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A STUDY ON IMAGE TRANSFORMATIONS IN VIEW OF CONTENT BASED IMAGE RETRIEVAL

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Abstract : Image Retrieval is very one of the biggest task in the recent years. It is widely used in many real time databases to retrieve related images in various fields like medicine, military, online shopping etc. This paper offers with using radon transform followed by PCA and LDA techniques for image retrieval is called as Combined Radon Space Features Set (CRSFS). Caltech 101 database image sets used in this paper. The correct direction is select means the computation time and complexity of operation is less to achieve good retrieval rate. Due to tremendous technological advancements, need of image information systems has became an important issue, since visual media requires large amounts of memory and computing power for processing and storage, there is a need to efficiently index and retrieve visual information from image database. In recent years, the digital document image has become an important means of enhancing information management. Content-Based Image Retrieval (CBIR) is a challenging task which retrieves the similar images from the large database. Most of the CBIR system uses the low-level features such as colour, texture and shape to extract the features from the images. In so many works available, interest points are used to extract the similar images with different view and accuracy. In this paper, the same is tried to retrieve with the use of SURF. SURF is fast and robust interest points detector which is used in many computer vision applications and other methodologies available for the same have been discussed.

Index Terms : *Content based Image Retrieval (CBIR), Speed up Robust feature(SURF), image databases, Wavelet transform (WT).*

I.INTRODUCTION

Recent years have seen a rapid increase in the size of digital image collections. Every day, in the both military and civilian equipment generates Giga-bytes of images. However, cannot access or make use of the information unless it is organized so as to allow efficient searching, browsing, and retrieval. The image retrieval has been a very active research area since the 1970s, the thrust from two major research communities, in database management and computer vision system. These two research communities study image retrieval from different angles, a one being text-based and the other visual-based scheme. The text-based image retrieval can be traced back to the late 1970s. A very popular framework of image retrieval then was to first annotate the images by text and then use text-based base management systems to perform image retrieval method. Many advances, such as multidimensional indexing, data modelling, and query evaluation, have been made along this research area. There exist two major difficulties, especially when the size of image collections is large. The one is the vast amount of labour required in manual image annotation. Other difficulty, which is more essential, and results from the rich content in the images and the subjectivity of human perception. For the same image content based different people may perceive it differently. Gabor filter is widely adopted to extract texture features from the images for image retrieval, and has been shown to be very efficient. Yong-Hwan Lee, have shown that image retrieval using Gabor features outperforms that using wavelet transform (WT) features, and multi resolution simultaneous autoregressive model features. Hence, in our proposed method, and Gabor filter is used for extraction of texture features.

The feature of vision can be classified by semantic hierarchy into middle level feature and low- level feature. Low-level feature includes color, texture and inflexion. Middle level involves shape description and object feature. Content based Image Retrieval systems try to retrieve images similar to a user-defined specification or pattern (e.g., shape sketch, image example). Their goal is to support image retrieval based on content properties (e.g., shape, color, texture), usually encoded into feature vectors. One of the main advantages of the CBIR approach is the possibility of an automatic retrieval process, instead of the traditional keyword-based approach, which usually requires very laborious and time-consuming previous annotation of database images.

II. RELATED WORK

The many researchers have been done significant work in the field of Content-based Image Retrieval problem some of the work is described in this paper.

Bongani Malinga, [1] in this paper, presents two image clustering techniques to automatically group color images that correlate with semantic concepts. In this paper work goes towards satisfying the ever growing need for techniques that are capable of automatically generating semantic concepts for images from their visual features. The first technique is based on the localized histogram information while the second approach uses global histogram information to characterize the images. An adaptation of k-means clustering using a non-Euclidean similarity metric was applied to discover the natural patterns of the data in the low-level feature space. In the second approach, global image histograms were derived and Principal Component Analysis (PCA) was used to reduce the size of the image descriptor matrix. This means that images clustered or retrieved by using the global color histogram may not be semantically related even though they might share similar color distributions. The using local histogram approach improves this situation but combining color histograms with other image features such as shape and texture should improve the overall image clustering performance.

