IMAGE RETRIEVAL SYSTEM BASED ON SKETCHES

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Abstract

In digital image processing domain CBIR (Content Based Image Retrieval) is an important research area. Many existing image retrieval tools such as Google Images and Yahoo! Image retrieve images based on the textual annotations given associated with images. With respect to these real time tools, the annotations are given with the help of keywords and text based search methods are used to retrieve the images later. The performance of such real world systems is not satisfactory. The purpose of a CBIR system is to take an image as input and retrieve most relevant images from database based on the color, texture and even shape of the given input image. This paper aims at discussing and developing a new CBIR system that not only works with input images but also sketches. Before processing such query pre-processing is done to fill the gap between the real world images and the hand drawn sketches. We studied concepts like SIFT, HOG and EHD. Experiments are done on two sample databases. The empirical results revealed that the proposed SBIR (Sketch Based Image Retrieval) is useful and can be used in real time applications.

Index Terms – CBIR, SBIR, digital image processing, pre-processing

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1. INTRODUCTION

With advent of computers and the development of IT paved the way to process large volumes of data in a short span of time. However, the digital image processing or searching image database for a given image has become an essential task in many computer applications. For instance in hospital, doctor has to make search with an example. In other words this kind of search is also known as CBIR (Content Based Image Retrieval). In traditional CBIR, end user gives an image as input and gets output from the designated folder. The results include the images that match visual features of given input image. The Internet technology and image compression techniques have led to large scale storage and retrieval of images in a convenient fashion. Annotated Images can be searched. However, that is not correct approach with respect to database containing huge amount of records in the form of images. To deal with such database, a novel approach is required. This approach is named "CBIR", the content based image retrieval. Human beings can easily remember visual qualities of images or any objects for that matter. As human being is a type and remembers visual qualities of images easily. Using textual information images can be retrieved by using annotations or keywords.

Later on content based image retrieval has become very prominent as it is intuitive to end users. This is of two types. The input image can be given as colored image or a hand drawn sketch. When the user has drawing area that can be utilized in order to draw sketch and give it as input to the proposed application. In criminal investigation, CBIR systems play an important role. The identification of images, sketches is supported by CBIR systems. Such applications are found in [1], [2] and [3]. While searching research circuits graph from a big image database is another area of research [4]. For this to happen, user is supposed to draw a circuit sketch so as to obtain relevant images from database. Thus CBIR has been changed to SBIR (Sketch – Based Image Retrieval). This kind of work was introduced in QBIC [5] and VisualSEEK [6]. Images are classified into grids and the texture features and color are decided in the grids. The drawback of these methods is that they are not really invariant opposite rotation, translation and scaling. Fuzzy logic with neural networks is logic while image features [7].

2. PROPOSED SYSTEM

The proposed system has certain components as part of the architecture. It does mean that the proposed architecture includes some sub systems. They are displaying subsystem, preprocessing

sub system, feature vector generating sub system and retrieval sub system. Apart from these another important component is database management system. The displaying sub system is responsible to present images and also let the user provide a hand drawn image or sketch as input to the SBIR. It provides an image (sketch) to preprocessing sub system. The preprocessing sub system is responsible to take the image and apply transformation technique that improves the input image and reduced the gap between the images in database and the input image. This is a phase where important features that are not with sketch image are associated so as to make query processing easier. Once pre processing is completed, the processed image is given as input to the feature vector generating sub system that extracts feature vector and the feature vector is given to retrieval sub system. The retrieval sub system then interacts with database and retrieves images that match the input image. Then the result is shown in the displaying sub system. This process can be continued until the required images come in the query process. The database management system is responsible to store images on which queries are made. The queries are essentially content based. In this case, that is sketch rather than a photograph

Preprocessing

As part of pre-processing activities involved is scaling, histogram equalization, color quantization, canny edge detector, morphological opening, and distance transform. The hand drawn sketch and images or photographs stored in databases are having much difference. This has to be filled using pre-processing. The preprocessing starts with scaling of input image. After scaling, the image is subjected to histogram quantization and color quantization. The result is given to canny edge detector. Then the resultant image is subjected to morphological opening and finally distance transformation is carried out. The result of this is an image which is improved by transforming it into some form that can be used to search the images in the database.

3. EXPERIMENTS

The proposed system has been implemented using an application that facilitates end user to give sketch as input and get images that matches it to be retrieved and presented in a user-friendly manner.

