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Enhancement of Efficient Image Searching by using Advance Hashing Method

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Abstract— Image processing is a technique which takes an image as an input and display the image or features of the image as an output. It involves analysis and manipulation to improve the quality of the image. Image retrieval system is browsing, searching and retrieval of the image based on the given query. The query may be a text or image. It retrieve the image based on the color, shape, texture and some other characteristics of the image. Feature extraction is to describe the features of the image with accuracy. Hashing is a technique to convert the complex data into index data, based on the index data it can find the needed data easily. Multi-view alignment hashing method is used to convert the image into binary code, it is based on kernel non negative matrix factorization[KNMF].Non negative matrix factorization is to study and find the non negative parts of the image data. Kernel is to find the minute parts that may be edges, curves, dots in the images. KNMF neglects the non negative values in the kernel images. In this paper, we retrieve the images using multiple feature extractors to get the related image from the given query image search, the feature extractors used in this project are GIST, HOG(Histogram Of Gradient), LBP(Local Binary Pattern), SURF(Speeded Up Robust Feature) and COLORHIST(Color histogram), it is evaluated in caltech256 dataset and their results show that using multiple feature extraction we can get the efficient image.

Keywords— Efficient image search, multiple feature extraction, GIST, HOG, LBP, SURF, COLORHIST.

I. INTRODUCTION

Image Processing is the process of images which involves mathematical operation. The images or videos are taken as an input and the image or features of the image displays as an output. The images can be treated either a two dimensional or three dimensional signal. Image processing are used to enhance the images or to extract the information from the images. Analog, Digital and Optical image processing are the types involved in image processing. Analog image processing is done by using analog signals. Based on the variation of electrical signal the images are manipulated. The best example for analog image processing is television image. In analog image processing the data is represented by analog waves. The processing of analog images is very simple. It have a capacity to store infinite amount of signals.

Digital image processing was introduced in 1960. Digital images are taken by using camera. In digital image processing, the image is converted into digital form (i.e) binary format 0 or 1 for processing the images. It allows a diverse number of algorithms including complex algorithms for processing the images. During the processing of images, it neglect the problem such as data noise and misleading of signals. The major tasks in image processing such as classification, feature extraction, pattern recognition, multi-scale signal analysis and projection can be done by digital image processing. Digital images are used in our day to day life. for example images are taken by a mobile. Optical image processing is done by using optical systems. The optical image in light sensitive media are captured by using camera with optical systems such as telescope and microscope.

The various techniques in image processing are image representation, image pre processing, image enhancement, image restoration, image analysis, image reconstruction, image data compression, image retrieval. Image representation is the display of images which includes bitmap representation and how the images are stored. The images can be stored in any image format such as gif, jpeg, png, bmp etc. The images are segmented into regions, as a result the combining segmented pixels are represented. Representation of the images classify *into* two, external and internal features. External feature representation is to represent the boundary features of the image such as shape of the object. Internal feature representation is to represent the interior features of the image such as color and texture. User can choose the representation based on their needs.

Image Preprocessing is the improvement of images. It reduces the distortion of images. Image Preprocessing is based on the size of the neighbor pixel. Based on the neighbor pixel value, it can calculate the brightness of the new pixel, it is very crucial that the new pixel brightness must have same or similar brightness to the neighbor pixel. Image Analysis is to extract the statistical data from the image. It involves finding shapes, removing noise, counting objects, detecting edges, measure region and the properties of image. Image Enhancement is the sub category of image analysis. It includes sharpen the image, noise removal and brighten the image. Image Restoration is the process of getting the clear image by correcting the noisy data. Image restoration is differ from image enhancement. The corrupted image may be a blur, noise and non focused image.

The image processing is used in various applications such as medical field, robot vision, remote sensing, forensic studies, material science, film industry, graphics arts, textiles etc. computer graphics and computer vision are closely related to image processing. computer graphics is the graphical representation of data. The graphical images and videos can be created with the help of graphical hardware and software. the best example for computer graphics is video games. computer vision is considered as high level image processing. Sensors are attached to the physical body, it observes and register the activity of the physical body.

