CBIR Feature Extraction method using Trace Transform

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Abstract — The use of CBIR is rapidly increasing in many computer vision applications. So the methods to extract the features form images to measure the similarity is also increasing. The trace transform based feature extraction method is proposed in this paper which is applied to extract the features from query and database images. It reduces the complexity of the retrieval process. Trace transform provides highly discriminate features for context categorization purposes that can be encoded as considerably short feature vectors. Similarity measurement is used to calculate the difference between two images. According to this difference the image is retrieved. The proposed method increases the accuracy and the efficiency of the retrieval system.

Key Words — CBIR, trace transform, feature vector, feature extraction.

I. INTRODUCTION

The rapid growth of internet technology and using images on the internet rapidly increases, additional information such as text attached to images is often unavailable—hence the need for retrieval methods based on the contents of images has been on the increase. CBIR (content based image retrieval) uses the contents of the query image for retrieving similar images. The term content may refer to colors, shapes, textures or any other information derived from the image itself. The problem of image retrieval depends on accuracy, efficiency and scalability. The retrieval of these images from the huge collection has become very essential for different fields like medical, crime prevention, engineering, art, education etc; to get useful and purposeful information. The need and demand of an efficient and accurate retrieval system has increased.

The color feature is one of the most widely used feature many researchers uses this feature to retrieve the images[1,5]. Color features are extracted to represent image color distributions and are often presented as color histograms[5]. Recently the method of specifying multiple regions of interest (ROI) based image retrieval has been suggested. However it measures the similarity of the images without proper consideration of the spatial layouts of the ROIs and thus fails to accurately reflect the intent of the user[2]. There may be some favourable restrictions in product images, background may rarely complex, and the main object - the product may be distinct and composes the centre of the image. To tackle this problem image retrieval based on region of main object is proposed [3].

In this paper we have used trace transform to extract the features from the query as well as database images. The trace transform involves mapping of the image from spatial domain into the trace domain by applying a trace functional. The trace transform method can produce feature values of an input image, invariant to translation, rotation and even reflection of an input image. The trace transform has already been proposed for several computer vision applications like image fingerprinting, face recognition, character recognition and sign recognition. Trace transform introduces prior knowledge of specific identification [1]. In proposed method trace transform is apply to extract the features from the images in database and query image. Which is apply to reduce the complexity and extracted feature’s number. Hence the feature vector will contain the few numbers of features which will help to measure the similarity of the images from query and database. The image with maximum similarity will be retrieve from the database. The proposed method reduces the complexity of the retrieval system and increases the accuracy and efficiency.

II. BACKGROUND

An image retrieval system used for searching, retrieving images according to the keyword, text. Text-based techniques can capture high level concepts. It is easy to issue text queries. But text descriptions are sometime subjective and incomplete, and cannot illustrate complex image features very well. But Content based image retrieval produces good result based on similarity. Most feature extraction methods require prior knowledge to decide if they are suitable for a specific domain and to optimize their input parameters[1]. This prior information on scene context could represent a valuable asset in computer vision for purposes ranging from regularization to the pre-selection of local primitive feature extractors. Among the low level features of image the color feature is deemed the most common feature extracted for various image applications. The color feature is used in any methods to retrieve the image from database [1,2,5]. The dominant colors of images to automatically extract regions of interest [2]. For ROI-based image retrieval, ROIs should be specified in images and then the feature values of these ROIs extracted to compare their similarity to the target images. To tackle the problem of background restrictions image retrieval based on region of the main object is proposed [3]. To increase the efficiency and correctness of the image retrieval system trace transform is introduced in this paper. It reduces addressing complexity for feature extraction. The trace transform can be optimized to efficiently represent the information contained in the original images.

III. RELATED THEORY

There are various methods discovered by the researchers to retrieve the images with CBIR form database. Igor G. Olazia [1] have proposed trace transform based method for color image domain identification. This method is very suitable for semantic context classification, especially for those cases where
the lack of prior knowledge does not allow the effective use of specific local features. The problem of dimensionality reduction of the obtained trace transform signal is addressed through statistical descriptors of its frequency representation that keep the underlying information. This method improves the classification performance. Content-based image retrieval method using the relative location of multiple ROIs is proposed by the Jongwon [2]. This method divides images into blocks of certain size and extracted MPEG-7 dominant colors from the blocks overlapping with the user designated ROIs to measure their similarities with the target images. This selects only those blocks whose ROI-overlapping areas exceed the threshold and reflecting the relative location of multiple ROIs to measure similarity. This method gives the higher performance than the global image retrieval method and the retrieval method that does not consider the relative location of ROIs. But this method does not select blocks whose proportion of overlap with ROIs is below 20% as ROI-corresponding blocks.