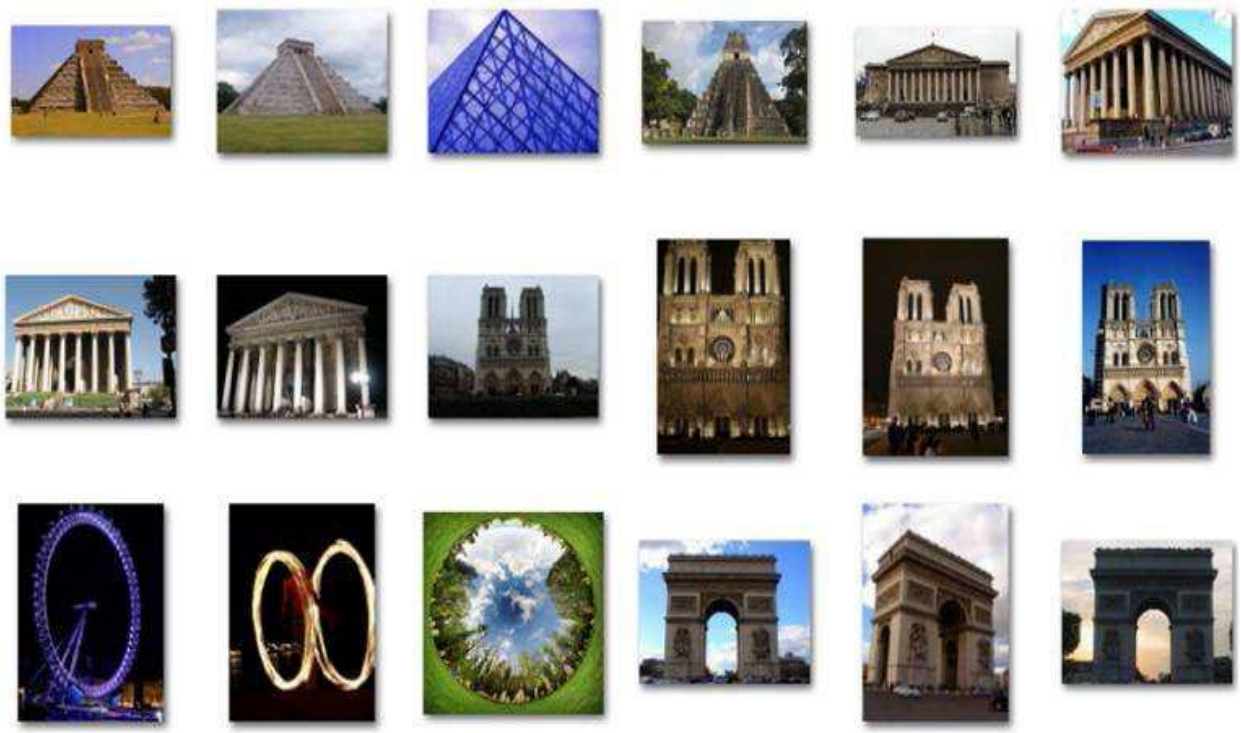
Environment

The environment used for experiments include a PC with 2 GB RAM, 2.X GHz processor with Windows 7 OS. The software used is JSE 6.0, and NetBeans IDE.

Image DB

Flickr 160 database contains freely available images. They are downloaded from Internet. The images are used in the experiments in this paper. Sample images of Flickr database are shown in fig. 4.

Fig. 4 – Sample images from Flickr 160 database



Microsoft Research Cambridge Object Recognition Image Database is also used in the experiments of SBIR. Some of the sample images of this database are shown in fig. 5.

