Development of Biometric Security System using CBIR

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Abstract— The project focuses on the Content-Based Image Retrieval (CBIR) technique for biometric security systems. The demand for efficient and effective tools for retrieval of images has increased significantly because of the growing of image databases at a faster rate. Content-Based Image Retrieval systems have become very popular for image retrieval of digital images from a very large database by browsing or searching. As the years have passed by, the advances in biometric technology have been gaining importance increasingly due to its reliability and efficiency in real world applications. The previous systems were based on text annotation of images where every image was given a keyword. The current systems are based on three distinct features of an image: colour, texture and shape which can be integrated into biometric security for effective security systems.

Key words: CBIR, Biometric Security

I. INTRODUCTION

A. Overview

The internet provides people to create image databases, process and store. This has lead into increasing need to manage and search images. Therefore, finding efficient image retrieval mechanisms from large resources has become a wide area of interest to researchers. Image retrieval method is a technique for searching and retrieving images from a large database of digital images. In today's modern age commerce, hospitals, crime prevention, surveillance, engineering, architecture, journalism, fashion and graphic design, government, academics, and historical research use images for efficient services. A large collection of these images is referred to as image database. An image database is a system where image data are integrated and stored. Image data include the raw images and information extracted from images by automated or computer assisted image analysis. Image retrieval is the problem encountered when searching and retrieving images that are relevant to a user's request from a database. Development of methods which would increase retrieval accuracy and reduce retrieval time is the main challenges in CBIR. "Content-based" means that the search analyzes the contents of the image rather than the metadata such as keywords, tags, or descriptions associated with the image. The term "content" in this context might refer to colours, shapes, textures, or any other information that can be derived from the image itself. CBIR is desirable because searches that rely purely on metadata are dependent on annotation quality and completeness. Early techniques were not generally based on visual features but on the textual annotation of images. The images were first annotated by text and then searched using text based approach. However, in many situations, text annotation scheme is inefficient. For the huge image data, the vast amount of labor required in manual annotation. Also, describing every visual feature within the images is very time consuming and difficult. So instead of manual annotations by text based keywords, images are indexed by their own visual features such as colour, texture, shape etc. The difficulties in this approach are usage of the three features in extraction for the biometric security. Hence CBIR is used for this Biometric Security System using CBIR approach since it deals with the co-relation of histogram, texture filters and shape moment invariants.

II. LITERATURE SURVEY

The content of an image is related to the visual features of an image, for example, colour, texture and shape. These contents can be extracted, and statistical methods can be used to find the similarity measures between the query image and the database image. IBM has various versions of QBIC system [2] which is widely used for image retrieval purposes; the users can search the image by identifying certain characteristics of the image. QBIC uses regional segmentation function to segment the image into different regions, but the previous version was based on the colour histogram. The main disadvantage of this system is that it is sensitive to the variation of illumination.

Another system known as Simplicity [3] is used to segment the image into regions/blocks and extracts features from each block. The system uses K-means algorithm for clustering and uses six features. Three of them are colour features extracted from LUV colour model, and other three represent energy features that are used for wavelet transform. The values that are assigned to regions are used for distance function. The system accommodates all the regions equally.

CIRES (Content-Based Image REtrieval System) [4] a retrieval system, developed by Qasim Iqbal, extracts the useful features from image such as structural, textural and colour features. The colour histogram method is used to extract the colour features that are used for colour comparison. The Gabor filter is used to extract texture feature. Lastly, image structure such as line junction and line crossing are extracted from the image to represent the structural image. The image retrieval process is carried out based on the weighted linear combination using structural, texture and colour histogram values. The values of the linear combination in the CIRES system are predefined.

A retrieval system known as Blob world [5], uses segmentation process to divide the image into different regions and then these regions are used as image query. The system searches images based on the region that have a similar relationship with other regions as found in the image query. This system uses colour and texture features for image retrieval.

The consumer electronics control system using moment invariants for hand gesture recognition has been proposed, to interpret the user hand gesture [6] into predefined commands to control one or many devices

simultaneously. The system has been tested and verified under both incandescent and fluorescent lighting conditions. Using the real-time system, the researchers were able to achieve good results.

In a system used for Gray Scale Morphological Operations [7] for Image Retrieval, features such as shapes and texture are extracted from the query and reference images and are compared using Euclidean distance. The morphological operation with spatially-variant structuring element is used for feature extraction.

