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QUERY BY IMAGE CONTENT: PRINCIPLE, TECHNIQUES AND APPLICATION OF IMAGE RETRIEVAL

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Abstract- ***Image Recognition and Retrieval is a dominate research field nowadays and covers wide applications. The efficient method to recognize and retrieve relevant images from large database becomes essential and this due to remarkable growth in image processing as well as the widespread use of internet. The escalating use of images in numerous application areas like medical science, education, remote sensing and entertainment has led to vast image archives and hence require management, recognize and retrieval of effective image data. In this paper, we review the concept of Query by image content (QBIC). The methods and applications of image reorganization and retrieval system is briefly discussed in this paper.***

Index Terms—QBIC, HSV, Feature Extraction, Similarity Measures.

I. INTRODUCTION

The amount of images or the pictorial data is growing day by day with the expansion of internet services. As the network and development of multimedia technologies are becoming more popular, users are not satisfied with the traditional information retrieval techniques. So nowadays the Query by Image Content (QBIC) is becoming a source of exact and fast retrieval. It is very difficult for the users to retrieve the required images using a operative and efficient mechanism. There are many techniques which are used to retrieve the images depending upon the requirement of different applications [1]. Query by Image Content is an important research area in image processing, with a vast domain of applications like recognition systems i.e. finger, face, biometrics, medical sciences etc. However, the technology still lacks maturity, and is not yet being used on a significant scale. In the absence of hard evidence on the effectiveness of QBIC techniques in practice, opinion is still sharply divided about their usefulness in handling real-life queries in large and diverse image collections [2].

In many areas of government, academia, commerce, and hospitals, large collections of digital images are being created. Many of these collections are the product of digitizing existing collections of drawings, paintings, analogue photographs, diagrams and prints. Usually, the only way of searching these collections was by keyword indexing, or simply by browsing. Digital images databases however, open the way to content-based searching. Effective and operative retrieval of

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images from a large data base is a very difficult task. Therefore the retrieval of similar and relevant images based on the similarity between automatically derived content features such as color shape, texture, etc of the query image and that of the images which are stored in the data base and that task is popularly known as Query by Image Content. The term color can be achieved by the techniques histogram and averaging [3-4]. The term texture refers the use of vector quantization or transforms. The term shape is the use of gradient operators or morphological operators. The accuracy of the CBIR system can be improved by the iterative refinement process of the queries and the features that are decided by the users' feedback. An image consists of global and local features. Depending upon the problem we can use the features of our interest to retrieve the images from a database [5]. Some of the major areas of applications of QBIC are: medical diagnosis, Intellectual property, art collections, crime prevention, military and engineering design and geographical information and remote sensing systems.
The steps that are to be followed in the system realization are

1. Image acquisition
2. Feature Extraction
3. Similarity Matching

The query images undergo three stages. A large number of images are stored in the database. Image enhancement takes place where various techniques are applied on the image to improve its quality like histogram manipulation. The enhanced image is then subdivided and segmented to get the color, texture and edge density features forming a feature vector. The resultant feature vector can be compared with the feature vector of the query image [6]. The closest image in comparison with the query image from the feature database is returned.

II. CONCEPT OF QBIC SYSTEM

Retrieval of images can be performed by various approaches. One such approach which uses textual description of images in terms of keywords is a complex process and consumes much time. Yet another ambiguity with retrieval of images is that the level of perception varies with different people where it would be just a prediction. The emanation of QBIC is to enhance the search in case of large database. It reduces the demerits of the existing approaches and provides desirable features like indexing, clustering to enhance image retrieval accurately by content. There are various approaches for QBIC. One of the most popular methods of QBIC is image retrieval based on feature extraction. Image retrieval is an amalgamation of low set of features and high set of features. Color, shape and texture belong to low level features. High level features cannot be extracted from visual contents. It uses conventional textual descriptor for image retrieval. Fundamental technique of

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QBIC is visual feature extraction [7]. This is mainly to overcome the semantic gap which is the difference between the interpretation of the user and the information in the visual data. A typical QBIC system is depicted in Figure 1.