Image retrieval is the concept of browse, search and retrieve the images from large datasets. The first image database retrieval system was introduced at 1990. Retrieval of images is based on the color, texture, shape and semantic image. Image retrieval is to retrieve the similar or related images from the large image database. Image retrieval system is classified into text based image retrieval and content based image retrieval**.** Text based image retrieval is to retrieve the images based on the given keyword as text. It is not efficient to achieve the efficiency of the images. Content based image retrieval was originated in 1992.It retrieve the images based on the content of the image such as color, shape, texture etc. It search the image/ data based on the meta data of the image. It is used to solve the problem related to retrieve the images from large dataset. Content based image retrieval is the developing field in image retrieval system because it doesn't have any limitations on metadata.

Image Search is to find the images. Images are to be searched based on the given query. The query may be a text or an image. The result for image search may be a similar or related images.

Images are processed as two dimensional or three dimensional signal. In image processing, the digital, analog and optical image processing are possible. The various techniques in image processing are image retrieval, image representation, image preprocessing, image enhancement, image restoration, image analysis, image reconstruction, image data compression. Image retrieval is a computer system for browsing, searching and retrieving of the image. Image matching algorithm can be categorized into two, gray based and feature based matching. Gray based matching is sensitive to data noise. in feature based matching, image feature extraction plays a vital role. Achieve accuracy in image retrieval while using image feature extraction[1,2]. Image search is a specialized data search used to find images. Visual similarity search stands for image search based on one (or several) of the following criteria are color, theme, texture. The basic method for similarity search is nearest neighbor search(linear search) which is not suitable for large dataset. To overcome this issue tree based search is used to index the data for fast query responses. However it is also not efficient for high dimensional data because the image consists of hundreds and thousands of dimensions. Hashing search provides very fast access to records on certain search conditions. The types of hashing methods are Locality Sensitive Hashing, Spectral hashing, principled linear projection hashing, anchor graphs hashing. The above methods are focus on only the single view hashing. The drawback of the above method leads to multi-view hashing[3]. The types of multi-view hashing are Multi-view anchor graph hashing, sequential update for multi-view spectral hashing, composite hashing with multiple information sources and deep multi-view hashing. The above methods are sensitive to data noise. This retrieval based on the given high dimensional feature. However a single feature is not efficient for image search. The drawback for the above method leads to multi-view alignment hashing. By using this we can get multiple representation or multiple view of data for enhance the relative image search. Multi-view alignment hashing method is based on Kernel Non negative Matrix Factorization (KNMF). Non negative matrix factorization technique for finding parts based, linear representation of non negative data[4]. NMF is to learn the non negative parts of the object, match the multiple information sources and discard the duplication of data. Kernel Non negative Matrix Factorization is a special case of convex-NMF[5].

II. METHODOLOGY

The feature extractors used in this paper are GIST, HOG, LBP, SURF and COLORHISTOGRAM.

A. GIST

GIST is a feature descriptor that can be used for object recognition. The image is divided into 4*4 blocks for orientation of histogram are extracted. The image size are rescaled into 32*32 pixels, to represent the detail of an image. GIST feature descriptor is sufficient for low dimensional images.

The gist is a global descriptor, which is used to develop a low dimensional representation. Image segmentation is not needed for the low dimensional representation. It consists of a set of perceptual dimensions that represents the dominant structure of the image. GIST descriptor is similar to SIFT descriptor. GIST descriptor is used to retrieve the images from large database. It take the dominant points from the query image and compute the histogram .

Compare the histogram of dominant points with the image database. The results are refined and produce a three dimensional structure. Generally the images are gathered and stored in a database for processing the images such as finding the similar images from database related to the query.

Step 1: The image is divided into 4*4 blocks for orientation of histogram are extracted.

Step 2: The image size are rescaled into 32*32 pixels, to represent the detail of an image.

Step 3: Compute the histogram to each blocks of the image.

Step 4: Take the cumulative value to find the mean value of the histogram.

Step 5: Compare the obtained value of the query image with the values find in the database images.

Step 6: Retrieve the images, which is closely related to the query images first and other images are displayed based on the ranking order.

GIST feature descriptor is sufficient for low dimensional images. Similarity image search can be achieved through GIST.

B. HOG

The histogram of oriented gradients (HOG) is a feature descriptor for the purpose of object detection. In HOG, the first step is to detect the interest points then compute the histogram around 16*16 pixel block of each interest points[6]. The block is divided into 4*4 sub blocks. For each sub blocks, it consists of 8 bins. It forms 128 (4*4*8) dimension feature. Finally, combine all the histogram of interest points together to form 128 dimension.

