



An Overview of Content Based Image Retrieval

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Abstract— *Content Based Image Retrieval (CBIR) becomes one of the most important area for Research. In CBIR system image is retrieved on the bases of visual features like color , texture and shape. In this system image is retrieved from large collection of images i.e. database. This Document describes different Cbir systems, different types of system, cbir process and application of CBIR.*

Keywords— *Image Retrieval, CBIR (Content Based Image Retrieval), CBIR Systems, Types of CBIR, Fundamental of CBIR*

I. INTRODUCTION

A. IMAGE RETRIEVAL SYSTEM

Image retrieval is a system which is used for browsing, searching and retrieving images from the large database. There are different methods to search the images. Some of methods are to search images by text or keywords are called text based image retrieval and other method is to search images based on their visual contents are called content based image retrieval. There are different visual contents. Basically visual contents are of two types: high level and low level. High level contents are fingerprints, face etc. and low level contents are colors, shape, texture. There are some search methods used for searching images are as following:

IMAGE META SEARCH:

Image meta search is a search method or search engine which is used to search images using meta data such as text, keywords etc. Image meta search also called text based image retrieval . It have specialisation of finding images, pictures, animation etc.

Image meta search working: The metadata of image is indexed and stored in large database. When the query is given for search than search engine look for query index in database if query is match in store information than it represents the result in order of relevancy.

CONTENT BASED IMAGE RETRIEVAL(CBIR):

Content based image retrieval also called query by image content and content based visual information(CBVIR).CBIR is application of computer vision techniques to the image retrieval problem i.e. problem of searching digital images from large database. CBIR is a system which is used to search images based on their visual contents. The Term "CONTENT" refers to the features of images such as color, shape, texture. CBIR means search analyses contents of images rather than the metadata such as text, keywords etc.

IMAGE COLLECTION EXPLORATION:

Image collection exploration is a method in which search is done by use of novel exploration paradigm.

II. CONTENT BASED IMAGE RETRIEVAL

Content based image retrieval also called query by image content and content based visual information(CBVIR). CBIR is application of computer vision techniques to the image retrieval problem i.e. problem of searching digital images from large database. CBIR is a system which is used to search images based on their visual contents. The Term "CONTENT" refers to the features of images such as colour, shape, texture. CBIR means search analyses contents of images rather than the metadata such as text, keywords etc.

There are two frameworks: text based and content based. In text based images are manually annotated by metadata such as text descriptors and these descriptors are than used by database management system to search the images from stored data.

Content based image retrieval was proposed to solve these problems in text based image retrieval. In this system, images are indexed by their visual feature contents like colour, shape and texture. Problems in text based image retrieval are as following:

- (i) Image annotation, when there is large volume of database. The vast amount of labour required in manual image annotation.
- (ii) Human perception, the perception subjectivity and annotation impreciseness may not cause unrecoverable mismatches in retrieval process.

In CBIR, each image that is stored in the database has its features extracted and compared to the features of the query image. It involves two steps

- **Feature Extraction:** The first step in the process is extracting image features to a distinguishable extent.
- **Matching:** The second step involves matching these features to yield a result that is visually similar.

III. CBIR PROCESS

The process of CBIR system consist of different stages :

- 1. Image Aquisition:** This stage is used to acquire digital images from database.
- 2. Image preprocessing:** to improve the image in ways that increases the chances for success of the other processes. The image is first processed in order to extract the features, which describe its contents. The processing involves filtering, normalization, segmentation, and object identification. Like, image segmentation is the process of dividing an image into multiple parts. The output of this stage is a set of significant regions and objects.
- 3. Feature Extraction:** Features such as shape, texture, color, etc. are used to describe the content of the image. The features further can be classified as low-level and high-level features. In this step visual information is extracts from the image and saves them as features vectors in a features database .For each pixel, the image description is found in the form of feature value (or a set of value called a feature vector) by using the feature extraction .These feature vectors are used to compare the query with the other images and retrieval.
- 4. Similarity Matching:** The information about each image is stored in its feature vectors for computation process and these feature vectors are matched with the feature vectors of query image (the image to be search in the image database whether the same image is present or not or how many are similar kind images are exist or not) which helps in measuring the similarity. This step involves the matching of the above stated features to yield a result that is visually similar with the use of similarity measure method called as Distance method. Here is different distances method available such as Euclidean distance, City Block Distance, Canberra Distance.
- 5. Resultant Retrieved images:** It searches the previously maintained information to find the matched images from database. The output will be the similar images having same or very closest features as that of the query image.
- 6. User interface and feedback** which governs the display of the outcomes, their ranking, the type of user interaction with possibility of refining the search through some automatic or manual preferences scheme etc.