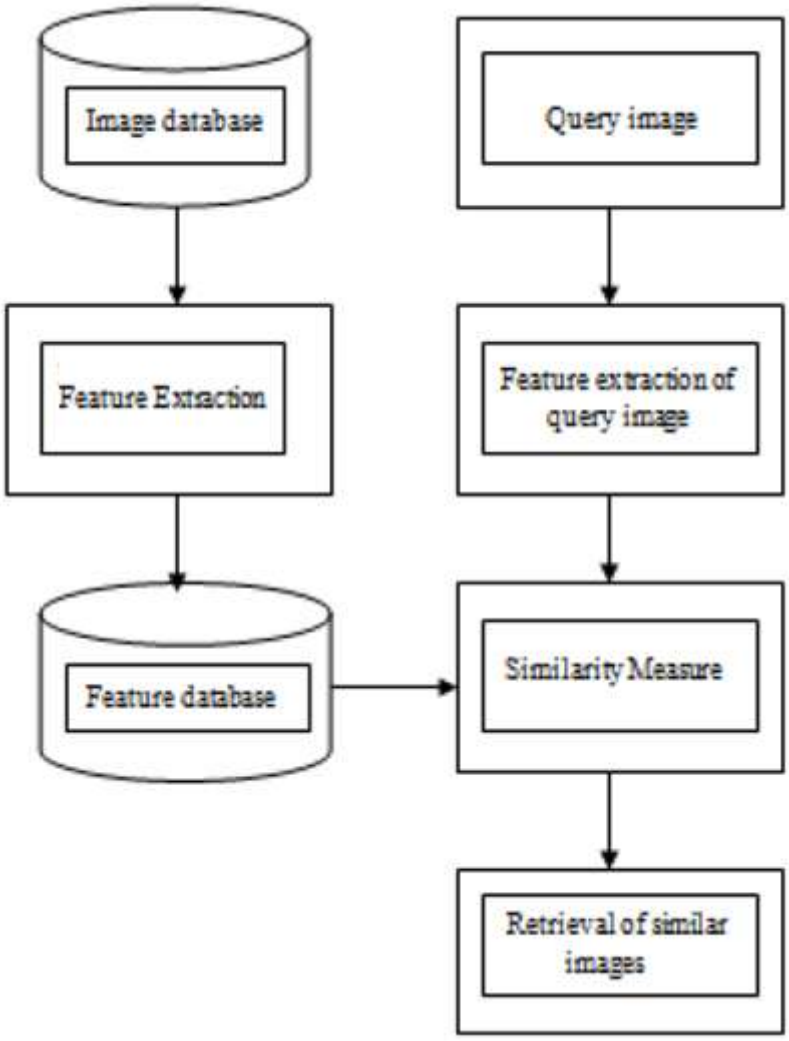

Figure 1: General architecture of the CBIR system.

Features that are widely used include spatial relationships, shape, color, texture. Choosing the appropriate feature extraction method contributes much towards the accuracy of QBIC systems. Shape does not specify the shape of the image instead it refers to a particular region of interest in the shape acquired by segmentation. Color feature extraction is a widely used technique since it does not depend on the size of the image.

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III. FEATURE EXTRACTION

In image processing, feature extraction is a special form of dimensionality reduction or it is a process of reducing the dimensions of an object. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction [8].

i. Color based Extraction

Image Color is widely used general visual image feature for QBIC system due to its invariance to image scaling, translation, and rotation. It is represented by its three color component values like red/green/blue (RGB), hue/saturation/value (HSV), Luv/Lab (luminance/chrominance values). The color features that are widely used for QBIC system are:

- Color histogram: Extensively used and most effective color representation with the distribution of the number of pixels for each quantized color bin located in three different color components.
- Color moments: Very compact color representations, with three low-order moments (mean, variance, and skewness) for each color component.
- Color coherence vectors (CCVs): Incorporating spatial information into the color histogram.
- Color correlogram: A color descriptor characterizing both color distributions of pixels and the spatial correlation of pairs of colors.
- HDS-S (hue/diff/sum–structure): Color structure descriptor for capturing local color image structure based on MPEG-7 HMMD (hue-min-max-difference) color space.