Lunshao Chai [3] proposed multi-feature content-based product image retrieval based on region of main object in which author focused on two key issues are fast extraction of the main region in which the product locates and efficient shape and color features extraction. The fuzzy histogram linking technique is applied to extract color feature. Using prior information, this method can extract the main region, which contains the product, with much less time expense than traditional segmentation algorithms. The extraction serves two basic purposes eliminate the interference of background Color and discard interferential information in non-product region unconnected with the main object region. This method removes non-product regions unconnected to the main object region. Disadvantage of this method is that it increases the computational cost. Fazal-e-Malik [4] proposed CBIR algorithm which is based on texture statistical features. This method converts the RGB color image into grayscale image to reduce the computation speed and increase efficiency. The grayscale image is divided into blocks of different sizes. The statistical texture features are extracted by using the probability distribution of intensity levels in all blocks. The block is used as a model of the probability distribution of intensity levels. This method increases the efficiency and accuracy but reduces the computation speed.

The adaptive color feature extraction based on image color distributions is proposed by Wei-Ta Chen [5]. This method able to extract color features by preserving the color distribution of an image up to the third moment and to substantially reduce the distortion incurred in the extraction process. This extraction method is equipped with the capability of exploiting the concurrent property of hardware implementation. FC (fixed cardinality) and VC (variable cardinality) attempt to preserve the image color distribution during the extraction process. FC extract a fixed number of pixel clusters from an image and VC extract a variable number of pixel clusters from an image, and the number of pixel clusters extracted depends on the variances of clusters. This method improves the efficiency of the color feature extraction process but execution time does not grow as fast as the number of colors extracted.

### IV. Existing Methodology

Different researchers proposed the different techniques to extract the features from image. In paper [1] introduced a new color image context categorization method based on the trace transform. The problem of dimensionality reduction of the obtained trace transform signal is addressed through statistical descriptors of its frequency representation that keep the underlying information. Author also analyzed the distortions produced by the parameters that determine the sampling of the discrete trace transform. Moreover, Feature Subset Selection is applied to both, improve the classification performance and compact the final length of the descriptor which provides to the classifier. This method improves the classification performance.

Efficient image retrieval based on texture feature is proposed in [4]. The proposed algorithm is based on statistical texture moments. In this method RGB image converted into grayscale. Then grayscale image is divided into blocks. Each block provides the probability distribution of intensity levels that is used in computation of textures features. These features describe the properties of the intensity level distribution in image. A feature vector is constructed by using the computed values of features. For all images in database the feature vectors FV are computed and stored in database to be retrieved by query image. The feature vector FV is also calculated for the user query image by using the same procedure. the difference between query image and database image and this is computed for all images in database. The distance values are arranged in ascending order. The smallest values will be on top which correspond to the most relevant or similar images and irrelevant will be at bottom. The top most images are displayed to the users which are the required images.

### V. Analysis and Discussion

Trace transform based feature extraction offers a highly discriminant behaviour for content categorization without prior knowledge requirements [1]. The fig. 1 shows the high resolution values of the trace transform parameters tend to create a convex contribution intensity map. Therefore, high parameter values do not necessarily imply optimal image content representation on the trace transform. High values of improve the rotational invariance of the trace transform while very low values cannot be considered as producing a valid trace transform since there is not enough angular information. For different resolution settings the accuracy has maintained around 82% and 92% . Thus this method shows the best performance.
results are for 16*16, whole image as one block and 4*4 block methods[4]. The process of Feature extraction involves a large number of computations and speed of computation is increasing. The algorithm divides image into different block sizes . For each block the probability distribution of intensity levels is calculated and then is used to compute all seven statistical texture features. Total seven features are calculated for all block methods, thus this method is efficient in computations. The average precision of algorithm for all block methods is 61 and recall is 76. Thus this approach is not only efficient in computations but also gives good results in terms of precision and recall.

VI. PROPOSED METHODOLOGY

The proposed method of content based image retrieval system using the trace transform is shown in fig. 3. Database used to store the extracted features of images into device. In retrieval process it helps to retrieve the feature vectors as it contains. The method is consist of four steps 1) applying trace transform to image, 2) feature extraction, 3) similarity measurement and 4) image retrieval. Transformation of the input data into the set of features is called feature extraction which divides the image into sub-blocks and then it extracts features from each sub-block.

The proposed CBIR involves transform based feature extraction. The data transformation process is carried out through the trace transform. The trace transform extends the Radon transform by enabling the definition of the functional and thus enhancing the control on the feature space. These features can be set up to show scale, rotation transformation invariance or high discriminance for specific content domains. Trace transform provides highly discriminate features for context categorization purposes that can be encoded as considerably short feature vectors. Similarity measurement is used to calculate the difference between two images. According to this difference the image is retrieved. The image which has the less difference is extracted.

Fig. 1 : Trace transform at very high resolution parameters

Fig. 2 : Comparison of average precision and recall for different block sizes.

Fig. 2 shows the comparison of precision and recall for 9 different block sizes. In which the good precision and recall
CONCLUSION

In this paper image retrieval is carried out by applying the trace transform to extract the features of the image. This method is very suitable for semantic context classification, especially for those cases where the lack of prior knowledge does not allow the effective use of specific local features. The data transformation process is carried out through the trace transform. The trace transform can be optimized to efficiently represent the information contained in the original images. The proposed method retrieves the image effectively. Trace transform provides highly discriminate features for context categorization purposes that can be encoded as considerably short feature vectors. The similarity is measured between the query feature vector and database feature vector and then image is extracted from the database according to the similarity measurement.

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