PERFORMANCE EVALUATION OF FEATURE EXTRACTION FROM A NOISY DISTORTED IMAGE

Er.Jaspreet Kaur
Department of Computer Engineering,
Punjabi University,Patiala,
Punjab,India

Er.Jagroop Kaur
Department of Computer Engineering
Punjabi University,Patiala,
Punjab,India.

Abstract—This paper gave an overview introduction of content based image retrieval Content Based Image Retrieval a technique for retrieving image on the basis of automatically derived features such as color, texture and shape to index images with minimal human intervention. CBIR is an active research field in past decades. Against the traditional system where the images are retrieved based on the keyword search, CBIR system retrieves the images based on the contents. In this paper HSV –based Scaled Color Descriptor (SCD), Edge Histogram Descriptor (EHD) ,Homogeneous Texture Descriptor(HTD) and proposed system is discussed. Using the precision the performance of feature extraction techniques is compared with proposed system.

Keywords-Content based image retrieval (CBIR), feature extraction, Hue Saturation Value (HSV),histogram.

1. INTRODUCTION

Content-based image retrieval (CBIR) is the application of computer vision to the image retrieval problem. It is the process of retrieving the desired query image from a huge number of databases based on the contents of the image It is also known as Query By Image Content (QBIC) and Content-Based Visual Information Retrieval (CBIR).There are three fundamental bases for Content Based Image Retrieval which are visual feature extraction, multidimensional indexing and retrieval system design. The color aspect can be achieved by the techniques like averaging and histograms. The texture aspect can be achieved by using transforms or vector quantization .The shape aspect can be achieved by using gradient operators or morphological operators [2].

The main goal in CBIR system is searching and finding similar images based on their content. accomplish this, the content should first be described in an efficient way, e.g. the so-called indexing or feature extraction and binary signatures are formed and stored as the data. When the query image is given to the system .The system will extract image features for this query. It will compare these features with that of other images in a database. Relevant results will be displayed to the user. Fast and accurate retrievals among the data collections can be done according to the content description of the query image [8]

The CBIR system have used in varies applications such as Crime prevention, The military, Intellectual property, Architectural and engineering design, Fashion and interior design, Journalism and Advertising, Medical

diagnosis, Geographical information and remote sensing systems, Cultural heritage, Education and training, Home entertainment and Web searching[1].

2. FEATURE EXTRACTION IN CBIR SYSTEMS

Feature extraction is a common way to improve the performance of the visual features and improve the efficiency of the CBIR systems. The best subset of features is selected by a heuristic search algorithm to improve the precision of CBIR system. Three types of features are used for image indexing [7].

2.1. Edge Histogram Descriptor (EHD)

Edge features are taken from the Edge Histogram Descriptor (EHD) that is the local edge distribution in the image. To localize edge distribution to a certain area of the image, we divide the image space into 4x4 sub-images. To define different edge types, the sub-image is further divided into small square blocks called image-blocks.

Edge Types :Four directional edges include vertical, horizontal, 45 degree, and 135 degree diagonal edges and non-directional edge.
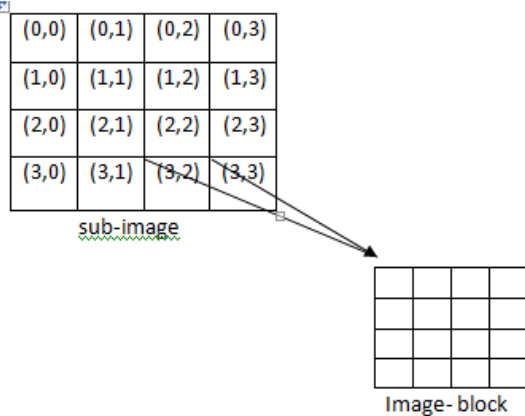

Fig 1. Definition of sub-image and image-block

After the edge extraction from image-blocks, we count the total number of edges for each edge type in each sub-image. Then, since there are 4x4=16 sub-images, we have total 16x5=80 bins for the edge histogram. After generating local edge histograms for all 16 sub-images, we need to normalize each bin in the histogram by dividing it with the total number of image-blocks with an edge in the corresponding sub-image. Among the calculated five directional edge strengths for five edge types, if the maximum of them is greater than a thresholding value , then we accept that the block has the corresponding edge type. To achieve high performance beside the local histogram, we need the global and some semi-global edge histograms. The global edge histogram represents the edge distribution for the whole image space. Since there are five edge types, the global edge histogram also has five bins. For the semi-global edge histograms, we cluster four connected sub-images. There are 13 different clusters and for each cluster we generate edge distributions for five different edge types. Consequently, we have total 80 bins(local) + 5 bins(global) + 65 bins (13x5, semi-global) = 150 bins. Note that the bin values for all global and semi-global histograms can be obtained directly from the local histogram. We also note that the 13 clusters used for the semi-global histogram are supposed to represent the edge distributions in larger areas.