ii. Texture based Extraction

Texture is a powerful visual feature widely used in pattern recognition and computer vision. It is used for identifying visual patterns with properties of homogeneity that cannot result from the presence of only a single color or intensity. The size of the image patch and the number of distinguishable gray-level primitives and the spatial relationships between them are all interrelated elements that characterize a texture pattern. Some commonly used texture features are [9]:

- Co-occurrence matrices, with 14 texture descriptors for capturing the spatial dependence of gray levels.
- Tamura features, with six visual texture components designed in accordance with psychological studies of the human perception of texture.
- Run-length matrices, for quantifying the coarseness of texture in specified directions.

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- Wavelet transform coefficients, representing frequency properties of texture patterns, including pyramid-structured and tree-structured wavelet transform.
- Gabor filters, as orientation and scale tunable edge and bar/line detectors.
- Wold decomposition, providing perceptual properties with three components: harmonic (repetitiveness), evanescent (directionality), and in-deterministic (randomness).
- Markov random Weld (MRF).
- Fourier power spectrum.
- Fractal dimension.
- Shift-invariant principal components analysis (SPCA).

iii. Shape based Extraction

Shape can be used to identify an object/region as a meaningful geometric form. Shape features in an image are normally represented after that image has been segmented into objects or regions.
QBIC based on shape features is considered to be one of the most challenging tasks and has usually been limited to specific applications where objects or regions are readily available [10].
Shape representation techniques of an object classified into two broad categories: (a) boundary based and (b) region based approaches. Boundary based approaches work on the outer boundary of the shape. The shape descriptors in this category include:

- Fourier descriptor, which describes the shape of an object with the Fourier transform of its boundary.
- Turning functions, for comparing both convex and concave polygons.
- Finite element method (FEM), with a stiffness matrix and its eigenvectors.
- Curvature scale space (CSS).
- Chord-length statistics.
- Chain encoding.
- Beam angle statistics (BAS).
- Wavelet descriptor.

Shape descriptors generally used in region based approaches are:

- Invariant moments, a set of statistical region-based moments.
- Zernike moments.
- Generalized complex moments.
- Morphological descriptors.

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IV. SIMILARITY MEASURE

The QBIC process is used for general applications like recognizing patterns biometric data. We need to compare two images and check whether they are similar or they match or not. To compute this, it is required to have certain techniques by which one can statistically evaluate if two images are similar or not. It is for this reason that similarity measurement is done. Once we extract a set of features, we need compare the extracted feature for similarity for; it is believed that if good sets of features are extracted, the similarity between 2 images is given by how close the extracted features are of the two images.

Euclidean Distance

The Euclidean distance is mostly used because of its simplicity. The smaller the distance, the more similar the image is. The Euclidean distance between two points T=(t1, t2,…tn) and Q=(q1, q2,…qn), in Euclidean n-space is given as Sqrt(Sum((ti-qi)2)).

Manhattan Distance

The Manhattan distance measure is given by

$$D_M(q,i) = \sum_{j=1}^{n} | f_{qj} - f_{ij} |$$

Where DM (q, i) is the Manhattan distance between the feature vector of the query image and every image in the database. fq and fi are normalized feature vectors for the query image and database image respectively, and n is the number of dimensions of both fq and fi.

V. APPLICATIONS

The increasing use of images in miscellaneous application areas has led to vast image archives that require management and retrieval of effective image data. The various applications of QBIC system are given as [11]:

Crime prevention

Rule enforcement agencies have maintained large database of visual evidence like past suspects facial photographs, fingerprints and shoeprints. By the use of this system, they can compare evidence from the scene of the crime for its similarity to records in their database.

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Military/Defense

Military applications of imaging technology are probably the best-developed. Recognition of enemy aircraft from radar screens, identification of targets from satellite photographs, and provision of guidance systems for cruise missiles are known examples. Many of the surveillance techniques used in crime prevention could also be relevant to the military field.

