A Review on Image Retrieval System

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Abstract— **Due to increased use of social sharing websites like Facebook, Flickr and Picasa, effective and efficient mechanism is needed to retrieve relevant images from large database. The paper presents a review on different ways of image retrieval techniques. The text-based approach is a simple keyword based search. Content Based image retrieval is a system by which various images are retrieved from an image database. Content Based image retrieval system uses various visual features like color, shape, texture which are extracted using different techniques.**

Proposed approach contains fusion of Content and link based similarities. Also personalized image search approach is proposed which helps to improve searching experience in the terms of query relevance and user preference by considering images annotations. Proposed method provides better results in terms of relevance and speed in image retrieval process over traditional approaches.

Index Terms— **Image mining, feature extraction, image retrieval and Content based image retrieval.**

I. INTRODUCTION

Image retrieval system became important due to the rapid growth of the World Wide Web (www).Now a days, use of social sharing websites like Flickr, Facebook and Picasa is increased rapidly which allow users to create, share, and annotate images. Social sharing websites contains images uploaded by users and accompanied by information such as annotations, comments. This meta-data helps users in sharing and organizing multimedia content and also helps to improve image retrieval and management process.

Conducting image retrieval from such large image database is a very challenging task because image database contains a lot of information such as text, image feature, users, and groups.

II. EXISTING IMAGE RETRIEVAL APPROACHES

Due to increasing use of internet, there is a need to develop efficient and effective methodologies for image retrieval from large image databases. Here overview of current research in image information retrieval is provided. Refer Fig. 1 for architecture of image retrieval system.

Existing Image retrieval systems can be categorized as: text-based retrieval (TBIR), content-based retrieval (CBIR), and Hybrid approach with image information retrieval systems [1].

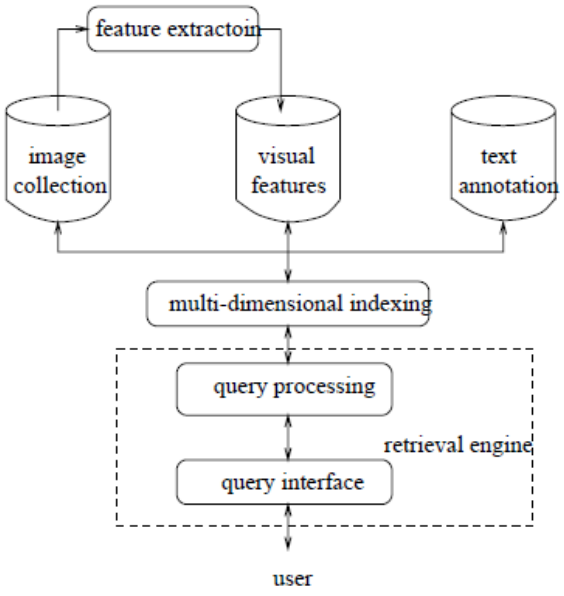

Fig 1: Architecture of Image Retrieval System

A. TEXT BASED IMAGE RETRIEVAL (TBIR)

TBIR is currently used in the most of the web image retrieval systems. The text-based approach is a keyword based search. This approach uses the text linked with an image to perform image retrieval from image database. In this framework, images are annotated by text and then image retrieval is performed from the database. Google, Yahoo such Image Search engines are based on this type of approach. Text-based methods are fast and give reliable result when images are well annotated. However these search engines are fast and robust but sometimes fails to retrieve relevant images because manual annotations are not accurate or surrounding text may not be proper to describe the

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image. The difficulty arises from the intrinsic difference between the text and image in representing and expressing information [3].

Content based image retrieval (CBIR) came into picture to overcome these problems faced in Text-based image retrieval. In CBIR system images are searched based on their visual contents such as colour, shape, and texture [2].

B. CONTENT BASED IMAGE RETRIEVAL (CBIR)

Content based image retrieval is the task of retrieve the images from the large collection of database on the basis of their own visual content. Visual contents are defined by a set of low level features which are extracted from an image that describe the color, texture or shape of the image [5]. In content-based search approach, the processing of a query image involves extraction of visual features and performs searching in the database for similar images. In content-based search involves extraction of visual features of query image and perform search in the database for similar images CBIR system compares features of query image with target images based on similarity measures of extracted features and perform ranking of the result. The low level image features can be used to compute similarity between images [4]. Refer Fig2. for CBIR system.