After the feature extraction process, the feature vectors are calculated by applying Block Truncation Coding (BTC) [8] over the feature extracted images. It improves the performance of image retrieval with reduced computational complexity for query execution. Based on HSV colour model, a method of object-based spatial colour feature (OSCF) [7] [8] for colour image retrieval is proposed. Firstly, objects are extracted from colour, and then image features are represented by objects in it. Colour and spatial colour feature are adopted for description of objects. The new method only pays attention to main central objects. The author proposed a novel fuzzy approach to classify the colour images based on their content, to pose a query regarding natural language and fuse the queries based on neural networks for fast and efficient retrieval.

III. PROBLEM STATEMENT

The image retrieval method is searching for a tag that would match the descriptive keyword that describes the image. This method is called the Textual Annotation. The retrieval of images based on their content is called Content Based Image Retrieval. The CBIR method gives the results as far more accurate than textual annotation method. The goal of this method is to retrieve relevant images from a large number of databases that matches to the query image or input image. The image retrieval process involves Colour, Texture and Shape Feature Extraction. These three modules use the relevant algorithms to find the features of images. Using these features, similar images are retrieved from the database by using Similarity Measure.

IV. OBJECTIVE

The main objective of Content Based Image Retrieval (CBIR) system is to retrieve images from large database based on query image. It also includes-

1) To develop an improved method for visual similarity search in CBIR.
2) To use proximity function that effectively measures similarity between images.
3) To experimentally prove that the proposed method outperforms other retrieval methods.

V. SYSTEM ARCHITECTURE

The system architecture is a conceptual model that defines the structure, behavior, and more views of a system. The general architecture of CBIR system is shown in figure below. For the given image database, features are extracted first from individual images. The features can be visual features like colour, texture or shape. The extracted features are described by feature vectors. These feature vectors are then stored to form image feature database. For a given query image, similar feature extraction is done, and it forms feature vector. This feature vector is matched with the already stored vectors in image feature database.

The distance between the feature vector of the query image and those of the images in the database is then calculated. The distance of a query image with itself is zero if it is in database. The distances are then stored in increasing order and retrieval is performed with the help of indexing scheme. Feature extraction techniques affect the retrieval rate of the CBIR system. In this project, various popular algorithms for feature extraction are considered. A feature vector is a set of numeric parameters describing an image. The majority of such vectors represent one image feature, such as colour, texture, or shape of the object. Biometric Security System using CBIR System Design.

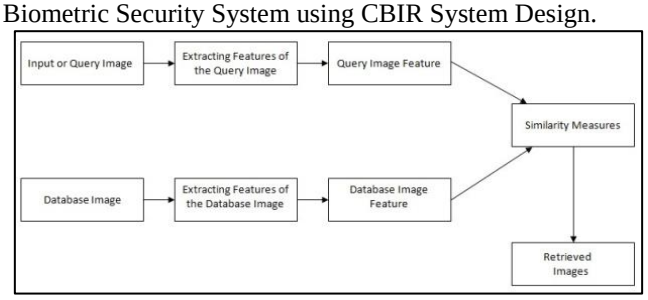

Fig. 4.1: System Architecture of CBIR

VI. MODULE DESCRIPTION

A. Colour Histogram

For the colour feature, two types of histogram based methods are integrated using a colour image histogram and an intensity image histogram. For the colour image, RGB colour model is used that is based on the Red, Green and Blue components. The histogram method is widely used for visual feature representation due to many advantages in image retrieval such as its robustness, effectiveness, implementation and computational simplicity. Every pixel in an image is basically represented as a point in the colour model such as RGB. This colour point is represented by three values that hold the information of color. The image is represented by its histogram. The colour histogram helps to find the images which contain similar colour distribution. It is achieved by measuring the similarities through computing distance between two histograms.

