Comparison Survey on Content Based Image Retrieval with Soft Computing Techniques

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Abstract- *Relevance feedback is a technique which is used in CBIR to improve the retrieval efficiency. It is a way to interacting the human in between of your query and output and re-associate the new output image. Traditional RF is used to reduce the semantic gap between low level feature and high level feature and it has disability of presumption of the user relevancy for their output which is based on their query image.. In this paper we are presenting the some different method of soft computing technique by which we can prepare our database according to user perception and improve the retrieval efficiency.*

Keywords- Content Based Image Retrieval, Soft Computing Technique.

I. INTRODUCTION

Content-based image retrieval (CBIR) [1], is a technique for retrieving the images on the basis of automatically-derived features such as color, texture and shape.

Now researchers are performing various analysis methodologies to extract the information of image. So for this analysis part of image we are first giving effort on important features of image.

Digital images find a wide range of applications in field of medicine, science (medical and scientific images), military and security purposes and personal photo albums etc. While dealing with this sort of information like organizing and searching large volumes of images in databases, users have difficulties to found the appropriate images on the basis of their query image [2][3]. It is not well suited and compatible for digital images. Therefore there is a need for an efficient way for image retrieval.

1. Text Based Approach.
2. Content Based Image Retrieval

A. Text Based Approach

This type of approach is used to find the image from the database on the basis of query text. In text based approach, we first write the text and this text annotates the image and gives the output image. It is very difficult task to analysis the image from the database based on its text so, for this purpose we use the different technique.

B. Content Based Image Retrieval

1). Color Retrieval

Color is the property of Image which consist of various component of color such as RGB (Red, Green and Blue), HSV (Hue, Saturation and vague) etc on the basis of this color component of image we can identify the different feature like Color histogram etc, this color histogram consist of different value of each color component which may be helpful for analysis purpose.

2). Texture Retrieval

Texture measures look for visual patterns in images and how they are spatially defined [6] [7]. Textures are represented by Texel's which are then placed into a number of sets, depending on how many textures are detected in the image. These sets not only define the texture, but also where in the image the texture is located. Texture is a difficult concept to represent. The identification of specific textures in an image is achieved primarily by modeling texture as a two-dimensional gray level variation [9]. Some methods are: wavelet transform, Co-occurrence matrix, law texture energy etc.

3). Shape Retrieval

A shape is the form of an object or its external boundary, outline, or external surface [2]. There are several methods to find shape based feature like edge detection algorithm etc.

4). Scale Invariant Feature Transform (SIFT)

It is proposed by Lowe in 2004 [20] to solve the image rotation, scaling, view point changes, noise, illumination change, also has strong robustness. It has 4 main

steps: Scale space extreme detection, key point localization, orientation assignment, Description generation.

5). Speeded up Robust Features (SURF)

It is based on Multi-Scale Space theory and feature detection based on hessian matrix [20]. Hessian matrix [20] has good performance and accuracy.

$$H(X,\sigma) = \begin{vmatrix} Lyx(x, \sigma) & Lxy(x, \sigma) \\ Lyx(x, \sigma) & Lyy(x, \sigma) \end{vmatrix}$$

Here Lxx(x, σ) is convolution result of 2nd order derivation of gaussian filter with Image I in point x for varying value of σ.

II. SIMILARITY MEASURES

For CBIR system similarity measurement is the fundamental step which is used to find the match between the images. The distance between two images can be calculated using feature vector that are extracted from the image. Therefore, similar to the query image a single image is not retrieved, but many images are retrieved. There are various methods to find the similarity between the images such as Manhattan Distance, Euclidean Distance etc.

III. RELEVANCE FEEDBACK

It is a technique that has been used quiet successfully in human computer interaction because of it allows users to express better their needs in the specification of query. So here according to user feedback, system will distinguish the positive or negative image from retrieved image and then we can apply the new algorithm which will generate the new image from database and give the better result compare to previous one till the user does not satisfy. Relevance feedback is engaged as a query refinement technique for helping the retrieval task [21].

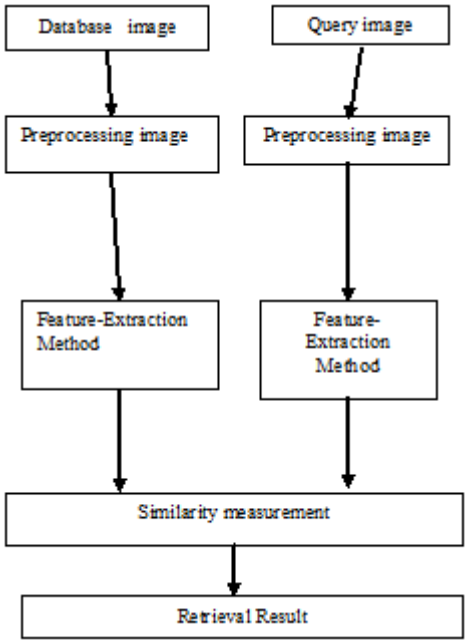

Figure 1 Flow Diagram of CBIR

Typical scenario of Relevance feedback is:-

1. Machine provides the initial result according to user perception of query image.
2. Here user accords the output image as to whether and to what degree, they are relevant or irrelevant.
3. Machine learns and tries again. Go to step 2.
4. Else result found.