It was first described in 2005. The main objective of HOG is to find the object appearance and shape within the image based on the direction of the edges or gradient of the image. In HOG, the first step is to detect the interest points then compute the histogram around 16*16 pixel block of each interest points. The block is divided into 4*4 sub blocks. For each sub blocks, it consists of 8 bins. It forms 128 (4*4*8) dimension feature. Finally, combine all the histogram of interest points together to form 128 dimension.

The algorithm of HOG are as follows

Step 1: The image is divided into blocks.

Step 2: For each blocks, the gradient value is computed.

Step 3: Each block of histogram in the image is normalized. It can be normalized by computing the intensity values in the block.

Step 4: Combine the histogram gradient value of all blocks.

Step 5: The normalized histogram value is compared with the histogram of images from large database.

In theoretically, the HOG algorithm implementation involves gradient computation, orientation binning, descriptor blocks and block normalization. Normalized color and gamma values are the first step for any image pre-processing but in HOG these steps are omitted. The first step in HOG is to calculate the gradient value. This approach takes the intensity of images. Orientation binning is to create the histogram for each block. The block can either be radial or rectangular in shape. Depending on the gradient which are signed or unsigned, the histogram can spread from 0 to 360 degrees. Descriptor blocks used to concatenate the normalized block of histogram into large ones. There are two main blocks in hog descriptor that are R-HOG and C-HOG. R-HOG is the rectangular blocks of the image, it is a square grid which are represented by three arguments. It is similar to the SIFT(scale invariant feature transform) descriptor. These blocks are computed without knowledge of the orientation of image. C-HOG is the circular blocks in the image. It also consists of four arguments to compute the circular histogram. Block normalization, it normalize all the histogram present in each and every blocks. Support vector machine is a binary classifier used to make a decision about the presence of objects in the image. SVM combines with HOG, can achieve the accuracy of the similarity images. The normalized value of histogram in query image is compared with the histogram value of database image, it retrieve the images based on the histogram values, similar values are retrieved first and other images are ranked and displayed in ascending order.

C. LBP

Local Binary Pattern(LBP) is a type of visual descriptor used for classification. LBP was introduced by ojala[7]. It transforms an image into array. The LBP uses eight pixels in 3*3 pixel block. Each block of the image is converted into binary format. The center pixel is compared to each of its eight neighbors pixel value, if the neighbor value is greater than the center value then it take it as 0, if the neighbor value is lesser than the center value then it take it as 1. It read the values in row by row manner to get the eight bit binary value(2^8=256). The dimension of the histogram is 256 bins, each corresponding to the binary code contain eight bits. It was described by ojala in 1994. It is a powerful feature descriptor for classify the images. It is also called as uniform pattern. In LBP histogram, uniform patterns are grouped in one single bins and the non uniform patterns are grouped in another single bins for computation. Generally, the binary value consists of either 0 or 1. LBP is processed by using support vector machine to simplify the computation of histogram.

The algorithm of LBP are as follows

Step 1: Divide the whole image into blocks.

Step 2: Each block consists of a number of pixel. Each pixel is compared to each of its neighbor pixels in a clockwise or anticlockwise direction.

Step 3: if (taken pixel > neighbor pixel) then

value = 0

else

value = 1

Step 4: Compute the histogram of a block by combining every pixel values in a binary format.

Step 5: It can be obtained as a 256 dimensional.

Step 6: Normalize the histogram.

Step 7: Concatenate the normalized histogram of all blocks.

LBP is a best method for texture analysis. It transforms an image into array or labels for describe the features of the image. LBP operator divides the image into blocks. Each block consists of a number of pixels. Each and every pixel in a block is compared with the neighbor pixels. The neighbor pixels of the taken pixel are right, left, top, bottom, top left, top right, bottom left, bottom right. If the taken pixel value is greater than the neighbor value then take it as 0. If the taken pixel value is lesser than the neighbor value then take it as 1. It gives a 8 digit binary value for every pixel. Based on the pixel values in binary format, compute a histogram for every block. 256 dimensions are obtained from the image. Normalize the histogram of each block and then concatenate the normalized histogram of all blocks. It retrieve the images based on the difference in the cumulative of normalized histogram value. The related images are retrieved in a ranking basis.

