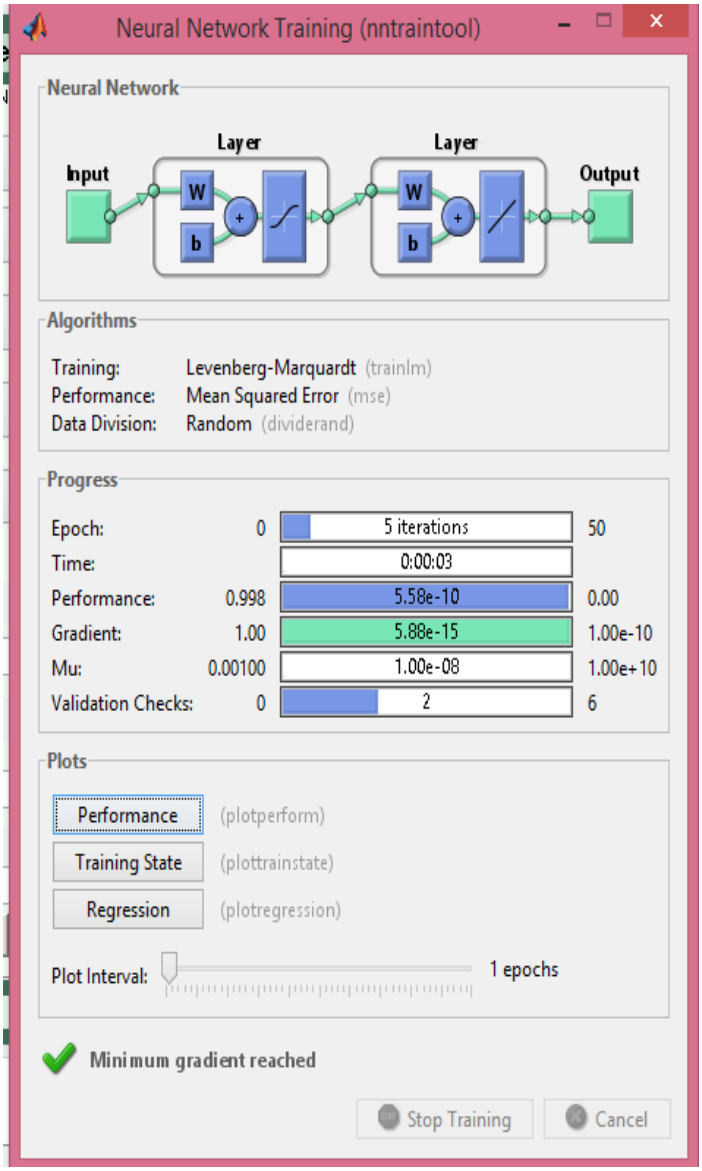

Fig.6.3: BPNN

BPNN calculates average of error using the inbuilt function like levenberg marquard.

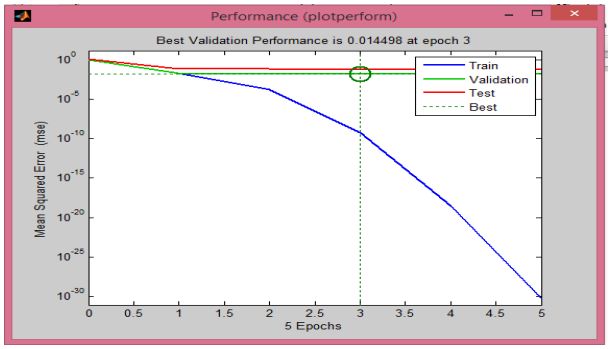

Fig.6.4: Best Validation performance

Figure 6.4 shows that best validation performance value is 0.014498.

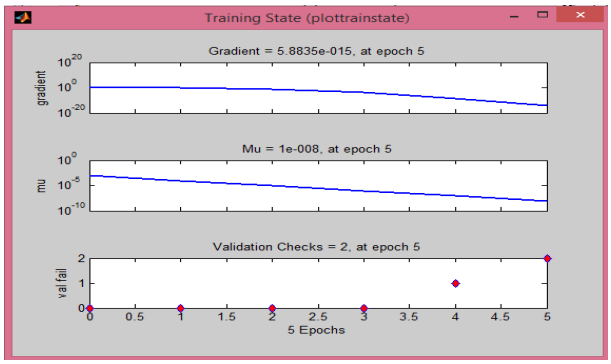

Fig.6.5: Training Sate

Figure 6.7 shows that the training state defined that gradient=5.88 at epoch 5, Mutation 1e-008 at 5 epochs and Validation Checks 2 at epoch 5.

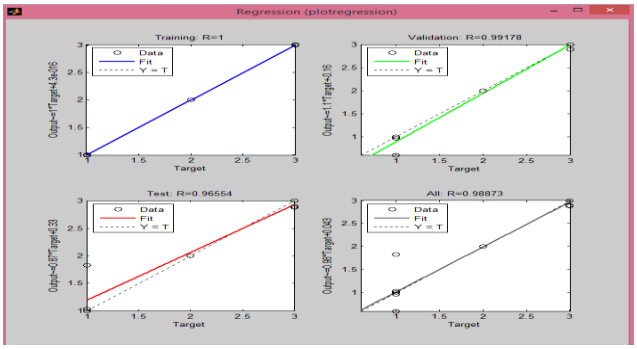

Fig.6.6: Regression

Figure 6.6 represents that the regression like Training R value is 1, Validation value is 0.99, Testing value is 0.96 and R=0.98.

