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Image Retrieval Based on Feature Extracted Interactive Genetic Algorithm

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Abstract:
Digital image processing is one of the emerging technologies in present economically and technologically developing world. Generally image processing includes importing the image with optical scanner or by digital photography, then analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs and finally output is the last stage in which result can be altered image or report that is based on image analysis. The principle advantage of Digital Image Processing methods is its versatility, repeatability and the preservation of original data precision. Content-based image retrieval (CBIR) is the application of computer vision to the image retrieval. CBIR aims at avoiding the use of textual descriptions and instead retrieves images based on similarities in their contents to a user-supplied query image or user-specified image features. Generally, research activities in CBIR have progressed in three major directions: global features based, object/region-level features based, and relevance feedback. From the advantages of genetic algorithm, by overcoming its limitations like more number of iterations, we developed an algorithm interactive genetic algorithm (IGA). Though different types of such algorithms are present, we considered more number of feature extractions to increase the accuracy with speed.

Keywords:

CBIR,IGA, global features, object level features, relevance feedback.

I. Introduction:

Image processing is the method of converting an image into digital domain in order to perform operations like enhancement, compression, segmentation, etc on it. A digital image is numerical representation of an object. The elements of image processing system are acquisition, storage, processing and displaying image. An analog image can be mathematically represented as a continuous range of values representing position and intensity. A digital image is composed of picture elements called pixels; they are the smallest sample of an image. To obtain digital image an analog image is sampled and then quantized. The digital images have many advantages; the processing of images is faster, immediate analysis of picture quality, easy storage, provides wide scope for image manipulation etc.

Even it drawbacks like, more memory is required for the storage of high quality images, and processing time will be more for them. The image processing by means of computer or digital devices is generally termed as digital image processing. As the processing is done in computer it is more flexible and adaptive, including with that the image storage and transmission can be easier. Coming to the classification of images; the image which takes only two values '0' or '1' is said to be binary image; the image that consists of brightness information i.e., each pixel value in gray scale image corresponds to an amount or quantity of light, it is said to be gray scale image; the pixel of image with three values which measure intensity and chrominance of light and it is said to be color image. Generally image processing includes importing the

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image with optical scanner or by digital photography, then analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs and finally output is the last stage in which result can be altered image or report that is based on image analysis. The principle advantage of Digital Image Processing methods is its versatility, repeatability and the preservation of original data precision.

Histogram has a lot of importance in image enhancement. It reflects the characteristics of image. By modifying the histogram, image characteristics can be modified. One such example is Histogram Equalization. Histogram equalization is a nonlinear stretch that redistributes pixel values so that same number of pixels with each value within a range is approximated. Quantitative measurements of object features allow classification and description of the image.

The purpose of image processing is divided into 5 groups. They are:

1. Visualization - Observe the objects that are not visible.
2. Image sharpening and restoration - To create a better image.
3. Image retrieval - Seek for the image of interest.
4. Measurement of pattern – Measures various objects in an image.
5. Image Recognition – Distinguish the objects in an image.

II. Image Retrieval Systems:

An image retrieval system is a computer system for browsing, searching and retrieving images from a large database of digital images. Most traditional and common methods of image retrieval utilize some method of adding metadata such as captioning, keywords, or descriptions to the images so that retrieval can be performed over the annotation words. Manual image annotation is time-consuming, laborious and expensive; to address this, there has been a large amount of research done on automatic image annotation. Additionally, the increase in social web applications and the semantic web have inspired the development of several web-based image annotation tools. Image search is a specialized data search used to find images. To search for images, a user may provide query terms such as keyword, image file/link, or click on some image, and the system will return images "similar" to the query. The similarity used for search criteria could be meta tags, color distribution in images, region/shape attributes, etc. Search techniques include the following.

II.I Image Meta Search:

Image Meta search (or image search engine) is a type of search engine specialized on finding pictures, images, animations etc. Like the text search, image search is an information retrieval system designed to help to find information on the Internet and it allows the user to look for images etc. using keywords or search phrases and to receive a set of thumbnail images, sorted by relevancy. Image Meta search is also called text based image retrieval (TBIR)[1].

