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Content Based Image Retrieval Using Neural Network and SIFT

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Abstract: *Extensive digitization of pictures, portraits, charts and origination of World Wide Web (www), has made traditional keyword based quest for picture, an incompetent technique designed for recovery of mandatory picture data. In this paper, a global picture properties based on CBIR technique using a back propagation neural network is suggested. In the beginning, the neural network is skilled about the features of pictures in the particular database. The training is carried out using back propagation algorithm. This trained when presented with a query picture retrieves and displays the pictures which are relevant and similar to query from the specific database. The results demonstrate quiet significant enhancement in terms of precision and recall of image retrieval.*

Keywords: *CBIR, Feature Extraction, Neural Network, SIFT.*

1. INTRODUCTION

Content Based Image Retrieval is a well-known area in image processing due to its diverse applications in internet, multimedia, medical image files, and crime avoidance [1]. Improved insist for image databases has improved the need to store and retrieve digital images. Extraction of visual features, viz., color, texture, and shape is an important component of CBIR [2]. Out of these, Shape is one of the main visual features in CBIR. Shape descriptors fall into two categories i.e., contour-based and region-based. Contour-based shape descriptors use only the boundary information by disregard the shape interior content while region-based shape descriptors exploit interior pixels of shape. Region-based shape descriptors can be functional to more common shapes. However, contour-based shape descriptors have limitations of extract complex shapes [3]. Therefore, this paper will solve the problem of image retrieval in CBIR systems based on SIFT and Neural Network method.

2. METHODOLOGY OF CBIR SYSTEM

1. Image acquisition

Image acquisition/capturing of image is the first step of our proposed technique image is of size 10-12 kb and of any format like bmp, png, jpej etc.

2. Feature extraction

In this we give a comprehend review of considered low-level visual features in the proposed approach using SIFT method and then pass for classification of the feed-forward backpropagation neural network. The essential SIFT estimation includes five noteworthy stages [5]:
The accompanying sub-segment will portray every stage.

a) Scale-space local extreme detection: The first step is to build a Gaussian scale space, which is finished by including a adaptable scale 2D Gaussian operator G(a1, b1, σ) with the i/p picture [6]

J (b1, c1): M(b1, c1, σ) = H (b1, c1, σ) * J (b1, c1)---(1)

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

E(b1, b1, σ) = M (b1, c1, k σ) - M (b1, c1, σ)-----(2)

Where k is a constant multiplicative factor in scale space. Nearby extrema are then recognized by watching each image point in E(b; c; σ). A point is decided as a local minimum or maximum when its value is smaller or larger than all its surrounding neighboring points.

b) Accurate Key-point Localization: Once a key point competitor has been establish, anyhow if it saw to have low difference (and is along these lines delicate to noise) or on the off chance that it is localized along an edge [7], it is uprooted because it cannot be dependably recognized again with little variety of perspective or lighting changes. Two thresholds are utilized, one to prohibit low contrast points and other to exclude edge points.

c) Orientation assignment: An introduction histogram is shaped from the gradient orientations inside a 16*16 locale around each key-point. The presentation histogram has 36 bins covering the 360 degree range of orientations [8]. Every specimen added to the histogram is weighted by its gradient magnitude and by a Gaussian weighted circular window centered at the key point. The significant introductions of the histogram are then appointed to the key-point, so the key-point descriptor can be spoken to with admiration to them, along these lines fulfilling invariance to picture rotation.

d) Key-point descriptor: In this stage, a particular descriptor is registered at every key-point. The picture gradient magnitudes and introductions, with respect to the significant introduction of the key point, are inspected inside a 16*16 locale around every key-point [9]. These specimens are then amassed into orientation histograms summarizing the contents over 4*4 sub regions.

e) Trimming of false matches: The key-point matching procedure described may generate some erroneous coordinating focuses. We have evacuated spurious coordinating focuses using geometric limitations [10]. We constrain ordinary geometric varieties to small rotations and displacements. Therefore, if we place two iris images side by side and draw matching lines true matches must appear as parallel lines with similar lengths. According to this observation, we compute the predominant orientation QP and length lp of the matching, and keep the matching pairs whose orientation µ and length ` are within predefined tolerances ϵQ and ϵP so that |Q -QP| < ϵQ and |l-lP| < ϵl.