S. Mangijao Singh, et.al, [2], done study in this paper, are investigate of content based image retrieval (CBIR). Many indexing techniques are based on global feature distributions. these global distributions have limited discriminating power because they are unable to capture local image information. Propose a content-based image retrieval method which combines color and texture features. As its color features, image is divided horizontally into three equal non-overlapping regions. In each region in the image, an extract the first three moments of the color distribution, from each color channel and store them in the index i.e., the assign weights to each feature respectively and calculate the similarity with combined features of color and texture using Canberra distance as similarity measure. To improve the discriminating power of color indexing techniques, in encode a minimal amount of spatial information in the index by extracting features from the regions of image divided horizontally into three equal non overlapping regions. The experiment also shows that only color features or only texture features are not sufficient to describe an image. In considerable increase in retrieval efficiency when both colorfeatures and texture features are combined.

Suchismita Das, et.al, [3], in this paper, proposed the content based image retrieval using wavelet and curvelate transform. This paper implements a CBIR using different feature of images through four different techniques, two were based on analysis of color feature and other two were based on analysis of combined color and texture feature using wavelet coefficients of an image. One of the standard ways i.e. the color histogram was used in YCbCr color space and HSV color space. In this paper a color image retrieval system is illustrated, the novelty lies in the use of a fuzzy partition of the HSV color space and wavelet transformation of the fuzzified new image. For this purpose, we have investigated the texture analysis using several approaches. Contrast, the characteristics of the main MR methods, discrete wavelet, and discrete curvelet were discussed. The discrete curvelet transform has absorbed the advantages of both the color feature and wavelet while overcomes the disadvantages of both these scheme. From experimental results, curvelet texture features are found to be promising. Finally, we compared the curvelet content based image retrieval performance with that of the existing color based methods and wavelet based methods. This research has found that curvelet features outperformed the existing texture features in both accuracy and efficiency. Yong-Hwan Lee, et.al, [4], study in this paper, the content based image retrieval is one of the most fastest growing research area in this field of multimedia techniques. Proposed the content based image retrieval method that applies a weighted combination of color and texture and using wavelet transform scheme, based on the spatial-color and second order statistics, respectively. The simulation's performance in terms of average precision and Fscore using several image databases, and perform comparative analysis with existing methods such as MPEG-7. The experimental results of trials revealed that the proposed descriptor shows a significant improvement in retrieval effectiveness, an especially in multi-resolution image searches. This approach does require additional computing time and storage space in memory buffer in comparison to other methods such as histogram-based approaches. The key contribution of this paper lies in its use of a weighted combination of color and texture features to improve the performance of retrieval technique incorporating automated indexing for large image collections.

III.DIFFERENT IMAGE RETRIEVALTECHNIQUES

There are various techniques have been proposed to retrieve the image effectively and efficiently from the large set of image data in which some of the methods are described below:

Relevance Feedback: Every user‟s need will be different and time varying. A typical scenario for relevance feedback in content-based image retrieval is as follows [19]:

Step 1: Machine provides early retrieval results

Step 2: User provides opinion on the currently exhibited images based on the degree whether they are relevant or irrelevant to her/his request

Step 3: Machine learns the judgment of the user and again search for the images according to user query. Go to step 2

Gaussian Mixture Models:

Gaussian mixture models are one of the density models which includes a number of component Gaussian functions. These functions are combined with different weights to form a multi-modal density. Gaussian mixture models are a semi-parametric which can be used instead of non-parametric histograms (which can also be used to approximate densities). It has high flexibility and precision in modeling the underlying distribution of sub-band coefficients. Consider N texture classes labeled by n ∈N ≅{1,….N} related to different entities. In order to classify a pixel, neighborhood of that pixel must be considered. Then S´S sub-images blocks features can be computed assign classes to these blocks [20]. The set of blocks is represented by B. The neighborhood of a block b is called patch P(b). It should be defined as the group of blocks in a larger T.´T sub-image with b at its centre. Db is designated as the data associated to that block and Vb ∈ N be the classification of b. The classification can be done based on the following rule Equation (1):

v = argmax ÕPr(Db | vb = n) (1)