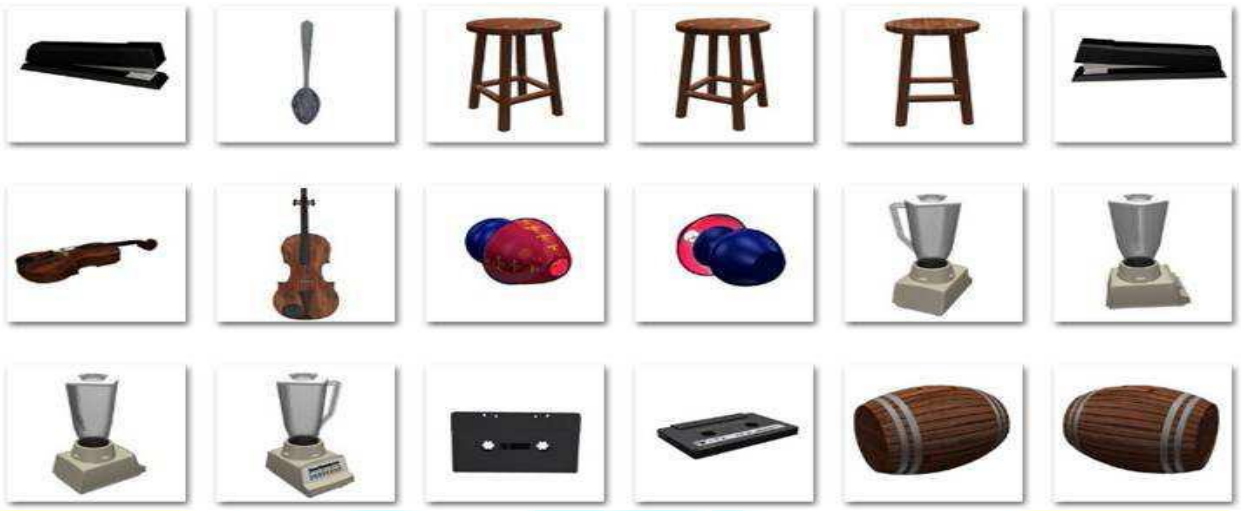


Fig. 5 – Sample images from Microsoft Research Image Database

Some wang database images clustered by color are in the experiments. These images are not like other images as they are clustered by color.

Fig. 6 – Sample images from

Prototype Application

The proposed SBIR has been implemented using SWING API of Java programming language. The SWING API is used to build only graphical user interface. The image processing API provided by Java community is used to implement the functionality for SBIR. The application

has been tested with various image databases available over Internet and as mentioned in the prevision sections.

Evaluation and Results

The performance of the proposed system is evaluated using a well known technique known as precision and recall. Precision and recall is well known bench mark approach followed to know the accuracy of CBIR/SBIR. The formulae for precision and recall are:

precision = relevant hits (Q) / all hits (P) (1)

recall = relevant hits (Q) / expected hits (Z) (2)

The precision gives information with respect to relative effectiveness of SBIR/CBIR while the recall gives information about the absolute accuracy of the proposed CBIR/SBIR. Fig. 6 shows the effect of threshold value change using EHD method.

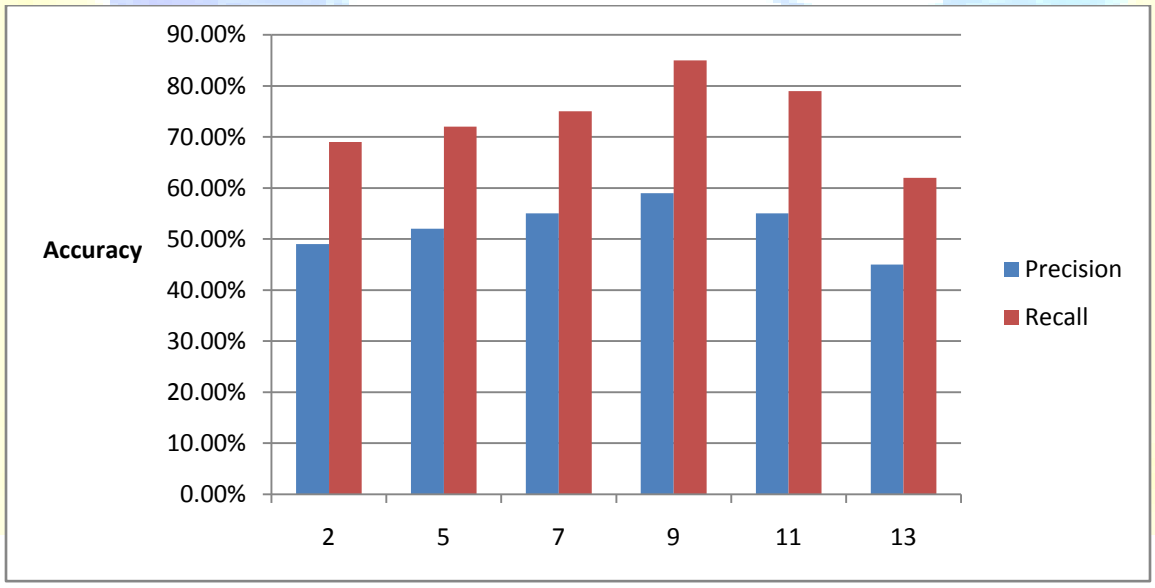


Fig. 1 - Effect of block size change using EHD method. The threshold is constant

As seen in fig. 1, the precision and recall results are presented using different threshold values. The effect of threshold value changes are shown in terms of precision and recall values plotted in the graph.