3. Neural Networks

Neural network is a network of “neuron like” units entitled as nodes [11]. This neural evaluating method is utilized in fields of optimization, classification, as well as control theory and also for solving regression problems. NN are very effective in case of classification problems where detection and recognition of target is required. NN is preferred over other techniques due to its active nature. This active nature is attained via amending the weights according to final output and also to applied input information. This amendment of weights takes place iteratively until desired output is obtained. And this weight adjustment of network is known as “learning” of neural system. The structural design of neural network be made up of a large number of nodes and interconnection of nodes. A multiple-input neuron with multiple inputs ‘*R*’ is shown in Figure 1. The individual inputs are each weighted by corresponding elements of the weight matrix. The neuron also has a bias ‘*b’*, which is summed with the weighted inputs to form the net input ‘*n’*.

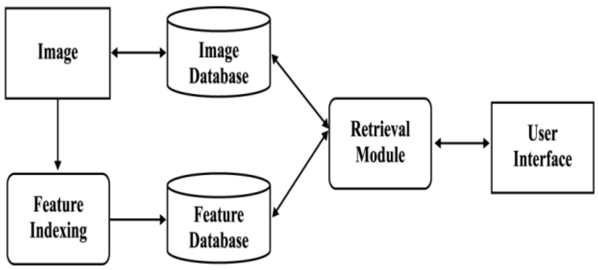

Fig 1: General Methodology of CBIR System

A. Flowchart

As mentioned our CBIR system has two main functions [4]. Each of them can be part of one or both of the following stages: the database training stage and the retrieval stage. Diagram 1 shows the database training stage and diagram 1 shows the flowchart.

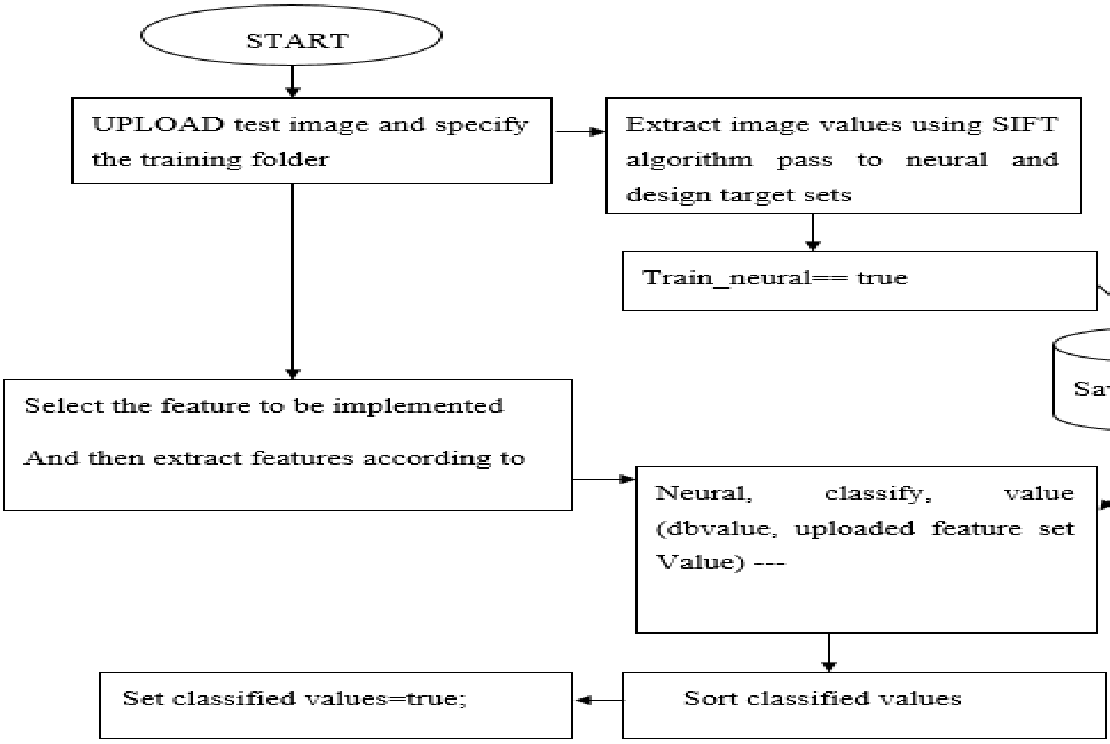

Fig 2: Proposed Method

The subsequent steps demonstrates the variety of phases that need to be accomplished:

Step-1: Upload dataset (MPEG-7)

Step-2: Feature extraction using SIFT algorithm

Step-3: Implement neural network (back propagation neural network).

Step-4: Calculate performance metrics like accuracy, precision rate and recall rate.

3. EXPERIMENTS

The whole simulation has been taken place in MATLAB environment and proposed work implementation evaluation will be done using three parameters like precision rate, recall rate, Accuracy. Below table shows overall accuracy, precision rate and recall rate of three category.

Table 1: Average parameter values

Images	Accuracy	Precision	Recall
Apple	93.22524	0.0368416	0.00527
Bird	89.6434	0.01296672	0.006484
Octopus	92.5011	0.01486204	0.005624 1

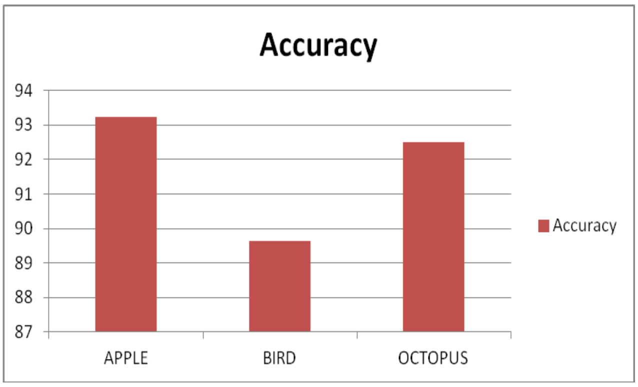

Fig 3: Accuracy

The above graph represents a accuracy based upon the formula given below:

Accuracy= $1-(precision\,rate+recall\,rate)\times 100$

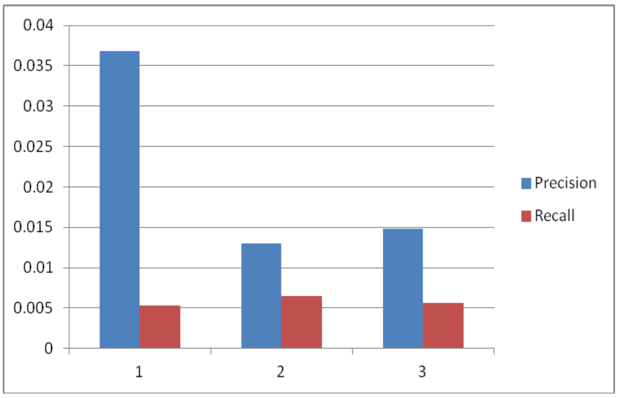

Fig 4: Precision and Recall

The above graph represents a parameter values like precision and recall.

Precision Rate = $\frac{No.of\ relevant\ image\ selected}{Total\ no.of\ retrieved\ images}$

Recall rate= $\frac{No.of\ relevant\ images\ selected}{Total\ no.of\ relevant\ images\ in\ database}$

4. CONCLUSION AND FUTURE SCOPE

This paper has presented a CBIR system using back propagation neural grid. The use of back propagation neural network has considerably improved the recall rate and also recovery period, as a result of its very much proficient as well as exact grouping ability. Similarly, the backpropagation procedure has increased the retrieval precision due to its capability of minimizing the error during training process itself. Also SIFT increases the feature extraction method.

Future scope include implementing the CBIR system considering more low-level image descriptors and highly efficient deep learning neural network, that may possibly verify to be quite fast as well as precise one. This work can be extended by integrating with Fuzzy C-means clustering algorithm for better efficiency.

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