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Comparative Study and Implementation of Image Retrieval using Interactive Genetic Algorithm

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Abstract— A content based image retrieval has became one of the most active research in the past few years. As previously, we were using the text-based approach where it founds very tedious and difficult task for solving the purpose of image retrieval. But the CBIR is the method where there are many methodologies are available and the task of image retrieval becomes effectively easier. In this, there are some effective methods for CBIR are discussed and the comparative study is made. However most of the proposed approaches emphasize on finding the best representation for different image features. There are the techniques called a'trous wavelet transform (AWT) and Julesz's texton elements are used to generate the texton image. Also the multi texton histogram (MTH) is one of the method for this task. It integrates the advantages of co-occurrence matrix and histogram by representing the attributes of co-occurrence matrix using histogram. Here, the user oriented mechanism for CBIR method based on an interactive genetic algorithm (IGA) is proposed. The color attributes like the mean value, standard deviation and image bitmap of a color image are used as a features for retrieval.

Keywords— CBIR, texton, texton detection, multi texton, IGA, population, crossover.

I. INTRODUCTION

As the technology advances, the use of internet and new advanced digital image sensor technologies increases and a very large database of image are being created by scientific, industrial, medical and educational applications. So the task of image retrieval is becoming very tedious. As in earlier days the text based approach was preferred where the text was first annotated with image, but now the database is very huge and this process cannot be useful or reliable. Therefore an effective and automatic procedure is required for indexing and retrieving images from database. Since the text based approach is cumbersome and expensive, the solution on this problem has been introduced, for this a new technique is evolved named " Content Based Image Retrieval (CBIR)". It is a technique which uses visual contents of an image such as color, shape & texture to search images from large databases. There are many areas where this technique works effectively.

II. RELATED WORKS

A) For this CBIR technique, there are several low level features (color, shape & texture) have been extracted. The texture & color are important features, the texture contains the information about the structural arrangement of surface & their relationship to the surroundings. The Haralick et al [2] suggested the use of gray –level co-occurrence matrices (GLCM) for texture feature in addition to this the wavelet transform provides a multi-resolution approach to texture analysis. Manjunath & Ma [3] suggested to use the combination of multi resolution analysis and color correlation histogram where then some computations are made with the use of wavelet coefficients. Then this advances by M. Saadatmand-Tarzjan [4] using OQCM. Gonde et al [1] used technique where more concentration was put on the texture, the color also played a role for CBIR. Guung-Hai Liu et al [5] introduced a technique of multi-texton Histogram. Chih-chin Lai & Ying-Chaunchen [6] used the IGA for CBIR also Takagi et al [7] evaluated the performance of IGA based image retrieval system that uses wavelet coefficient to represent physical features of images. Also Cho [10] made effective work of IGA in fashion designing & emotion based image retrieval.

A. B. Gonde , R. P. Maheshwari, R. Balasubramanium [1] proposed the use of texton co-occurrence matrix for CBIR, here proposed the use of AWT & Julesz's texton elements to generate the texton image. It suggest the methodology where the flow of steps as preprocessing, processing & feature construction is done. In preprocessing the RGB to gray conversion is done. Then further processing is done with the combination of processes called the AWT, quantization & texton matching, togetherly they form the texton & then feature vector called feature construction is done. The AWT is basically the decomposition of images into successive sales. The AWT gives the size of image which is same at every level.

Texton Detection:

As the texton plays important role in the task of image retrieval, the Julesz defined the term texton which is a fundamental microstructures in natural images & are considered a the atoms of pre-attentive visual perception. The pixel intensity & co-occurrence matrix gives the 1st & 2nd order statistics for texture discriminations. As per this technique it

has been told that the texture elements must fall within a critical distance in order for the preattentive system to count the number of textons in the corresponding critical area & this determines the texton gradients. The texton patterns are to cover adjacency in horizontal, vertical, diagonal & minor diagonal directions.

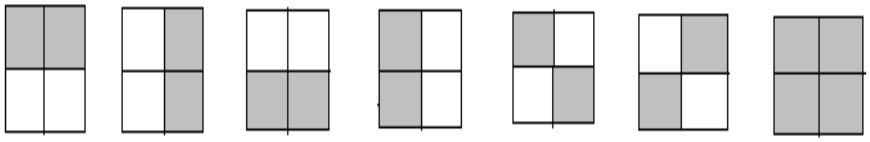

Fig. 1. Texton elements, T1,T2,T3,T4,T5,T6,T7.

Then forming the texton co-occurrence matrix of image the further operation on it can be done. Then distance measurement between query image & image in database is to be done & then with the help of average precision & recall rate the retrieval process is done.