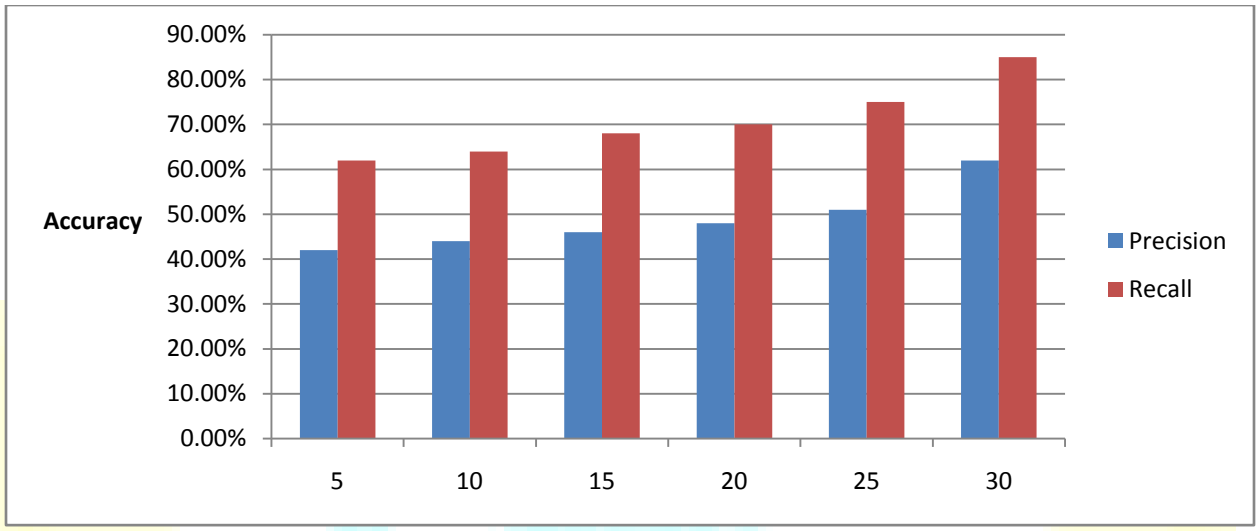


Fig. 2 - Effect of block size change using EHD method. The threshold is constant

As can be seen in fig. 2, the precision and recall values are plotted that reflect the effect of changes made to block size.

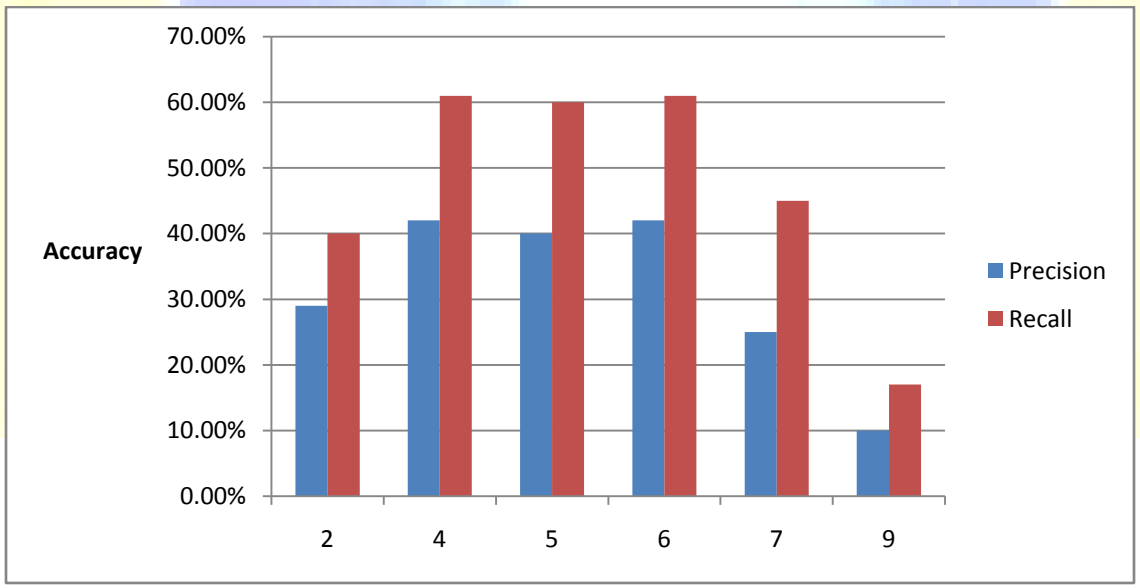


Fig. 3 - Fig. Effect of block size change using HOG method. The number of bins is constant 9.

As seen in fig. 3, the effect of block size change using HOG with number of bins 9 is visualized in terms of precision and recall values.