Text-based concept is by means of image annotation information given for the images, or the keyword actions used by the users for searching such images are the techniques used for image retrieval process, the major disadvantages of such systems are the complicated preprocessing, must invest a large amount of human resources, annotation are stored in the database of images.

If the user queries submitted uncertain key will decrease retrieval precision rate. In text based image retrieval (TBIR) method, two users want to retrieve the same image, but each of them do not submit the same key, which may be difficult by TBIR, to determine, resulting to provide inaccurate results of retrieval. In addition, the database image preprocessing is complex problem, you must spend large amount of human resources and time for all the images in the database for classification and annotation.

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II.II Content-based image retrieval (CBIR):

Content-based image retrieval (CBIR)[1] is the application of computer vision to the image retrieval. CBIR aims at avoiding the use of textual descriptions and instead retrieves images based on similarities in their contents (textures, colors, shapes etc.) to a user-supplied query image or user-specified image features. List of CBIR Engines - list of engines which search for images based image visual content such as color, texture, shape/object, etc. Further information: Visual search engine and Reverse image search; Image collection exploration - search of images based on the use of novel exploration paradigms. Generally, research activities in CBIR[2] have progressed in three major directions: global features based, object/region-level features based, and relevance feedback.

Initially, developed systems are usually based on the carefully selected global image features, such as color, texture or shapes, and prefixed similarity measure. It perform well for images that are either simple or contain few semantic contents. The second group of systems is proposed on image segmentation. The performance of those systems mainly relies on the results of segmentation. The third group of system is proposed on relevance feedback. It has more number of iterations and more complex. The main contribution of this paper is based on global features because of less complexity. The methods involved for detection of global features are low level features, search technique.

III. Low level features:

Low-level image features— color features from the Hue, Saturation, and Value (put all together known as HSV) color space and as well as texture, and edge descriptors are adopted in this approach. He is one of the main properties (called color appearance parameters) of a color, defined technically as the degree to which a stimulus can be described as similar to or different from stimuli that are described as red, green, blue, and yellow (the unique hues). Orange and violet (purple) are the other hues, for a total of six, as in the rainbow: red, orange, yellow, green, blue, violet. The other color appearance parameters are colorfulness, chroma, saturation, lightness, and brightness. Saturation gives a measure of the percentage of white light added to a pure color. Saturation is an expression for the relative bandwidth of the visible output from a light source. Image saturation is a concept used to describe the purity or intensity of color in an image, such that an image with very little saturation approaches a black and white image. Pink, then, is said to be less saturated than red because in a pure red color, the red completely dominates other color components, and hues of grey are said to be de-saturated because all the color components contribute equally to the hue. Value refers to the perceived light intensity. Intensity refers to the amount of light or the numerical value of a pixel. For example, in gray scale images, it's depicted by the grey level value at each pixel (e.g., 127 is darker than 220).

A color image can be represented using three primaries of a color space. Since the RGB space does not correspond to the human way of perceiving the colors and does not separate the luminance component from the chrominance ones, we used the HSV color space in our approach. The mean of pixel colors states the principal color of the image. mean value gives the contribution of individual pixel intensity for the entire image & variance is normally used to find how each pixel varies from the neighboring pixel (or centre pixel) and is used in classify into different regions. In order to know the statistical behavior of an image we must get the 'Mean' and 'Variance' information.

As we know the Gaussian distribution of any random variable indicates the maximum probability (aprrox. 94%) of an any value to lie within the range - (mean+2*standard deviation (sqrt(Variance)) to +(mean+(2*standard deviation)) . Hence we can analysis the probability of maximum like-hood of a pixel or using this idea you can divide image pixel region. However apart from that the Mean and variance of a signal/image mayn't provide much information about the image. Two images with total different structural similarity may have same mean and

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variance. Apart from that it totally depends upon the application usually mean is used in applications such as noise removal or low pass filtering (smoothing) while variance can be used in identifying sharp details such as edges. Wavelet network is used as an alternative for image feature extraction. Wavelet Networks attempt to combine the properties of the wavelet decomposition, along with the characteristics of neural networks. Wavelet Networks are employed in a wide range of applications in engineering, computer science or biology. These may range from classification, to feature extraction or approximation of complex nonlinear functions. The aim of this work is to propose an approach to extract a set of image features, based on wavelet and other six features, which is the main contribution of this work.