B) The multi texton Histogram based image retrieval is also played a part in the mentioned task. Guung-Hai Liu, Lei zhang, Ying-Kun Hou [5] et al suggested the use of Multi Texton Histogram. The MTH can be viewed as an improved version of TCM[1]. It can integrates the advantages of co-occurrence matrix & histogram by representing the attributes of co-occurrence matrix using histogram & can represent the special correlation of color & texture orientation. Here the work is done based on texton theory, the decomposition of texture into some elementary units is to be done, they are the texton classes of colors elongated blobs of specific widths, orientation & aspect rations & their termination of elongated blobs.There are the steps as,

1. Texture orientation & detection.
2. Color quantization in RGB color space.
3. Texton detection.
4. Feature representation.

This method made some conclusions as, this does not require any image segmentation & comparatively easy to implement.

C) Chih-Chin Lai & Ying-Chuan Chen [6] et al proposed the image retrieval process on the basis of interactive genetic algorithm (IGA). Here some features like mean value, standard deviation & image bitmap of color image are used. For texture features the entropy based on the gray level co-occurrence matrix & edge histogram of an image are considered. By using this method, here it has been proposed that it is easy to infer which images in the database would be of the most interest to the user. Here the main properties are,

1) Low-level image features, from the Hue, Saturation, Value (HSV) color space, as well as texture & edge descriptors are adopted here.
2) The query by example strategy as a search technique.

For this study of CBIR, Yoo et al [8] proposed a signature-based color-spatial image retrieval system. Also, Vadivel et al [9] have introduced an integrated approach for capturing spatial variations of both color & intensity levels & shown its usefulness in image retrieval applications.

Takagi et al[7] evaluated the performance of the IGA-based image retrieval system that uses wavelet coefficient to represent physical features of image.

Cho [10] uses this IGA technique for the field of fashion design & emotion based image retrieval.

Shi et al [11] also proposed this IGA based approach which deals with adjust function & support vector machine.

There are the low-level visual features as, Color descriptor, Texture descriptor & Edge descriptor, it has been told that the RGB space does not correspond to the human way of perceiving colors & does not separate the luminance component from the chrominance ones, here the approach called HSV color space is used. The mean & standard deviation of a color image are considered,

$$\mu = \frac{1}{N}\sum_{i=1}^{N} Pi \qquad \ldots\ldots 1)$$

$$\sigma = \left[\frac{1}{N-1}\sum_{i=1}^{N} (Pi - \mu)^2 \right]^{1/2} \qquad \ldots\ldots 2)$$

where, $\mu = [\, \mu H, \mu S, \mu V \,]^T$ & $\sigma = [\, \sigma H, \sigma S, \sigma V \,]^T$ each component of μ & σ indicates HSV information respectively & Pi is ith pixel of an image. In addition to this a binary bitmap feature also used to capture the local color information of an image. For texture descriptor gray-level co-occurrence matrix (GLCM) which is a simple & effective method for representing texture is used. Also the use of term called entropy is made to capture the textural information in an image,

$$E = -\sum_{i,j} Ci,j \log Ci,j$$

Where , Ci,j is the GLCM. For edge descriptor, the edge histogram descriptor is used.

The following is the procedure to implement the task of image retrieval using IGA,