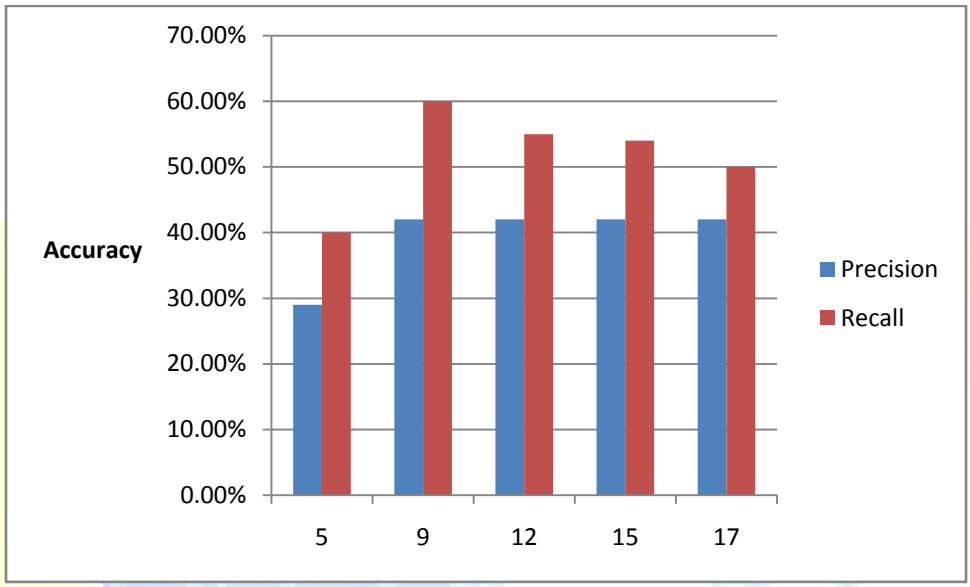


Fig. 4 – Precision and recall values for different number of bins

As seen in fig. 4, the effect of block size change using HOG with number of bins 9 is visualized in terms of precision and recall values.

4. CONCLUSION

This paper presents the design and implementation of a CBIR that allows sketches as input and retrieves images from image databases. Two image databases are used in experiments. The proposed CBIR is known as SBIR (Sketch Based Image Retrieval). The drawn image can't be directly compared with images present in database. For this purpose pre-processing is introduced. The pre-processing is responsible to fill the gap between the hand drawn rough sketch and actual image in the database. Once the gap is filled, the sketch image can be used to make queries. In pre-processing step actually a distance transform mechanism is applied. The experimental results revealed that the proposed SBIR is effective and can be used in real time applications.

REFERENCES

[1] A.K. Jain, J.E. Lee, and R. Jin, "Sketch to photo matching: a feature-based approach," Proc. SPIE, Biometric Technology for Human Identication VII, vol. 7667, pp. 766702–766702, 2010.

[2] A.K. Jain, J.E. Lee, R. Jin, and N. Gregg, "Graf_ti-ID: matching retrieval of graf_ti images," ACM MM, MiFor'09, pp. 1–6, 2009.

[3] A.K. Jain, J.E. Lee, R. Jin, and N. Gregg, "Content based image retrieval: an application to tattoo images," IEEE International Conference on ImageProcessing, pp. 2745–2748, November 2009

[4] Gy. Gy¨or¨ok, "Embedded hybrid controller with programmable analog circuit," IEEE 14th International Conference on Intelligent Systems pp. 59.1–59.4, May 2010.

[5] M. Flickner, H. Sawhney, W. Niblack, J. Ashley, Q. Hiang, B. Dom, M. Gorkani, J. Hafner, D. Lee, D. Petkovic, D. Steele, and P. Yanker, "Query by image and video content: the QBIC system," IEEE Computer, vol. 28,pp. 23–32, 2002.

[6] J.R. Smith, and S.F. Chang, "VisualSEEK: a fully automated contentbased image query system," ACM Multimedia '96, pp. 97–98, 1996.

[7] D.G. Lowe, "Distinctive image features from scale-invariant keypoints,"International Journal of Computer Vision, vol. 60, pp. 91–110, 2004.

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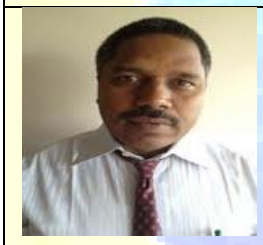	Dr.R.V.Krishnaiah is working as Principal at DRK INSTITUTE OF SCINCE & TECHNOLOGY, Hyderabad, AP, INDIA. He has received M.Tech Degree EIE and CSE. His main research interest includes Data Mining, Software Engineering.