IV. RELATED WORK IN RELEVANCE FEEDBACK

In 1998, Chang, et al. [5], proposed a framework, which allows for interactive construction of a set query which detects visual concepts such as Sunsets.

In 2001, Scloroff, et al. [6], describes the first WWW image search engine, which focused on relevance feedback based improvement of the results. In their initial system, a relevance feedback was used to guide the feature selection process. It was found that the positive examples were more important towards maximizing accuracy than the negative examples.

In 2001, Rui and Huang [7], compared heuristic with optimization based parameter updating and found that the optimization based method achieves higher accuracy.

In 2001, Chen, et al. [8], described a one class SVM method for updating the feedback space which shows substantially improved results over previous work.

In 2001, Guo, et al. [20], performed a comparison between AdaBoost and SVM and found that SVM gives superior retrieval results.

In 2002, He, et al. [9], used both short term and long term perspectives to infer a semantic space from user's relevance feedback for image retrieval. The long term perspective was found by updating the semantic space from the results of the short term perspective.

In 2003, Dy, et al. [10], proposed a two level approach via customized queries and introduced a new unsupervised learning method called feature subset selection using expectation-maximization clustering. The proposed method doubled the accuracy for the case of a set of lung images.

In 2004, Tieu and viola [11], proposed a method for applying the AdaBoost learning algorithm and noted that it is quite suitable for relevance feedback due to the fact that AdaBoost works well with small training sets.

In 2005, Yin, et al. [12], found that combining multiple relevance feedback strategies gives superior results as opposed to any single strategy.

In 2007, Bing Wang and Shuo Wang [13], a unified log-based relevance feedback network for integrating log data of user feedback with regular relevance feedback for image retrieval was proposed. Here the framework first compute the relevance functions on the log data of user feedback and then combines the relevance information with regular relevance feedback for the retrieval task. In order to address the noisy log data problem in real world applications, a novel learning algorithm to solve the log-based relevance feedback problem was proposed. The proposed algorithm, named Soft Label support vector machines, is based on the solid regularization theory.

In 2006, Ming li, Zin-Yun [14], a relevance feedback image retrieval method based on PCA image classification was proposed. From the experiment, it could be seen that more accurate classification result can be obtained by using PCA clustering algorithm. The proposed method can not only improve retrieval precision greatly but also reduces retrieval time and complexity.

In 2014, Srikanth and Annapurni.K [18], give the comparison between the feature extraction of image from all domain e.g. color, texture and shape.

Relevance feedback approach is used with two perspectives.

Short term learning approach

This kind of relevance feedback only we consider the feedback for current search session in learning algorithm [22]. The main challenge is to find the similarity measurement.

Long term learning Approach

In long term learning approach, we utilize the all collected feedback of particular queries for further improvement of output. Long term learning approach is adopted from the work of collaborative filtering [23].

But there having some limitation which makes this process complex.

1. It is unsuitable for the dynamic database, where the images is frequently added or removed from the database.
2. Here we need a separate place to keep information of feedback that we can say log information, to keep the feedback we need separate database which is complex or not an easy task to collect the sufficient log information.
3. Lastly, the most long term learning approach only recommend the memorized semantic knowledge to user but lack a learning ability to predict hidden semantics in terms of acquired semantic.

V. SOME SOFT COMUTING TECHINIQUE

Soft computing consists of set of technologies like Artificial Neural Network (ANN), Fuzzy logic (FL), Genetic Algorithm (GA), Machine learning and probabilistic reasoning. Due to their strong learning, cognitive ability and good tolerance of uncertainty and imprecision, soft computing techniques have found wide applications [23]. Image processing and retrieval is one of such applications. The aim of this paper is to compare and analysis of soft computing technique for content based image retrieval and provide their efficiency based on precision and recall.

A. Artificial Neural Network (ANN) Technique for CBIR

The Neural Network-based Image Retrieval (NNIR) which is the human-computer interaction system model of content based image retrieval using the Radial Basis Function (RBF) network [23]. The RBF network is chosen in this system, because BP (Back Propagation) requires a large set of classified training data and RBF network is more appropriate to reflect the subsequent feature of feedback.