2.2 Homogeneous Texture Descriptor (HTD)

Texture features calculated by Homogeneous Texture Descriptor (HTD). HTD describes directionality, coarseness, and regularity of patterns in images. It is

computed by filtering the image with a bank of Gabor filters, and then computing the mean and standard deviation of the filtered images in the frequency domain. By 30 Gabor filters with six different orientations and five different scales, HTD has 62 components that are 60 components of mean and variance of filtered images in addition to energy and energy deviation [7].

Similarity measure:

$$d(\text{HTD}_1, \text{HTD}_2) = \sum \frac{|\text{HTD}_1(k) - \text{HTD}_2(k)|}{a(k)}$$

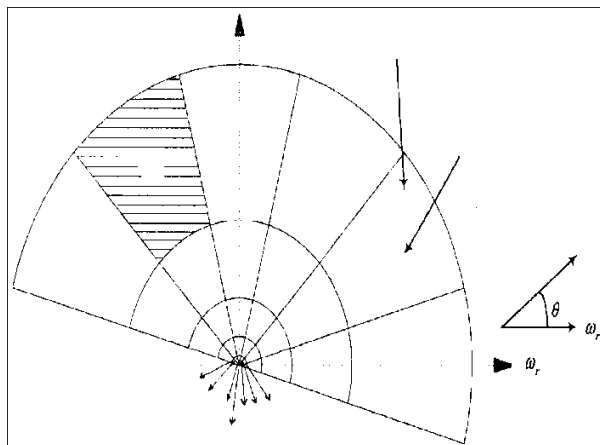where a(k) is normalization constant use kth standard deviation of the HTD of an image collection

Figure 2: Frequency layout for Homogenous Texture Descriptor frequency extraction. Energy and energy deviation values are extracted from this frequency division into 30 channels.

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2.3 Scaled Color Descriptor (SCD)

The color features are taken from 128 bins (8×4×4) HSV-based scaled color descriptor (SCD). SCD measures color distribution over an entire image. It is defined in the HSV color space and produces a color histogram.[7]The HSV stands for the Hue, Saturation and Value, provides the perception representation according with human visual feature. Hue, the color type Range from 0 to 360. Hue is expressed from 0º to 360º. It represents hues of red (starts at 0º), yellow (starts at 60º), green (starts at 120º), cyan (starts at180º), blue (starts at 240º) and magenta (starts at 300º).Eventually all hues can be mixed from three basic hues known as primaries. Saturation, the "vibrancy" of the color: Ranges from 0 to 100%, and occasionally is called the "purity".Value, the brightness of the color. Ranges from 0 to 100%[2].

2.3.1 Color Co-occurrence Matrix (CCM)

A co-occurrence matrix is a matrix that is defined over an image to be the distribution of co-occurring values at a given offset. Value of an image is originally the gray scale value of a specified pixel. The co-occurrence matrix is mainly used to measure the texture of the image and hence it is used for texture analysis.

Color co-occurrence matrix = 9H + 3S + V

Here H, S and V correspond to Hue, saturation and value. The Hue values are from 20 to 316, saturation values are 0 to 1 and values ranges from 0 to 1.The CCM in the same way is found for the database images and the feature difference is found using the Euclidean distance. Euclidean distance measures the similarity between the two different feature vectors [2].
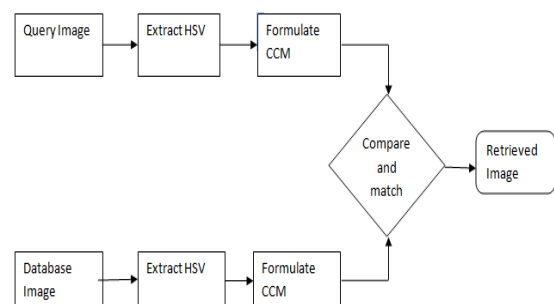
Figure 3.CBIR using HSV model