B. Texture retrieval

The second element of our proposed approach is the texture feature. For this purpose, Gabor wavelet algorithm is used. Texture representation based on the Gabor wavelet is described in this section. Wavelets are extensively used in image processing application such as image compression, image enhancement, and image reconstruction and image analysis. The wavelet transformation provides a multi-scale decomposition of animage data. Two-dimensional Gabor filter is a group of wavelets. Many researchers have used the Gabor wavelet filters to extract texture features from an image. The Gabor filter is normally used to capture energy at a certain scale and at a certain orientation. Scale and orientation are two most important and useful features that are used for texture analysis. Therefore, in the proposed approach, Gabor method is used to extract texture features of an image that are considered very important for image retrieval purposes. The Gabor filters also known as scale

and rotation invariant. A 2D Gabor function consists of a sinusoidal plane wave of some orientation and frequency, modulated by a 2D Gaussian.

C. Shape retrieval

The third main element is shape feature. Shape feature plays a vital role in object detection and recognition. Object shape features provide robust and efficient information of objects to identify and recognize them. Shape features are considered very important in describing and differentiating the objects in an image. Shape features can be extracted from an image by using two kinds of methods: contour and regions. Contour based methods are normally used to extract the boundary features of an object shape. Such methods completely ignore the important features inside the boundaries. Region-based methods that rely on shape descriptors are normally able to extract both kinds of features: boundary and region. Region-based methods normally use moment based theory such as Hu moments, Legendre moments and Zernike moments.

These provide valuable information to represent the shape of an image for feature extraction. The existing literature shows the importance of the shape features for image retrieval purposes.

Region-based image retrieval methods firstly apply segmentation to divide animage into different regions/segments, by setting threshold values according to the desirable results. On the other hand, the boundary of an image can be obtained by applying any edge detection method to an image. We can use Hu moment invariant algorithm for shape features. The Hu moment invariants algorithm is known as one of the most successful techniques for extracting image features for object recognition application (such as hand gesture, object, face expression). It is a widely-used algorithm for image classification.

VII. CONCLUSION AND SCOPE FOR FUTURE ENHANCEMENT

A. Conclusion

The proposed approach is based on three features of an image: colour, texture and shape that produce a relevant result for the given input image. The use of genetic algorithm and standard measurement of Precision and Recall increases the accuracy of the retrieved image. The proposed approach demonstrates the effectiveness of the algorithms and accuracy of retrieved image better than previous systems which uses either one or two image features. The database used here is a normal image database consisting of various categories of images; this is used to check the reliability of the approach and this proves to give a better result than the previous systems. The CBIR systems are used in various fields, the purpose of this approach is to show an increase in the retrieval rate.

B. Future Scope

This area can be further explored and the techniques can be finely tuned with or without involving some pre or post processing works for increasing the retrieval efficiency. The fine-tuning may be done adding some shape and colour information in well-determined form with the already existing texture information to suit the application. This work can be further extended to some domain-based applications such as finger print recognition, retina identification, and object detection etc for large image database. Since texture analysis consumes a considerable amount of time for feature extraction, there is as cope for optimization also. Future work entails applying the proposed method to real-time surveillance data.

