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Content Based Image Retrieval (CBIR)

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ABSTRACT:
Image retrieval is important area of digital image processing. Image can be retrieved from a large database on the basis of color, shape and texture. Content-based image retrieval uses the visual contents of an image such as texture, color, shape, and spatial layout to represent and index the image. Due to the enormous increase in image database sizes, as well as its vast deployment in various applications, the need for CBIR development arose.The goal of CBIR systems is to support image retrieval based on content e.g., shape, color, texture. In typical CBIR systems, the visual content of the images in the database are extracted and described by multi-dimensional feature vectors. These features are extracted and used as the basis for a similarity check between images.
In this paper we present the review on the problem, the proposed solution, the final solution and the accomplishments achieved.

KEY WORDS: Advantages of CBIR, CBIR System, Color Retrieval, Shape Retrieval, Texture Retrieval.

INTRODUCTION:

Image retrieval is the process of searching and retrieving images from a large database. Image mining is a technique which handles the mining of information, image data association, or additional patterns not unambiguously stored in the images. It exploits methods from Computer vision, image retrieval, image processing, data mining, machine learning, Database, and artificial intelligence. There are two most relevant techniques. The first technique is to mine from huge amount of images alone and the second technique is to mine from the integrated collections of images and related alphanumeric data. Content-based image retrieval plays a central role in the application areas such as multimedia database systems in recent years. The work focused on using low-level features like color, text, shape and spatial layout for image representation.

DEFINITION:

CBIR or Content Based Image Retrieval is the retrieval of images based on visual features such as colour, texture and shape. Content-based image retrieval, also known as query by image content and content-based visual information retrieval is the application of computer vision to the image retrieval problem, that is, the problem of searching for digital images in large databases. Content-based means that the search makes use of the contents of the images themselves, rather than relying on human-input metadata such as captions or keywords. A content-based image retrieval system (CBIR) is a piece of software that implements CBIR. Reasons for its development are that in many large image databases, traditional methods of image indexing have proven to be insufficient, laborious, and
extremely time consuming. These old methods of image indexing, ranging from storing an image in the database and associating it with a keyword or number, to associating it with a categorized description, have

become obsolete. This is not CBIR. 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.

APPLICATION:
CRIME PREVENTION:
Automatic face recognition systems, used by Police.

SECURITY CHECK:
Finger print or retina scanning for access privileges.

MEDICAL DIAGNOSIS:
Using CBIR in a medical database of medical images to aid diagnosis by identifying similar past cases.

INTELLECTUAL PROPERTY:
Trademark image registration, where a new candidate mark is compared with existing marks to ensure no risk of confusing property ownership

LITERATURE SURVEY
RAY-I CHANG, SHU-YU LIN, JAN-MING HO, CHI-WEN FANN, AND YU-CHUN WANG IN 2012:
Proposed a novel content based image retrieval system using K-means/KNN with feature extraction. This paper first combines segmentation and feature extraction module, grid module, K-means clustering and neighborhood module to build the CBIR system. The problem with this technique is that the system architecture and modules proposed in this paper are not optimized properly.

MANIMALA SINGH AND K.HEMACHANDRAN IN 2012:
Presents a technique for content based image retrieval using color and texture. They proposed two algorithms for image retrieval based on the color histogram and Wavelet-based Color Histogram. They presented a novel approach for Content Based Image Retrieval by combining the color and texture features called Wavelet-Based Color Histogram Image Retrieval (WBCHIR). The computational steps are effectively reduced with the use of Wavelet transformation.

AMANBIR SANDHU, AARTI KOCHHAR IN 2012:
Presents a technique for content based image retrieval using texture, color and shape for image analysis. In this paper they worked with the three features i.e. texture, color and shape and its different combinations. The GLCM is used for texture feature extraction, histogram for Color feature extraction and for shape different factors are found like area, Euler No., eccentricity and Filled Area.

TECHNIQUES USED IN CBIR:

CBIR operates on a totally different principle, retrieving/searching stored images from a collection by comparing features automatically extracted from the images themselves. The commonest features used are mathematical measures of color, texture or shape. A CBIR System allows users to formulate queries by submitting an example of the type of image being sought (input), though some offer alternatives such as selection from a palette or sketch input we can also select color textures or any other visual information. The system then identifies those stored images whose feature values match those of the query most closely (right side), and displays thumbnails of these images on the screen like in