D. SURF

Surf is a feature detector and descriptor that can be used for object recognition or classification or reconstruction. SIFT algorithm was proposed by Lowe, which has average optimal performance[8] but the computation is very complex and also very time consuming. To overcome the disadvantage of SIFT, SURF was proposed on the basis of SIFT by Bay et al[9]. In SURF the overall process can be describe in three main steps such as detection, description and matching. Detection identifies the interesting points automatically[10].Description of the interesting points. Each and every interesting points must have a unique description, it doesn't depend on scale and rotation. Matching the images. from the given query image it determine what kind of object and transformation of the object based on the interest points.

SURF is an acronym of Speeded Up Robust Feature. SIFT is a feature descriptor for describe and detect the object in images. The computation of the SIFT is very slow. To overcome the problem of SIFT, SURF was introduced in 2006. SURF is used to locate and recognize the objects in the image.

The algorithm of SURF are as follows

Step 1: Image is transform into co-ordinates.

Step 2: Find the interest points in the image.

Step 3: The scale representation and the location of interest points.

Step 4: Orientation of the point of interest and the sum of wavelet response.

Step 5: Matching the images based on the descriptive value of the query image.

Surf is a feature detector and descriptor that can be used for object recognition or classification or reconstruction. SIFT algorithm was proposed by Lowe, which has average optimal performance but the computation is very complex and also very time consuming. To overcome the disadvantage of SIFT, SURF was proposed on the basis of SIFT by Bay et al. In SURF the overall process can be describe in three main steps such as detection, description and matching. Detection identifies the interesting points automatically. Description of the interesting points. Each and every interesting points must have a unique description, it doesn't depend on scale and rotation.

Matching the images, from the given query image it determine what kind of object and transformation of the object based on the interest points. . The first step of algorithm starts with finding the interest points in the image. The interest points are selected randomly. Blob detector is used to find the interest points of the image. It is based on hessian matrix. The changes over the interesting points can be calculated by the determinant of hessian matrix . The strongest points are extracted from the interest points. It takes the value of the strongest interest points pixel value for matching. The images are retrieved based on the strongest point of interest.

E. COLORHIST

Color Histogram is a feature method for retrieve the images based on the colors in the image. It shows the brightness distribution of each color individually. The images are computed based on the color histogram of the image. In database the color histogram of each images are stored. It retrieve the images based on the color histogram that is matched similar to the query image. It takes the cumulative value of histogram. It is classify into RGB and HSV color model. The RGB color model is based on Red, Green and Blue colors present in the image. RGB is the basic colors, other colors can be created by the combination of red, green and blue colors. It takes the histogram of images based on the red, green and blue content in the images. HSV color model represents the intensity of color information in the image. HSV is the acronym of Hue, Saturation and Value. The algorithms are created based on the Hue and Saturation, it represents the colors that can be realized or viewed by the human eye. Color conversion is used to get the good quality of results. The Euclidean difference is use to find the approximate difference in the colors. The color histogram are created based on the number of color pixels found in the image.

The algorithm of color histogram are as follows

step 1: select the color in the image.

step 2: mapping the color into small set.

step 3: calculate the color histogram

step 4: find the histogram distance.

step 5:create shortcuts like an index for identification.

The above steps are important to develop a color histogram algorithm. The color histogram have high dimensions. It make sure that high dimension data consists of feature reduction, pre-filtering and indexing are implemented. Because of high dimension, it is very complex and increase the calculation of distance. The histogram of image refers to the image intensity in probability density function. To find the intensity of three colors are joined is the color histogram.

It can be defined as

$$h_{X, Y, Z}(x, y, z) - N.Prob (X=x, Y=y, Z=z)$$

Where

X, Y and Z are the color that may be a RGB or HSV.

N is the number of pixels in the image.

h represents the histogram.