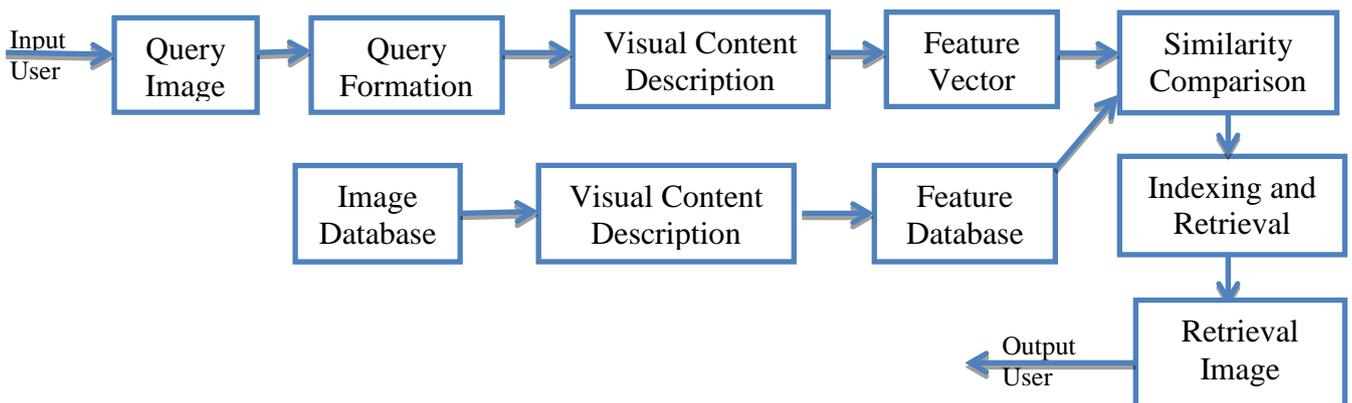


Fig.1.1 Diagram Of CBIR Systems

IV. TYPES OF CBIR

General
Application Specific

A.GENERAL:

In this type of CBIR we match the query image to the arbitrary collection of image.

B.APPLICATION SPECIFIC:

In this type of CBIR we match the query image to the collection of image of specific type such as Finger-prints, X-ray.

V. APPLICATION OF CBIR

- i. Crime prevention: Automatic face recognition systems, used by police forces.
- ii. Security Check: Finger print or retina scanning for access privileges.
- iii. Medical Diagnosis: Using CBIR in a medical database of medical images to aid diagnosis by identifying similar past cases.
- iv. Intellectual Property: Trademark image registration, where a new candidate mark is compared with existing marks to ensure no risk of confusing property ownership.
- v. Home entertainment
- vi. Architectural and engineering design
- vii. Geographical information and remote sensing systems
- viii. Military
- ix. Photograph Archives

VI. CBIR SYSTEMS

Several CBIR systems currently exist, and are being constantly developed. Examples are:

- *QBIC or Query By Image Content* was developed by IBM, Almaden Research Centre, to allow users to graphically pose and refine queries based on multiple visual properties such as colour, texture and shape. It supports queries based on input images, user-constructed sketches, and selected colour and texture patterns.
- *VIR Image Engine* by Virage Inc., like QBIC, enables image retrieval based on primitive attributes such as colour, texture and structure. It examines the pixels in the image and performs an analysis process, deriving image characterization features.
- *VisualSEEK and WebSEEK* were developed by the Department of Electrical Engineering, Columbia University. Both these systems support colour and spatial location matching as well as texture matching.
- *NeTra* was developed by the Department of Electrical and Computer Engineering, University of California. It supports colour, shape, spatial layout and texture matching, as well as image segmentation.
- *MARS or Multimedia Analysis and Retrieval System* was developed by the Beckman Institute for Advanced Science and Technology, University of Illinois. It supports colour, spatial layout, texture and shape matching.
- *Viper or Visual Information Processing for Enhanced Retrieval* was developed at the Computer Vision Group, University of Geneva. It supports colour and texture matching.