Thus, all the blocks in P(b) which has class n maximizes the probability of the data in P(b). It reduces computation time to classify the texture. The data Db linked with each block is denoted by the vector of features x. For each and every texture class, a probability distribution that represents the feature statistics of a block of that class must be selected. Thus the probability that obtained x will be a convex combination of M Gaussian densities Equation (2):

$P\ x\ pi\ ,\ \mu\ i = pi\ M\ i{=}1\ b\ x\ ,\ \mu\ i\ i$ (2)

where, $b\ x\ ,\ \mu i\ i$ is Gaussian of mean μi and Covariance Σ the parameters for a given class are thus $pi\ ,\ \mu\ i\ i\ i \in M$.

A GMM is the natural model which can be if a texture class contains a number of distinct subclasses. Thus by using Gaussian mixture model to retrieve the texture properties of the image gives desired accuracy.

Semantic template:

This technique is not so widely used. Semantic templates are generated to support high-level image retrieval. Semantic template is usually defined as the "representative" feature of concept calculated from a collection of sample images [8].

Wavelet Transform:

Wavelet transforms are based on diminutive waves, called wavelets, of varying frequency & limited duration. Discrete wavelet transform renovate the image in four different parts higher frequency part (HH), high low frequency part (HL), Low high frequency part(LH), lower part (LL) vertical parts is 1-level image decompositions then compute moments of all frequency part than store and use it as feature to obtain the images. Texture entropy and contrast, clumsiness are the mostly used properties. Statistical features of grey levels were one of the efficient methods to classify texture. The Grey Level Co-occurrence Matrix (GLCM) is used to extract second order statistics from an image. GLCMs have been used very profitably for texture calculations. From Grey Level Co-occurrence Matrix all the features are deliberated and stored into the database. The use of Grey Level Co-occurrence Matrix provides good result but it is in spatial domain so it is more error pron. CCH (Contrast Context Histogram) to find out the feature of the query image and other images stored in the database. CCH is in spatial domain and it presents global distribution. The MPEG Descriptors has been used like Edge Histogram Descriptor for texture. The Edge histogram differentiates edges according to their direction [20].

Gabor filter:

They are widely used for texture analysis because its similar characteristics with human perception. A twodimensional Gabor function g(x ,y) consists of a sinusoidal plane wave of some frequency and orientation (carrier), modulated by a two dimensional translated Gaussian envelope. Gabor Filter have one mother filter using that other filter banks are generated and their features are calculated and stored in database. Structure of different types of Edges [20].

Support Vector Machine:

Support vector machine is a supervised learning technique that analyzes data and identify pattern used for classification. It takes a set of input, read it and for each input desired output form [21] such type of process is known as classification, when if output is continuous than regression performed. For constructing maximum separating hyperplanes SVM maps input vector to a higher dimension feature space. Feature space refers to an input space which is reserved for measuring similarity with the help of kernel function. It is high dimension space where linear separation becomes very easier than input space [22]. In this, raw data is transformed into a fixed length sample vectors. Here are two terms which are used in feature space i.e. called feature values and feature vectors. The features of image is called feature values and these feature values presented the machine in a vectors is known as feature vectors. Kernel function used in the kernel method performing some operation such as classification, clustering upon different categories of data like text document, progression, vectors, group of points, image and graphs etc. it maps the input data into a higher dimension feature space because in this data could be easily separated or better structured [23]. There are some points in the feature space which are separated by

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some distance is called support vectors. It is the point between origin and that point and demonstrates the location of the separator. The detachment from the decision surface to the closet data point concludes the margin the classifier.

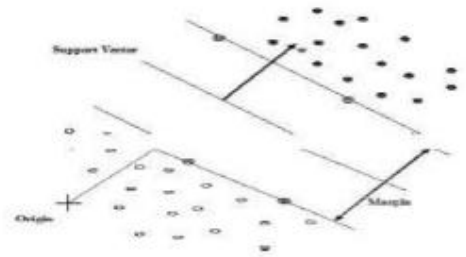

Fig. 3. Linear separating hyper-planes for two class separation.