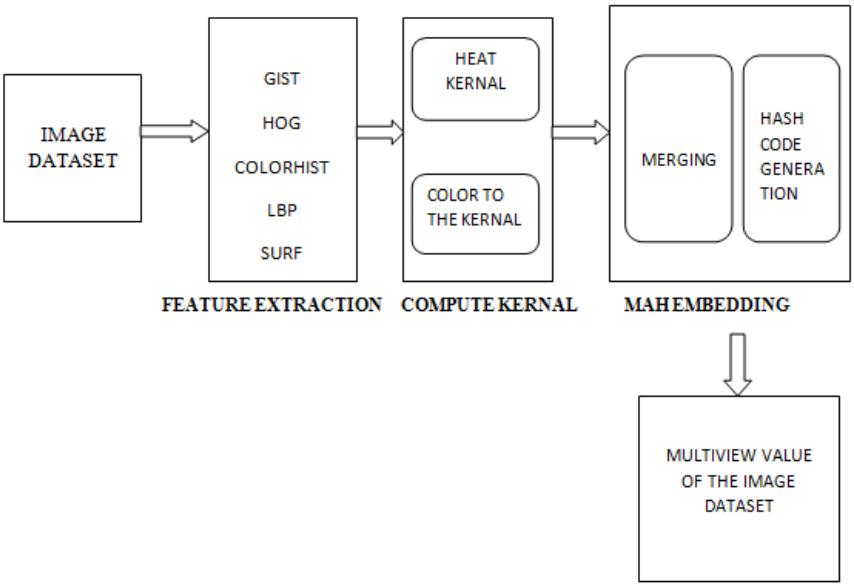
Prob represents the probability function.

The computer accepts the colors up to 225 colors. The major issue in color histogram is to index and calculate the given color. If uniform color is chosen then the calculation is same for the whole image. If non uniform color is chosen then calculation differs for each color in the image. It is very difficult to achieve the non uniform colors in the

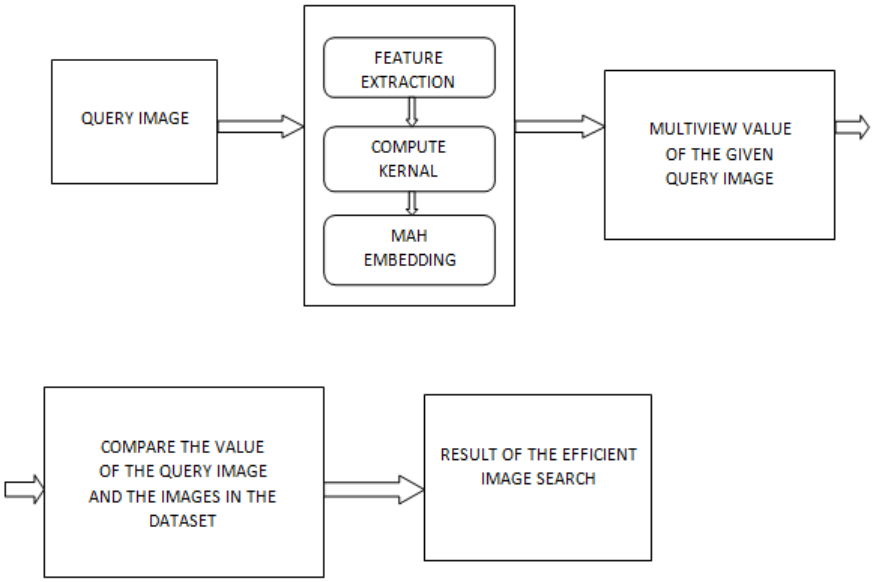
image. The color histogram is composed of four dimensional vectors, that makes difficult to visualize the color histogram. There are different functions to calculate the similarity of color histogram. Including Euclidean distance, two more formulas are used to find the histogram.

The retrieval of images in color histogram is based on the calculated distance of the query image. The distance value which is same or similar to the query image is ranked first, other closely related values are ranked and displayed in ascending order.

TRAINING PHASE



TESTING PHASE



III. PROPOSED SYSTEM

It consists of training phase and testing phase.

In training phase:

Step1: Take the image in caltech256 dataset and apply feature extraction such as GIST,HOG,LBP,SURF and COLORHIST uniquely.

Step2: Then heat the kernel of the image and also give color to the image kernel.

Step3: Fuse all the feature extraction into single one.

Step4: Apply multi-view alignment hashing based on non negative matrix factorization to the image for generate the hash code.

Step5: Find the hamming distance of the image using probability density function.

Step6: The above steps are repeated to every images in the caltech256 image dataset.

In testing phase:

Step1: Take the query image which has to be search and apply the feature extraction algorithms such as GIST, HOG, LBP, SURF and COLORHIST uniquely.

Step2: Then heat the kernel of the image and also give color to the image kernel.

Step3: Fuse all the feature extraction into single one.