VIII. SCREENSHOTS

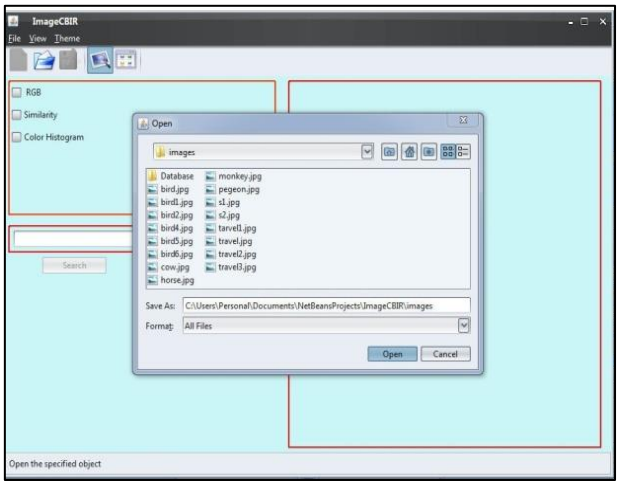

Fig. 8.1: Screenshot Showing the First Step of Indexing

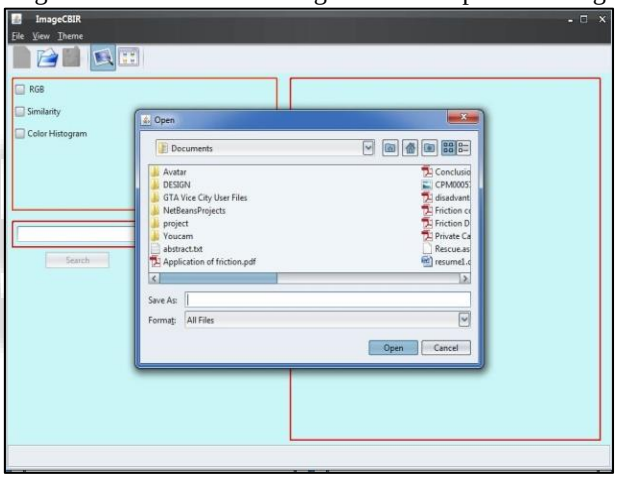

Fig. 8.2: Screenshot showing the Browsing of any Image to be searched in the Database

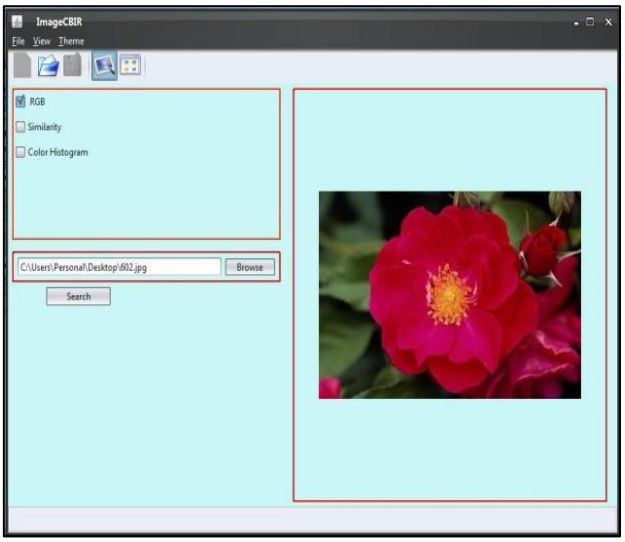

Fig. 8.3: Screenshot showing that the Searching for an Image is done based on RGB

Fig. 8.4: Screenshot Displaying the Similar Images from the Database

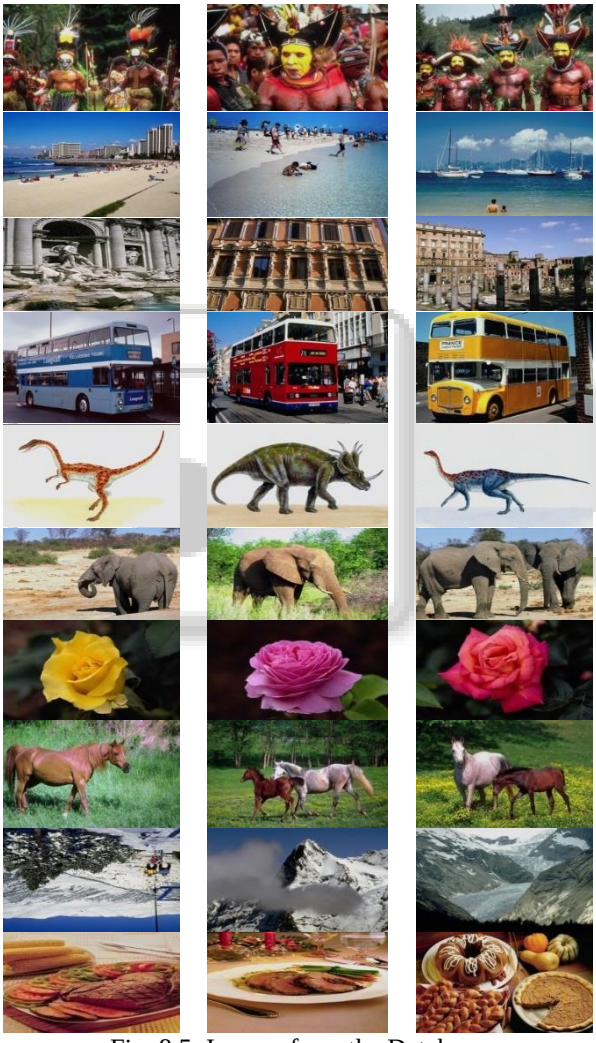

Fig. 8.5: Images from the Database

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