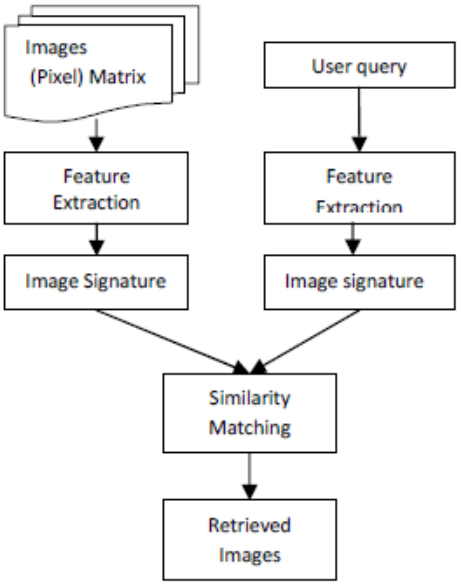

Fig 2: CBIR System

CBIR is a technique used for retrieving similar images from image database which uses various features of image to search the matching image to the query image in the image dataset. Content Based Image Retrieval (CBIR) is a technique which uses visual contents, called as features, such as shape, color, texture, edge to search images from large image databases according to users query in the form of a query image. The challenge of CBIR techniques are to increase the retrieval accuracy and reduce the retrieval time. Content Based Image Retrieval involves Feature Extraction, Multi-Dimensional Indexing/Ranking and Retrieval System Design.

Content-based image retrieval has its own limitations because of the semantic gap between the low level image features and high level semantic content of images. Many approaches have been proposed to reduce the semantic gap. They generally fall into two classes, depending on the level of user involvement in the retrieval: relevance feedback and image database pre-processing using statistical classification.

Relevance feedback is a powerful technique, used in the traditional text-based information retrieval systems. In CBIR, a relevance feedback system allows the user to interact with the retrieval algorithm by providing information regarding the images which the user believes to be relevant to the query

Classification of CBIR systems

Refer Fig.3. for classification of CBIR system

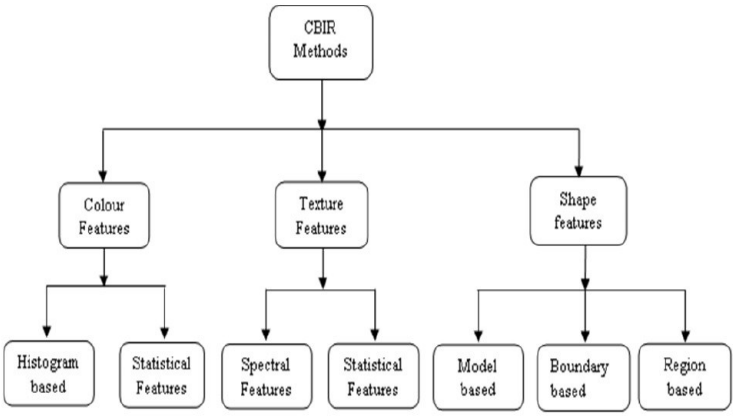

Fig 3: Classification of CBIR System

1. The retrieval based on Color feature

Color is an important visual factor. Different color spaces are used such as RGB, LUV, LAB, HSV (Hue, Saturation and Value), YCrCb and the hue-min-max difference based on the different applications. Among all models, the HSV model is considered as the most suitable for representing color because it is perceptual to the user. In image retrieval system, color histogram of query image is calculated and then compared with the color histograms of other images stored in the database and then those images are retrieved whose color histograms match those of the query most closely. Color histogram is representation as the proportion of pixels of each color represented in the color [6]. Color histogram of each image is then stored in the database. While searching, the user can either specify the desired proportion of each color, or submit a query image from which a color histogram is calculated. Histogram intersection is mostly used matching technique, was developed by Swain and Ballard. Methods of improving on Swain and Ballard's original technique include the use of cumulative color histograms, use of combining histogram intersection with few element of spatial matching and the use of region-based color query.