IV. CBIR SYSTEM

Content-based retrieval uses the contents of images to represent and access the images from the large database. The typical content-based retrieval system is divided into two types: first is off-line feature extraction and second is online image retrieval. Content-based image retrieval architecture shown in figure: 1. Off-line stage, the system automatically extracts visual attributes of each image in the database based on its pixel values, stores them in a different database within the system called a feature vector database. Feature data also known as image signature or image features for each of the visual attributes of each image is very much smaller in size compared to the image database, the feature database contains a compact form of the images in the image database. The significant compression can be achieved using feature vector representation of image database over the original pixel. On-line image retrieval, the user submits a query image to the Content-based Image Retrieval(CBIR) in search of desired images. The similarities between the feature vectors of the query example and of the images in the feature database are then computed and ranked. The retrieval is computed through applying an indexing scheme to provide an efficient way of searching the image database. The ranks the retrieval results and then returns the images that are most similar to the query images.

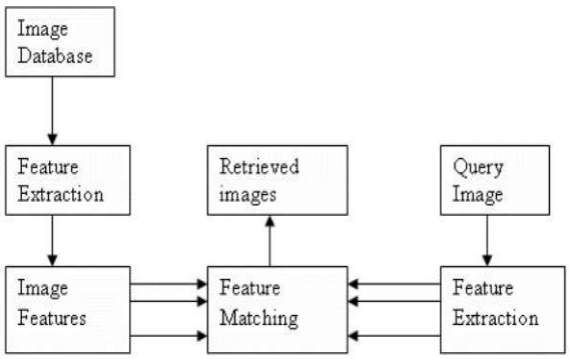

Fig. 1.Block diagram of CBIR system

V.SURF

Due to the large amount of data in a pattern recognition task (e.g. Face Recognition) and the time consumption of SIFT is significantly high, Herbert Bay have proposed the SURF [9] detector inspiring by the SIFT descriptor. It is able to generate scale and rotation invariant interest points and descriptors. SURF have been used as a feature selector in many studies because of the some reasons such as descriptors generated by SURF are invariant to rotation and scaling changes and computational time of SURF is small and fast in compare to other feature extraction algorithms in case of interest point localization and matching. Systematically, SURF uses 2-D Haar wavelet and integral images. For keypoint detection, it uses the sum of the 2D Haar wavelet response around the point of interest. A 2D Haar wavelet is obtained by an integer approximation to the determinant of Hessian matrix that extracts blob-like structures at locations where the determinant is maximum. Therefore, the performance of SURF can be attributed to non-maximal-suppression of the determinants of the hessian matrices. In description phase, firstly the neighborhood region of each keypoint is divided into a number of 4x4 sub-square regions. Then, it computes the response of a 2D Haar wavelet response each sub-region. Again, this procedure can be computed with aid of the integral image. Each response contributes four values to a descriptor, so each keypoint is described with a 64-dimensional (4x4x4) feature description of all sub-regions. Although the SURF method runs faster than the SIFT, but in some situations like viewpoint and intensity change it does not give good results as SIFT produced.

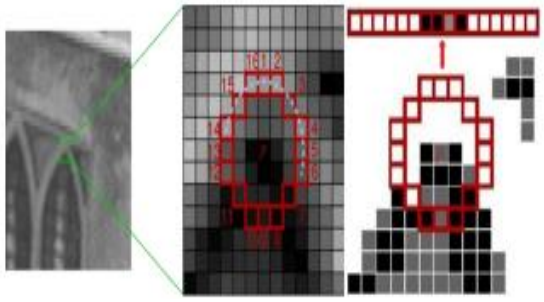

Figure 1. (a) A processed interest point and 16 pixels surrounding on it, (b) the demonstration of storing 16 values surrounding pixels in a vector form

VI. CONCLUSION

Content-Based Image Retrieval (CBIR) is a challenging task which retrieves the similar images from the large database. Most of the CBIR system uses the lowlevel features such as colour, texture and shape to extract the features from the images. In Recent years the Interest points are used to extract the most similar images with different view point and different transformations. In this paper the SURF is combined with the colour feature to improve the

retrieval accuracy. SURF is fast and robust interest points detector/descriptor which is used in many computer vision applications.

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