B. Fuzzy Logic (FL) Technique for CBIR

Fuzzy logic offers a good solution for posing a query in terms of natural language based on the various features of an image [24]. Fuzzy logic has been extensively used at various stages of image retrieval such as region groupings within the images as a feature extraction technique, for measuring the similarity between the target image and the images in the database. Fuzzy logic is proposed for the computation of fuzzy colour histogram as well as posing the queries in CBIR. This paper reviews the prominent CBIR systems along with fuzzy logic based techniques and proposes a technique based on fuzzy logic and neural networks for retrieving the images using natural language query for colour and texture features fuzzy logic based similarity is proposed between the two images.

C. Genetic Algorithm (GA) Technique for CBIR

CBIR has been an active area of research for long due to its applications in various fields like satellite imaging, medicine etc [24]. The most important considerations in the design and implementation of CBIR systems are: image feature extraction, features representation, features matching, database organizing and querying mechanisms.

CBIR system with GA is used retrieve the image efficiently. First extract the feature of image and then with the aid of GA based, similarity measures.

D. Neuro-Fuzzy Based Clustering Technique for CBIR

The process of grouping a set of objects or patterns into classes of similar objects is called clustering. Clustering is a process that organizes a data set into a number of groups. In Other words, clustering is an important technique for discovering the inherent structure in any given pattern set [20]. It has been applied across many disciplines including engineering, statistics, psychology, sociology, astronomy, biology, business, medicine to name a few. There exist two categories for clustering task: hard and soft clustering. In hard clustering, each data object is assigned to exactly one cluster, while soft clustering is more desirable to let a data object be assigned several clusters partially. Hence, the soft clustering is also called neuro-fuzzy clustering. The goal of this paper is to provide methodology that concentrates on retrieving of images, defined by variety of clusters, in order to find the particular clusters.

E. Neural Network and Genetic Algorithm (GA) based Technique for CBIR

An approach is described to content-based retrieval of medical images from a database provide a preliminary demonstration of a new approach as applied to retrieval of digital mammograms [24]. In the medical-imaging context, the ultimate aim of Content Based Image Retrieval (CBIR) is to provide radiologists with a diagnostic aid in the form of display of relevant past cases, along with proven pathology and other suitable information. This paper proposes a new hybrid approach to content-based image retrieval. Contrary to the single feature vector approach which tries to retrieve similar images in one step, this method uses a two-step approach to retrieval. In the first step, the use of a neural network called Self Organizing Map (SOM) for clustering the images with respect to their basic characteristics were proposed [11]. In the second step, the GA based search will be made on a sub set of images which were having the some basic characteristics of the input query image.

F. Comparison of five soft computing technique based on their Precision and Recall

On the basis of their precision and recall method, we are evaluating the performance of content based image retrieval using various soft computing techniques and showing comparison between them, table (1) shows the average recall rate of content based image retrieval and table (2) shows the result of average precision.

$$Precision = \frac{no.of\ retreived\ images\ relevant\ to\ query\ images}{total\ no\ of\ images\ retreived}$$

$$Recall = \frac{no.of\ retreived\ image\ relevant\ to\ query\ images}{total\ no\ of\ relevant\ image\ in\ the\ database}$$

Table 1 Avg. Recall Rate of Some Soft Computing Techniques

Approach	Average Recall Rate Number of query image				
	10	20	30	40	50
ANN	0.771	0.772	0.773	0.774	0.786
FL	0.787	0.780	0.775	0.781	0.789
GA	0.691	0.699	0.698	0.699	0.699
ANN & FL	0.980	0.980	0.980	0.980	0.980
ANN & GA	0.960	0.960	0.960	0.960	0.960

Table 2 Avg. Precision Rate of CBIR with Some Techniques

Approach	Average Precision Rate				
	Number of query image				
	10	20	30	40	50
ANN	0.763	0.764	0.764	0.764	0.766
FL	0.719	0.718	0.714	0.713	0.719
GA	0.711	0.729	0.729	0.729	0.729
ANN & FL	0.980	0.980	0.980	0.980	0.980
ANN & GA	0.960	0.960	0.960	0.960	0.960

In table 1 average recall rate is calculated for input query image ranging from 10 to 50 and table 2 gives the information about average precision rate for input query image ranging from 10 to 50. The experiment of all five techniques done in Mat lab and the result we received. This soft computing technique outperforms the traditional CBIR method in terms of precision and recall.

V. CONCLUSION

Mainly work on relevance feedback which is using to get the most appropriate image from large source of data of image according to our query. Hence relevance feedback is a type of technique by which human interaction can be possible and we can refine our output. Relevance feedback is wide research area on which we can enhance our results. It is most helpful technique to reduce the semantic gap between the low level feature and high level feature.

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