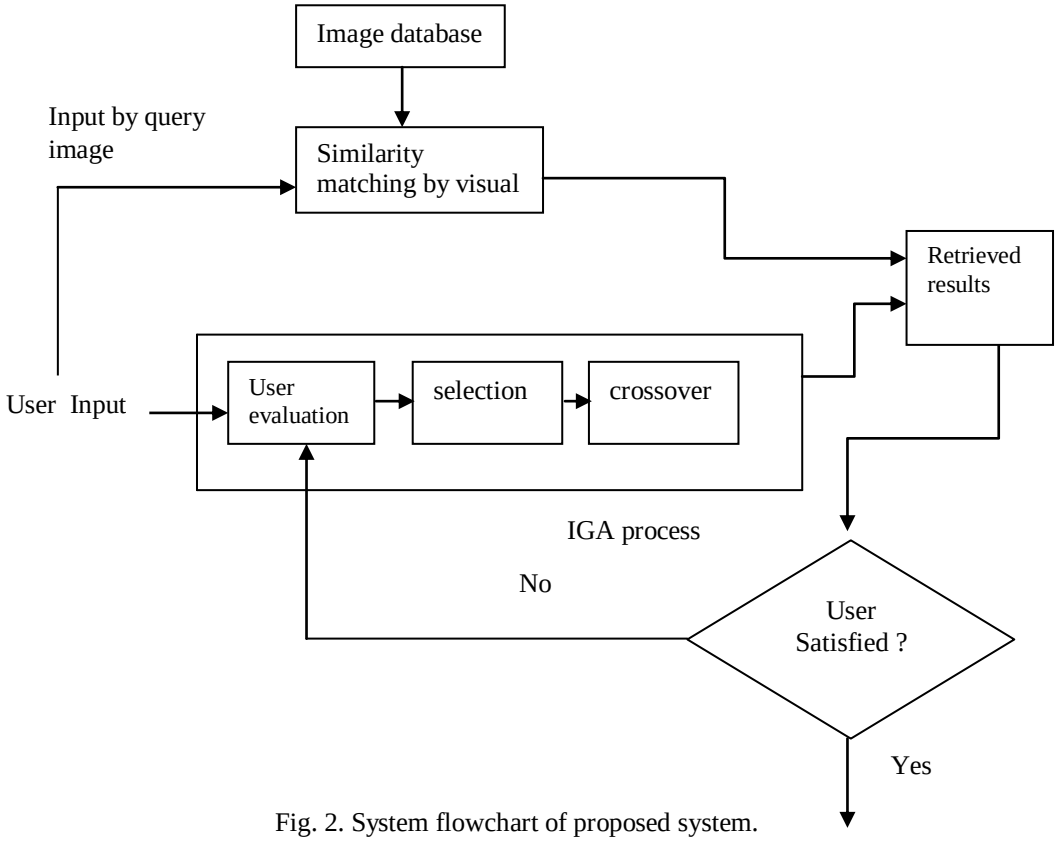

Fig. 2. System flowchart of proposed system.

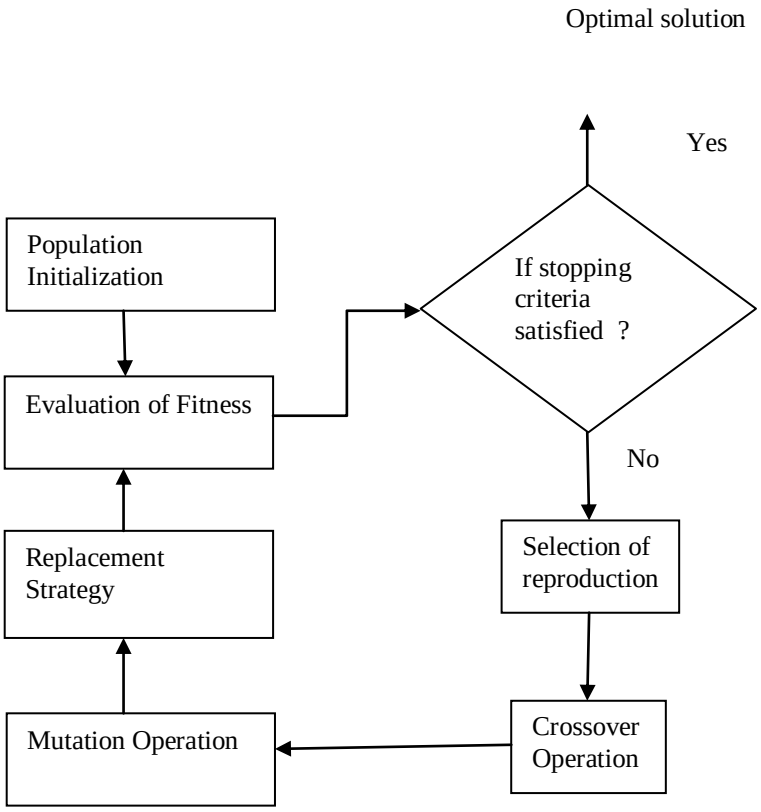

Fig. 3. General view of genetic Algorithm.

For every iteration, a new population is created by following the steps as,
1)Evaluation 2) selection & 3) Mating. In this proposed system, the very first component is to represent the chromosome & then form initial population by adopting first query results of sample image. Afterwards the fitness function is to be

find i.e. by evaluating the quality of the chromosomes in the population. The relation is defined between a quality of chromosome (C) & a query image (q).

$F(q,C) = \omega 1.sim(q,C) + \omega 2\delta$.

Where, δ= impact factor of human judgment.

$sim(q,C)$ = similarity measure between images.

$\omega 1$ & $\omega 2$ = coefficient to determine relative importance to them for calculating fitness.

The crossover is a genetic operator that randomly pairs chromosomes & swaps parts of their genetic information to produce new chromosomes. Here the one-point crossover is used & for better speed the mutation operator is omitted.

III. Conclusion

This paper gives the comparison of various methods of CBIR, in contrast to the conventional approaches that are based on visual features the IGA method provides an interactive mechanism to bridge the gap between visual features & human perception. The color information of an image & entropy in addition with edge histogram gives vital help in characterizing the image. As these features & performances of IGA approach to image retrieval lifts up a task of CBIR at more significant level

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