Step4: Apply multi-view alignment hashing based on non negative matrix factorization to the image for generate the hash code.

Step5: Find the hamming distance of the image using probability density function.

Step6: Compare the hamming distance with the query image and the dataset image.

Step7: Display the image related to the query image based on the hamming distance (exact same hamming distance value images are display first and the nearest value images are displayed one by one).

IV. EXPERIMENTS AND RESULTS

Caltech256 image dataset is used in our experiment. It consists of 256 object categories containing 30607 images. We implement each feature separately with the images and then kernel the image. Give color to the kernel image. The kernels are combined together by arithmetic mean. The images are ranked according to the hamming distance with the query image.

Fusion of multiple feature with multi-view alignment hashing method provides a good results for similar or related, efficient image search in image database. The implementation of each and every feature, execution time is calculated. Compare each feature execution with the other. The single feature based image retrieval doesn't provide the good results, the data accuracy is very less. The multiple feature extraction, fusion of GIST, HOG, LBP, SURF and COLORHIST gives good results and can achieve data accuracy in image retrieval system. The following are the results that are obtained by using the proposed method.

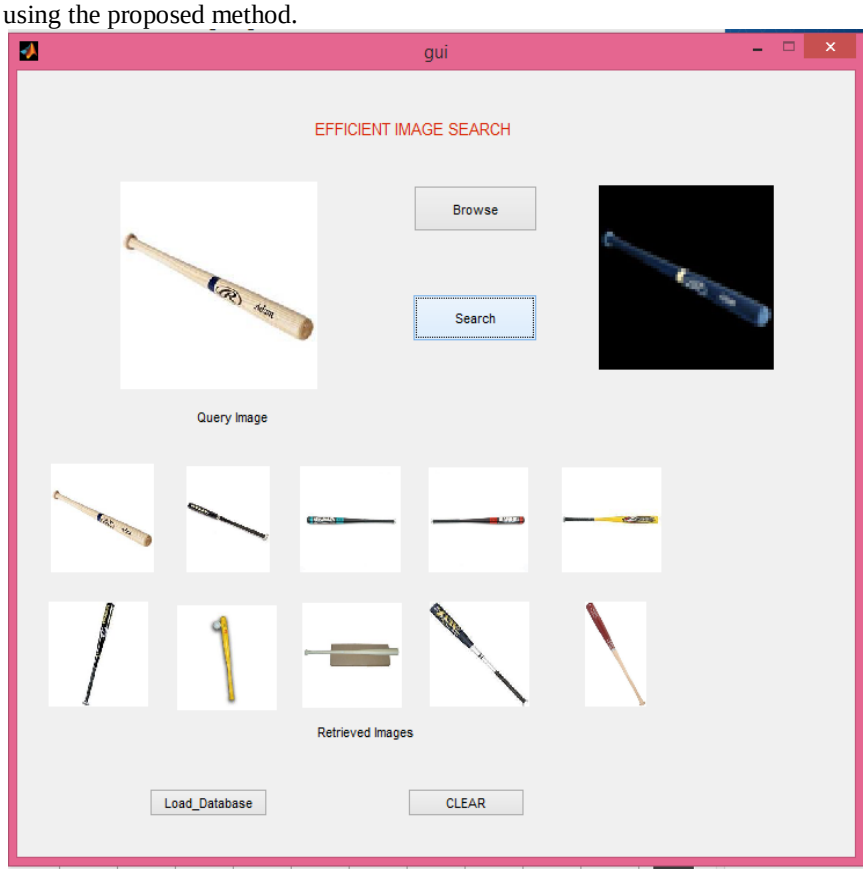


Fig.1Implementation of all the features

Fig 1. is the result of the image by combining all the GIST, HOG, LBP, SURF and COLORHIST features. The images are ranked based on the hamming distance.

V. CONCLUSIONS

The single feature extraction is used to retrieve the images from large image database. It doesn't provide data accuracy in image retrieval. The computation of the single feature extraction takes lees time but good results can't be achieved. Instead of using single feature extraction, multiple features such as GIST, HOG, LBP, SURF and COLORHIST are used to retrieve the similar image. Each feature extraction have its own unique characteristics to get the information from the image used for retrieval. It examine the images in a efficient way to get the accuracy in results by using various methods. It provides a good results for related or similar efficient image search in image database. Multiple feature extraction achieves the data accuracy in image retrieval system.

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