Intellectual property

Trademark image registration, where company mark/logo is compared with existing marks/logo to ensure that there is no replica, has been a prime application area for CBIR. Copyright protection is also a potentially important application area.

Fashion and interior design

The designer has to work within externally imposed constraints like choice of materials. The ability to search a collection of fabrics to find a particular combination of colour or texture is increasingly being recognized as a useful aid to the design process. Attempts have been made to use general purpose CBIR tool for specific tasks like colour matching of items from electronic versions of mail order catalogues and identifying textile samples bearing a desired pattern but no commercial use appears to be made of this at present.

Journalism and advertising

Newspapers as well as stock shot agencies maintain database of still photographs to demonstrate articles or advertising copy. This database can often be extremely large and expensive to maintain if detailed keyword indexing is provided. Broadcasting corporations are faced with an even bigger problem having to deal with millions of hours of archive video footage, which are almost impossible to annotate without some degree of automatic assistance.

Medicine

In medicine, doctors when examining x-rays, magnetic resonance imaging or ultrasounds scans need tools to provide them easy access to other similar cases. New applications can be created to overcome barriers in the field of ophthalmology, to help blind people in the visualization of objects and obstacles.

VI. CONCLUSION

In this paper, we give the brief overview of QBIC system. The techniques used for the system and along with similarity measure. The applications of the QBIC system are also discussed in this paper. The need for efficient technique to retrieve images from large dataset becomes essential due to tremendous growth in volume of images as well as the widespread use of World Wide Web. In comparison to traditional text-based approaches that performed retrieval only at a conceptual level, the automatic CBIR techniques support full retrieval by visual content or properties of images.

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REFERENCES

1. M.Eisa, I.Elhenawy, A.E.Elalafi and H. Burkhardt, "Image Retrieval based on Invariant Features and Histogram Refinement", ICGST Int. Journal on Graphics, Vision and Image Processing (GVIP) , Special Issue on Image Retrievaland Representation, Vol. 6, Year 2006, pp. 7-11.
2. Zachary J M, "An Information Theoretic Approach to Content Based image Retrieval", Louisiana State University and Agricultural and Mechanical College, Phd, Thesis, pp. 45-62, 2000.
3. S.Sural, G.Qian and S.Pramanik, "A Histogram with Perceptually Smooth Color Transition for Image Retrieval", Proc. Fourth Int. Conf. on CVPRIP, Durham, 2002.
4. A. W. M. Smeulders, "Content-based image retrieval at the end of the early years", IEEE Trans. PAMI. 22(12):1349–1380, 2000.
5. V. Castelli and L. D. Bergman (Eds.). Image Databases: Search and Retrieval of Digital Imagery. John Wiley & Sons, 2002.
6. H. Muller, "A review of content-based image retrieval systems in medical applications—Clinical benefits and future directions.", Int. J. Med. Info. 73:1–23, 2004.
7. Ying Liu, Dengsheng Zhang, Guojun Lu,Wei-Ying Ma, "A survey of content-based image retrieval with high-level semantics", Pattern Recognition 40 (2007) 262 – 282.
8. Mehwish Rehman, Muhammad Iqbal, Muhammad Sharif and Mudassar Raza, "Content Based Image Retrieval: Survey", World Applied Sciences Journal 19 (3): 404-412, 2012.
9. Serdar Arslan, Adnan Yazıcı, Ahmet Saçan, Ismail H. Toroslu, Esra Acar, "Comparison of feature-based and image registration-based retrieval of image data using multidimensional data access methods" , Data & Knowledge Engineering 86 (2013) 124–145.
10. Sanchita Pange and Sunita Lokhande, "Image Retrieval System by using CWT and Support Vector Machines", Signal & Image Processing : An International Journal (SIPIJ) Vol.3, No.3, June 2012.
11. S. Singaravelan, D. Murugan, K. Rajalakshmi, G. Santhiya, "Refining CBIR Using Rule Based KNN", Journal of Remote Sensing Technology May 2013, Vol. 1 Issue 1, PP. 13-19.