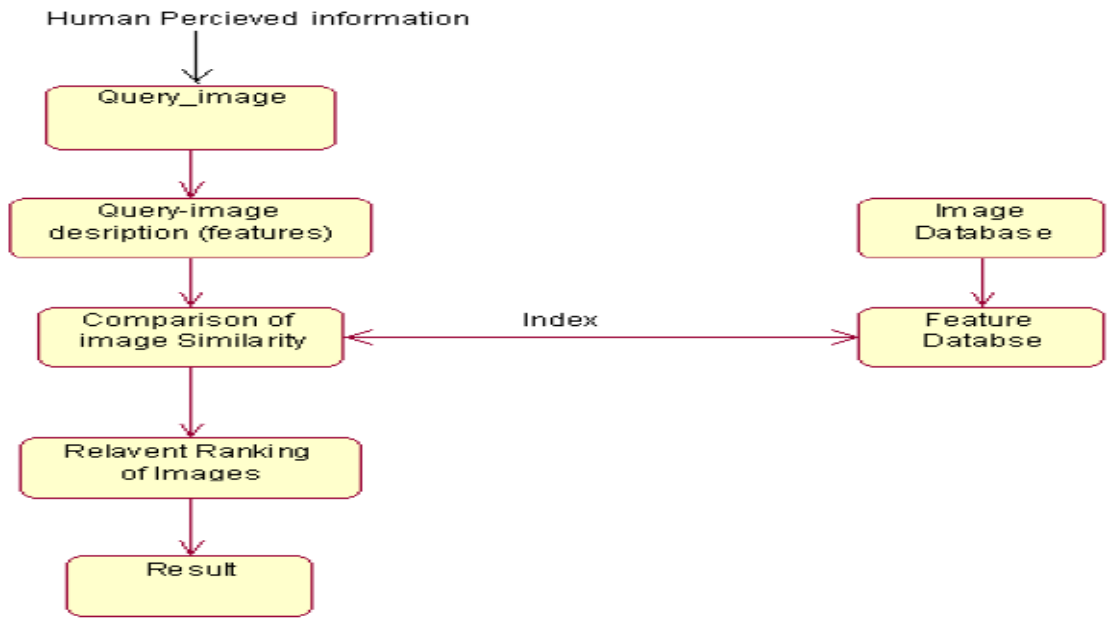

Fig. 1 Steps in CBIR System

The Fig. 1 explains the basic steps in any of the CBIR Systems.

COLOR RETRIEVAL:

One of the most important features that make possible the recognition of images by humans is color. Color is a property that depends on the reflection of light to the eye and the processing of that information in the brain. We use color everyday to tell the difference between objects, places, and the time of day. Usually colors are defined in three dimensional color spaces. These could either be RGB (Red, Green, and Blue), HSV (Hue, Saturation, and Value) or HSB (Hue, Saturation, and Brightness). The last two are dependent on the human perception of hue, saturation, and brightness. Most image formats such as JPEG, BMP, GIF, use the RGB color space to store information. The RGB color space is defined as a unit cube with red, green, and blue axes. Thus, a vector with three co-ordinates represents the color in this space. When all three coordinates are set to zero the color perceived is black. When all three
coordinates are set to 1 the color perceived is white. The other color spaces operate in a similar fashion but with a different perception.

TEXTURE RETRIEVAL:

Texture is that innate property of all surfaces that describes visual patterns, each having properties of homogeneity.It contains important information about the structural arrangement of the surface, such as; clouds, leaves, bricks, fabric, etc. It also describes the relationship of the surface to the surrounding environment. It is feature thatdescribes the distinctive physical composition of a surface. Texture properties include Coarseness, Contrast, Directionality, Regularity, Roughness. Texture is one of the most important defining features of an image. It is characterized by the spatial distribution of gray levels in a neighborhood. In order to capture the spatial dependence of gray-level values, which contribute to the perception of texture, a two-dimensional dependence texture analysis matrix is taken into consideration. This two-dimensional matrix is obtained by decoding the image file; jpeg, bmp, etc.

SHAPE RETRIEVAL:

Shape may be defined as the characteristic surface configuration of an object; an outline or contour. I permits an
object to be distinguished from its surroundings by its outline. Shape representations can be generally divided into
two categories Boundary Based and Region Based. Boundary-based shape representation only uses the outer boundary of the shape. This is done by describing the considered region using its external characteristics; i.e., the
pixels along the object boundary. Region-based shape representation uses the entire shape region by describing the
considered region using its internal characteristics; i.e., the pixels contained in that region.

CBIR SYSTEMS:

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

QBIC OR QUERY BY IMAGE CONTENT:

It was developed by IBM, Alma den 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:

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:

They 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:

It 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:

It 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:
It was developed at the Computer Vision Group, University of Geneva. It supports colour and texture matching.

ABBREVIATIONS AND ACRONYM:
CBIR – Content Based Image Retrieval
JPEG- Joint Picture Expert Group
RGB- Red Green Blue
HSV- Hue, Saturation and Value
HSB- Hue, Saturation and Brightness
WBCHIR- Wavelet Based Color Histogram Image Retrieval

CONCLUSION:
CBIR is still a developing science. The dramatic rise in the sizes of images databases has stirred the development of effective and efficient retrieval systems. The development of these systems started with retrieving images using textual connotations but later introduced image retrieval based on content. This came to be known as CBIR or Content Based Image Retrieval. Systems using CBIR retrieve images based on visual features such as colour, texture and shape, as opposed to depending on image descriptions or textual indexing. In this project, we have researched various modes of representing and retrieving the image properties of colour, texture and shape. Existing techniques shows good results only on small dataset but accuracy decreases considerably on large dataset. In future a system should be developed so that it can retrieve the images from a large data set efficiently in minimum amount of time. As image compression, digital image processing, and image feature extraction techniques become more developed, CBIR maintains a steady pace of development in the research field. Furthermore, the development of powerful processing power, and faster and cheaper memories contribute heavily to CBIR development. This development promises an immense range of future applications using CBIR.

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