III.I Wavelet Transform:

Wavelet transform (WT) has been introduced just recently in mathematics, even through the essential ideas that lead to this development have been around for many years. It is a linear transformation, which is more similar to the Fourier transform; however it allows time localization for the various frequency components of a given signal. In the case of the wavelet transform[3], the analyzing functions are called as wavelets. Wavelets are mathematical functions that divide data into different frequency components, and later analyses each component with a resolution matched to its scale.In numerical analysis and functional analysis a discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled.

As with other wavelet transforms, a key advantage it has over Fourier transforms is temporal resolution: it captures both frequency and location information (location in time). The image is subjected to discrete wavelet transformation (DWT) to obtain approximation co-efficient (app), horizontal detail co-efficient (hor), vertical detail co-efficient (ver) and diagonal (both horizontal and vertical) detail co-efficient(dia) The variance of the approximation co-efficient 'app' is computed and considered as 5th feature. Similarly the variance of the detail co-efficient, horizontal detail co-efficient (hor) is considered as the sixth feature.Similarly the variance of the detail co-efficient, vertical detail co-efficient (ver) is considered as the 7th feature.And the variance of the detail co-efficient, diagonal detail co-efficient 'dia' is considered as the 8th feature.

III.II Hueristic Variance:

As discussed earlier hue is one of the main properties of a color, defined technically as the degree to which a stimulus can be described as similar to or different from stimuli that are described as red, green, blue, and yellow. It gives the second moment about its central moment (mean). Variance of the histogram of the hue content of the particular image is computed by:

$$\mu_2(z) = \sum_{i=1}^{L-1} (z_i - m)^2 \, p(z_i)$$

III.III Measurement of uniformity:

$p(z_i)$ is the probability of gray value z_i in the particular sub block of the image. Mathematically it gives the mean square value. Here, it gives mean square values of histogram of the image. The uniformity ofimage is measured by:

$$U = \sum_{i=1}^{n} p^2(z_i)$$

III.IVMeasurement of Average Entropy:

Generally entropy is used to calculate average amount of information. In order to calculate the average amount of information present in every image, it is applied to the histogram of the image. Average entropy is given by

$$e = -\sum_{i=0}^{L-1} p(z_i) \log_2 p(z_i)$$

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III.V Measurement of Relative smoothness:

Relative smoothness is calculated from the variance measurement, which extract the features of the edges of the image. It gives the variation of the pixel with its adjacent pixels. Relative smoothness is given by:

$$R = 1 - \frac{1}{1 + \sigma^2(z)}$$

Where, σ (z) is the standard deviation of the gray values z in the particular sub block of the image.

III.VI Skew:

The Skew of the gray scale values is computed for every sub block of the image. It gives the third moment about its central moment (mean) and it is given by:

$$\mu_3(z) = \sum_{i=1}^{L-1} (z_i - m)^3 \, p(z_i)$$

III.VII Kurtosis:

The Kurtosis of the gray values is computed for every sub block of the image.It gives the fourth moment about its central moment (mean) and it is given by:

$$\mu_4(z) = \sum_{i=1}^{L-1} (z_i - m)^4 \, p(z_i)$$

IV. PROPOSED INTERACTIVE GENETIC ALGORITHM:

Consider the Image database of different images. Resize every image to the standard size 256x256. The features of the images are computed as calculated.The first feature namely variance of the histogram of the hue content of the image. This is treated as first part of the feature vector corresponding to the image. Similarly other features are also computed. The flow chart is shown in figure 1 and the complete process of execution is shown in figure 2. The algorithm of execution is given below.