VII. FUNDAMENTALS OF CBIR

Visual feature extraction

Multidimensional Indexing

Image retrieval systems

A, Visual feature extraction

Feature Extraction is bases of content based image retrieval .Feature Extraction is the set features called feature vectors or image signatures. These features are generated to represent the contents of each image in the database. Feature vectors are smaller than the real image about hundred elements. There are two types of features. One is Text based features like text, keywords, annotation. Second are Visual features like colours, shapes, textures, faces. Visual features are further divided in two types. First, General Features which includes colors, shapes, textures. Second, Domain Specific Features are application dependent features and which includes human faces, finger prints etc. Domain specific features are covered in pattern recognition. Due to problem of human perception there are different representations of these features.

(a) COLOR

The first and straightforward feature is color which is used for indexing and retrieving images from database. The color feature is robust and independent of orientation and image size. For representation of color feature color histogram, color moments and color sets are used. Color feature as compare to texture and shape have better stability. Color not only adds beauty to objects but also more information, which is used as powerful tool in content-based image retrieval (P V N Reddy et al. 2011).

- **Color Space:** Each pixel of the image can be represented as a point in a 3D color space. There are two most commonly used color spaces are RGB and HSV (HSB). RGB is Red, Green, Blue and HSV or HSB is Hue, Saturation, Value or Brightness. The property of color space is its Uniformity. Uniformity means when two colors pairs in color space are equal in similarity distance than these colors are recognised as equal by viewers. Mostly RGB color space is used in image retrieval. There are three components of RGB are Red, Green, Blue. These colors are called Additive Primaries. Because they are produced by adding. In contrast to RGB, there is CMY color space which is commonly used for printing. The components of CMY color space are Cyan, Magenta, Yellow. These colors called Subtractive primaries. Because they are produced through light absorption. Both RGB and CMY are non-uniform and device-dependent. HSB or HSV is most widely used in computer graphics. The components are Hue, saturation (lightness) and Value (Brightness).

- **Color Histogram:** Color Histogram is most commonly used in image retrieval. Color histogram has advantage of high speed and it uses low memory space. Color histogram is used to denote the proportions of pixels of colors in the image. The color histogram of each image Stored in database. The color histogram of an image described the presence of colours in image and also described in which amount (quantity) colors are present in image. Color histogram is used to denote the joint probability of intensities of color channels like red, green, blue (RGB) or Hue, saturation, variance (HSV).
- **Color Moments:** Color moments are used in some image retrieval systems (like QBIC). Color moments are used in images which contains objects. Color moments are divided as low order and high order moments. The low orders moments are first, second and third order moments. Most of the information depends on these low order moments. The First order is Mean, The Second order is Variance and The Third order is Skewness. These moments are very effective and efficient to represent the distributions of images.

(b) TEXTURE

Texture is another property of images. It gives the information about spatial arrangements of colours or intensities in an image or selected region of an image. The six visual texture properties were coarseness, contrast, directionality, linelikeness, regularity, and roughness (Yong et al. 1999). It represented by TEXELS. Texel's are placed into no. of sets. It depends on how many textures are detected in the image. These sets are used to defined textures and location of the textures. Image texture is used in segmentation in image processing and classification of images. In computer graphics, there are three ways to represent texture one is Structural, Statistical and Spectral approach.

- **Structural Approach:** This approach deals with arrangements of primitives of images such as description of texture based on regularity spaced parallel lines.
- **Statistical Approach:** This approach gives the characteristics of texture like smoothness, coarseness, grainy etc.
- **Spectral Approach:** These techniques based on Properties of Fourier Spectrum. It is used to detect global periodicity in an image by identifying high energy, narrow peaks in the spectrum.

(c) Shape

Shape Feature of region or object is used in content based image retrieval systems. As compared to color and texture features, Shape feature is used in images after when images are segmented into regions or objects. It attempts to obtain the objects to be distinguished from its boundary or outline. Shapes are represents in two ways Boundary Based and Region Based (Danish et al. 2013).

- **Boundary-Based:** In this boundary based, shape represents by using only outer boundary or outline of shape. This is done by using external characteristics of selected region i.e. the *pixels in outer boundary of selected region*.
- **Region-Based:** In Region Based, shape represents by using entire region of shape by describing the internal characteristics of selected region i.e. the pixels in that region.

VII. CONCLUSION

This paper describe the different systems of cbir and three bases of fundamental of cbir such as Feature Extraction, Multidimensional Indexing and Image retrieval systems and also describe the types of cbir and application. CBIR was proposed to improve the problems of text based image retrieval i.e human perception and image annotation.

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