2. The retrieval based on texture feature

Texture means visual patterns having homogeneity property and these cannot result from a single color or intensity. Texture is important property while searching image in an image database. Texture contains important information about the structural arrangement of surfaces and their relationship to the surrounded environment. It is an innate property of virtually all surfaces like clouds, trees, bricks, hair, and fabric. Haralick et al. proposed in 1970 the co-occurrence matrix which is constructed based on the orientation and distance between image pixels. The co-occurrence matrix it is used to calculate the contrast, coarseness, directionality and regularity, periodicity, directionality and randomness to understand the texture meaning.

Texture analysis can be performed at three levels. On statistical level, a set of statistics extracted from the image is called texture. In the structural level, the primitives of the image and their placement rules are known as its texture. On the spectral level, the texture is defined as a set of coefficients in the transform domain. With the help of these levels the textures can be identified but the textures may not agree with human way of evaluating the textures. Texture feature calculated using wavelet transform, tamura texture features, statistical features. Texture analysis by means of the Gabor filters is a special case of the wavelet approach. Texture queries can be used in a similar manner to color queries.

3. The retrieval based on shape feature

Natural objects are mainly recognized by their shape. For every object identified within each stored image, a number of features characteristic of object shape can be computed. As compared to color and texture features, shape features are described after images have been segmented into regions or objects. Shape features are further divided into two categories boundary based and region based. In Boundary based shape features, only boundary of the shape is used whereas in region-based shape features, entire shape region is used. The phrase shape refers to the information that can be deduced directly from the image. Shape is representation of grouped geometric cues such as edges, contours, joints, and polygonal regions extracted from an image. Shape features are known as geometric features. The most successful representation for these two categories is Fourier descriptor and moment variants. The main idea behind Fourier Descriptor is to use the Fourier transformed boundary as the shape feature. The idea behind Moment invariants is to use region-based moments. Queries to the system can be entered either in the form of query image or as a sketch [7].

C. HYBRID APPROACH

The text and content based techniques have their own advantages and disadvantages. By combining these two approaches, parts of their disadvantages can be overcome. The recent trend for image search is to use the basic techniques i.e. Textual based context (usually represent by the keywords search) and Visual features for image retrieval. In the hybrid approach the existing textual and visual features are combined to provide a better result.

An approach takes a different stand and treats images and texts as equivalent data. This approach attempts to discover the correlation between visual features and textual words by estimating the joint distribution of features and words and posing annotation as statistical inference in a graphical model. As a result, combination of text based and content based image retrieval approaches is not sufficient for handling with the problem of image retrieval for large scale database.

III. PROPOSED APPROACH

In the proposed approach, links between images are used to improve the image retrieval technique. In exiting works, linking between images is not considered. In this paper, linkage between images is considered along with text based and content based image retrieval approach to provide relevant image results efficiently and effectively [10]. Also personalized image search is can be combined along with the integration of link and content based image retrieval approach which helps to improve searching experience in the terms of query relevance and user preference by considering images annotations.

IV. PERFORMANCE MEASURES

Measuring the performance of image retrieval systems is vey important. Many methods are suggested and used by researchers. Precision and recall are mostly used performance measures in image retrieval system [9]. The standard definitions of these two measures are given by following equations.

Precision (P) is defined as the ratio of the number of relevant images retrieved to the number of total retrieved images [8].

$$\text{Precision} = \frac{\text{Number of Relevant Images Retrieved}}{\text{Total number of Images Retrieved}}$$

Recall (R) is defined as the number of retrieved relevant images over the total number of relevant images available in the database [8].

$$\text{Recall} = \frac{\text{Number of relevant images retrieved}}{\text{Numbet of relevnt images in the database}}$$

V. CONCLUSIONS

In this paper, existing techniques for image retrieval system are reviewed. The technology of content based image retrieval system needs more advanced techniques for few commercial applications. This paper provides a review of feature extraction, similarity measures, semantic gap reduction techniques and performance measures. It is concluded that although significant

amount of work has been done in this area but still there is need for a significantly better system for image retrieval in terms of both relevance and response time which can be achieved by proposed approach of fusion of link and content based similarity along with personalised image search.

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