Algorithm:

1. Consider an image database with images of different image formats (like .jpg, .png, .tif, .bmp, etc.).
2. Extract the features of every individual image in the image database which mainly includes heuristic variance, image uniformness, average entropy, relative smoothness, skewness, kurtosis, wavelet transform.
3. All the extracted features of images in database are saved in feature database separately.
4. Consider any input query image and extract the same features mentioned.
5. By the method of basic processing in genetic algorithm i.e., the process of selection, crossover and mutation is done bycomparing the input image features with every individual image feature in feature database.
6. Then finally retrieve the required number of images with similar features.

V. Simulation results

The simulation is done in MATLAB; image processing tool box has been used for the functions to execute. As shown in flow chart and algorithm, the simulation results are obtained. Figure 3 shows the image database that has been considered and which can be further expanded too. The image of rose is given as input query image and the result of images retrieved is shown in figure 4.

In table 1, the total number of images in database and their types are given along with their amount of retrieval when that particular image is given as input and its percentage of retrieval is also shown. Then in figure 5 the comparison chart of image retrieval per input image is shown. It is compared with total number of images in database to amount of images retrieved. Finally in figure 6 the percentage comparison of image retrieval is shown in comparison graph.

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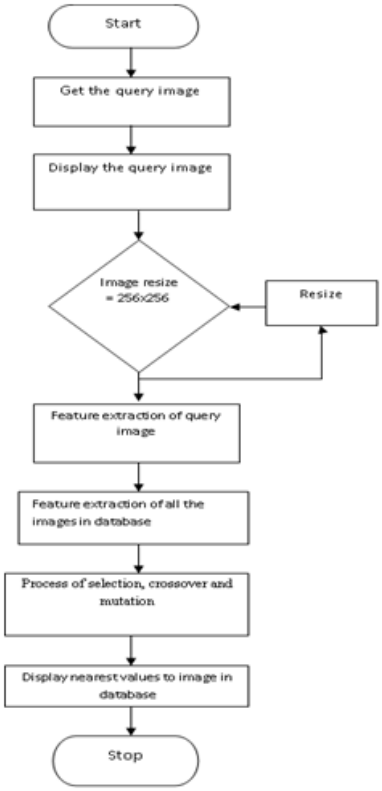

Figure 1: Flow chart of IGA

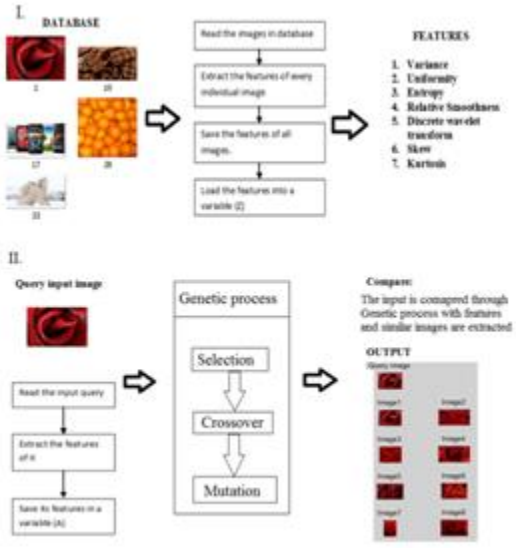

Figure 2: Complete process of execution

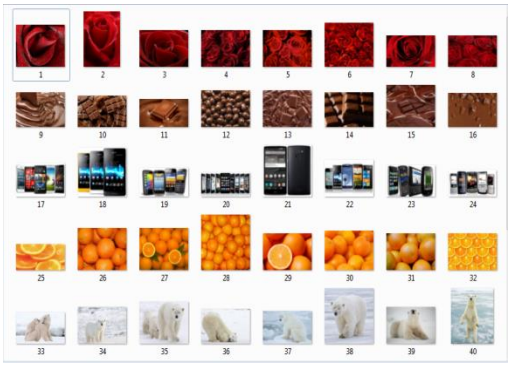

Figure 3: Image Database

Table 1: Table of image retrieval

Sl. No.	Image type	No. of images in database	No. of images retrieved	% of retrieval
1	Roses	8	8	100%
2	Chocolates	8	8	100%
3	Mobiles	8	6	75%
4	Oranges	8	6	75%
5	Polar Bears	8	5	62.5%
Total no. of images		40	Average retrieval	82.5%