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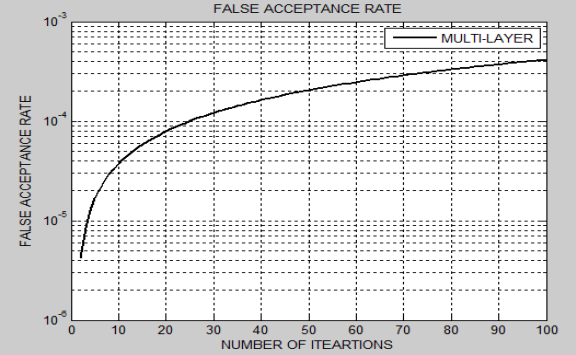
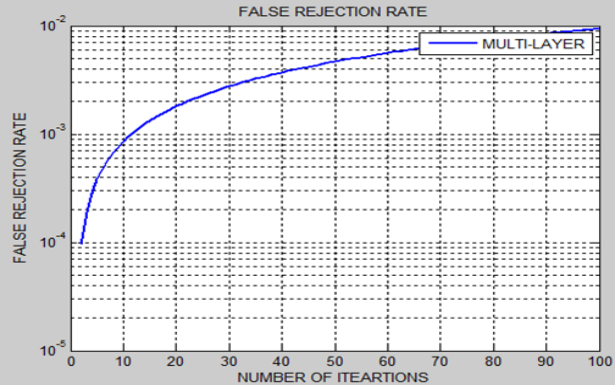


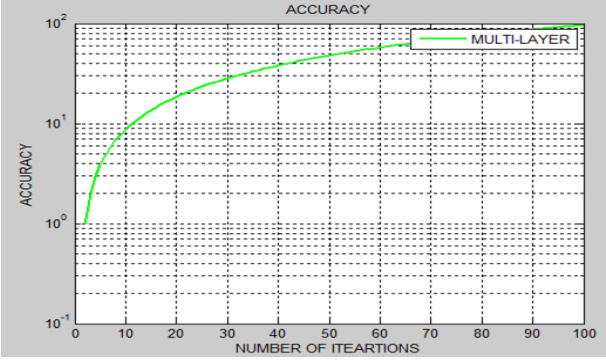
Fig.6.7(a) False Acceptance Rate (Proposed)

A system's FAR typically is stated as the ratio of the number of false acceptances to the ratio of the number of identification attempts.



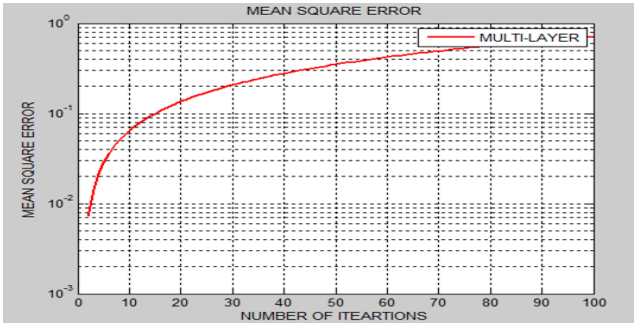
(b) False Rejection Rate (Proposed)

A system's FRR typically is stated as the ratio of the number of false rejections to the ratio of the number of identification attempts.



(c) Accuracy (Proposed)

Accuracy is how close a measured value is to the actual (true) value. Above figure shows the accuracy value for proposed method.



(d) Mean Square Error (Proposed)

The above figure calculates the performance of the training error and testing error average is known as means square error rate.

Image	Recall (Existing)	Recall (Proposed)	Precision (Existing)	Precision (Proposed)
	0.1	0.99	0.89	0.98
	0.99	0.996	0.85	0.983
	0.97	0.998	0.79	0.99

Figure 6.8: Comparison between Existing and Proposed Recall and Precision Values

The figure 6.8 calculates the minimum value of the precision and recall in existing work. Recall and Precision performance has improved. Maximum precision value performance achieved is 0.98 and Recall value achieved is 0.99.

VII. CONCLUSION

Motivated by the limitations of such an approach, recent research trends in CBIR has proceed to interactional systems and human computer interactive interfaces that involves a human as part of the output retrieval process. In this thesis the problem of image retrieval is solved using combination of SIFT and multi layer BPNN. Firstly feature extraction will be done using SIFT. Neural network training is based on the features of images in the dataset. The image features considered here are average value, minimum value and maximum value. The training is carried out using Multi layer Back Propagation Neural Network algorithm. This trained system when presented with a query image retrieves and

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displays the images which are relevant and similar to query from the multiple databases. The results show a considerable improvement in terms of FRR, FAR, Accuracy, Precision and Recall of images retrieved.

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