3. Proposed Methodologies

In the proposed approach the images are retrieved on the basis of their GLCM based features. These features are calculated from the images and then compared to each of image in database and after that the similarity is calculated. On the basis of similarity the result is produced
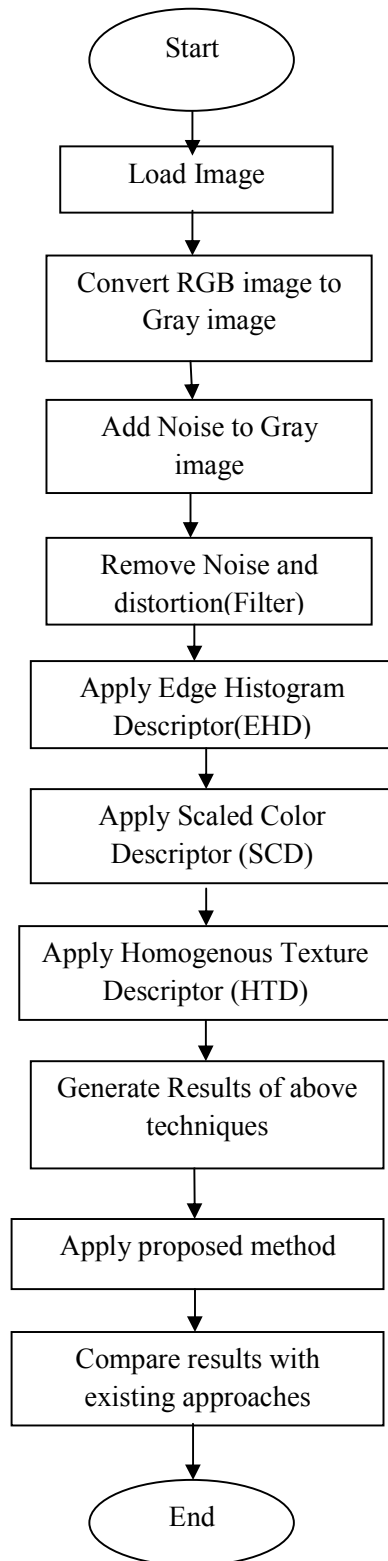
Start

Load Image

Convert RGB image to Gray image

Add Noise to Gray image

Remove Noise and distortion(Filter)

Apply Edge Histogram Descriptor(EHD)

Apply Scaled Color Descriptor (SCD)

Apply Homogenous Texture Descriptor (HTD)

Generate Results of above techniques

Apply proposed method

Compare results with existing approaches

End

Fig 4.Flowchart of system

4. Experimental Results
Parameters

Contrast: It is a measure of intensity or gray-level variations between the reference pixel and its neighbor.

$$\text{Contrast} = \sum_i \sum_j |i-j|^2 p(i,j) \qquad (1)$$

Correlation: It calculates the linear dependency of the gray level values in the co-occurrence matrix or the correlation presenting along a scan line of an image.

$$\text{Correlation} = \sum_i \sum_j \frac{(i-\mu_i)(j-\mu_j)p(i,j)}{\sigma_i \sigma_j} \qquad (2)$$

Energy: is the image homogeneity, and p(i,j) is the (i,j)th element of the normalized GLCM.

$$\text{Energy} = \sum_i \sum_j p(i,j)^2 \qquad (3)$$

Precision: A measure of precision of the CBIR system is used to design fitness function. Precision is the most common criterion used in CBIR for system evaluation. It is defined as the ratio of the number of correct retrieved images to the number of images in the retrieved set.

$$p_r = \frac{No.\ of\ relevant\ image\ retrived}{Total\ no.\ of\ images\ retrieved}$$
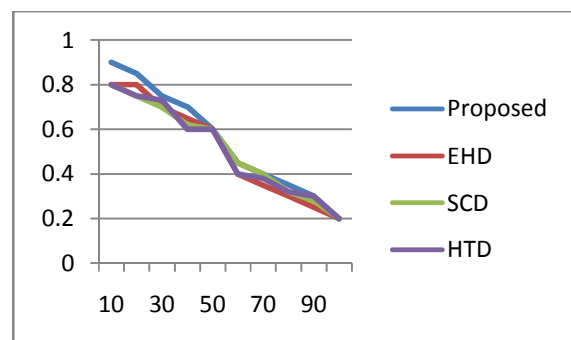
Fig 5. Precision graph of CBIR system using EHD, SCD, HTD and proposed.

5. CONCLUSION

Content-based methods can be used for large variety of images and in a large area of

based Scaled Color Descriptor (SCD), reduces computational time and at same time increases the user interaction.SCD can obtain good performance in case of retrieval accuracy and fast matching of the images since this idea is implemented in Mat Lab, it can be used in many real time applications.

In Edge Histogram Descriptor (EHD) the semi-global and global histograms generated from the local histogram bins help to improve the retrieval performance. Homogenous Texture Descriptor (HTD) is easy to compute because it is directly extracted in the frequency domain. It enables to classify images with high precision.HTD is to be used for similarity retrieval application.

By using these descriptor, the computational cost will decreased and it can be used for obtaining the effectiveness in key frame feature extraction .Experimental results prove that the proposed method is found to have an optimal tradeoff between the effectiveness and efficiency of feature extraction by calculating comparison parameters.

6. Future Scope

CBIR have a wide scope of research in future. In feature extraction mechanism, the number of parameters can be increased. Greater number of parameters will result in more accuracy. CBIR can be collaborated with various techniques like Neural

applications. To improve the overall CBIR system performance the low-level features (color, texture and shape) are used. The content based image retrieval using HSV

Networks, Feature Selection algorithm, Classification technique, CBIR algorithms using color models, etc to extract features with more improved matching performance, more ease and more efficiency.

Futuristic approach can be done to improve the efficiency of the descriptor in terms of scalability and to make the result far more accurate than the proposed method.

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