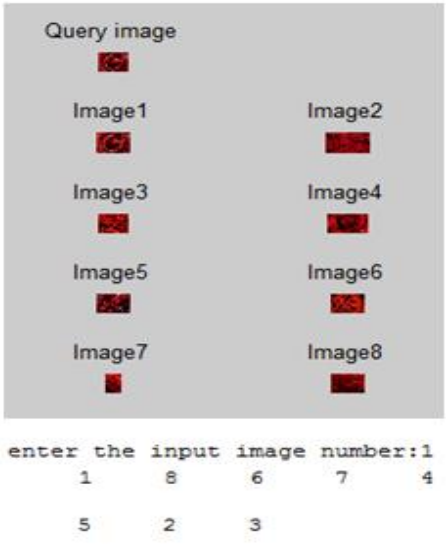

Figure 4: Image retrieval

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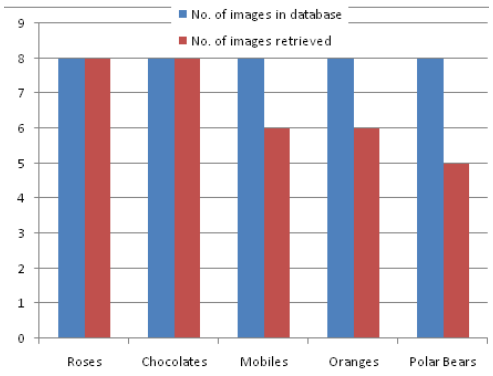

Figure 5: Comparison of number of images retrieved

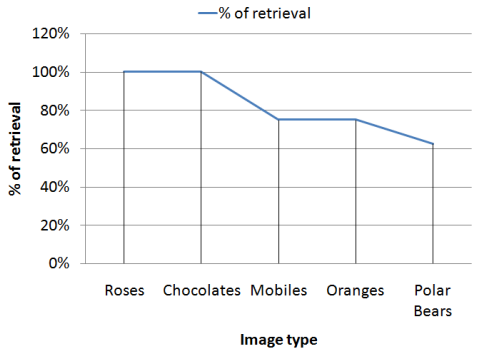

Figure 6: Comparison of retrieval percentage

VI. CONCLUSION:

As the image retrieval has wide number applications like in medical images, satellite images, internet browsing, finger printing, etc, its accuracy has become the crucial factor. So, in this paper the content based image retrieval using feature extracted interactive genetic algorithm has been very successful in retrieving the images with high accuracy as image features that are extracted plays a major role in image retrieval with genetic algorithm. So, hereby we would like to conclude that this image retrieval can be used in all cases of image retrieval systems where the future retrieval systems will have high accuracy.

REFERENCES:

[1]M. VenkatDass, Mohammed Rahmath Ali, Mohammed Mahmood Ali "Image Retrieval Using Interactive Genetic Algorithm" 2014 International Conference on Computational Science and Computational Intelligence IEEE 2014.

[2]Chih-Chin Lai, and Ying-Chuan Chen, "A User-Oriented Image Retrieval System Based on interactive Genetic Algorithm," IEEE transactions on instrumentation and measurement, vol. 60, no. 10, October 2011.

[3]HAMID A. JALAB, ALI M. HASAN "Image Retrieval System Based on Wavelet network", 2012 IEEE.

[4]D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning. Reading, MA: Addison-Wesley, 1989.

[5]Gonzalez R.C,WoodsR.E:Digital Image Processing, Addison Wesley,1992.

[6]G.Beligiannis, L.Skarlas, and S. Likothanassis, "A generic applied evolutionary hybrid technique for adaptive system modeling and information mining," IEEE Signal Process. Mag.—Special Issue on "Signal Processing for Mining Information", vol. 21, no. 3, pp. 28–38, May 2004.