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Image Retrieval via Feature Aggregation

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ABSTRACT

This paper describes content based image retrieval techniques via feature aggregation, using two major approaches of content-based image retrieval using local image descriptors. One of them is descriptor by descriptor matching and the other is based on comparison of global image representation that describes the set of local descriptors of each image. In this work we mainly focus on principle component analysis and min cost ranking to improve system efficiency. In cost ranking is used in this work for understanding short binary codes and feature aggregation approach.

Keywords- Content Based Image Retrieval, Principle Cmponent Analysis,Min Cost Ranking ,Feature Aggregation

I. INTRODUCTION

Image representation is one of the key issues for large-scale CBIR. Bag-of-visual-word (BOW) representations based on local descriptors such as SIFT are wildly used in CBIR systems. However, there are two nontrivial issues led by the BOW based methods, i.e., computational efficiency and memory cost. Proposed System provides compact image representation and relevant result to the user query. As Using MPEG-7 Descriptors no. of features are extracted from an image which will provide high accuracy in image retrieval. Principle component analysis method provides compression of image features without loss of data. In the embedding step, each local descriptor is mapped into a high dimensional vector. The aggregation step integrates all the embedded vectors of an image into a single vector which obtains a compact representation for image retrieval. Subsequently, k-means algorithm is used, clusters are formed and images are trained. In re-ranking step, Euclidean distance is used to find similarity and provide efficient searching.

II. LITERATURE REIVIEW

A. Previous work:

R. Arandjelovic and A. Zisserman introduced the Vector of Locally Aggregated Descriptors (VLAD), this image descriptor was designed to be very low di mensional(*e.g.* 16 bytes per image) so that all the descriptors for very large image datasets (*e.g.* 1 billion images) can fit into main memory. They presented three methods which improve standard VLAD descriptors over various aspects, namely cluster center adaptation, intra-normalization and MultiVLAD. Cluster center adaptation is a useful method for large scale retrieval tasks where image databases grow with time as content gets added. Intra-normalization was introduced in order to fully suppress bursty visual elements and provide a better measure of similarity between VLAD descriptors. It was the best VLAD normalization scheme. Multi-VLAD method is used to improves retrieval performance for small objects[1].

A. Babenko and V. Lempitsky [2] introduced and evaluated a new data structure called the Inverted Multi-Index which is a new data structure for the large-scale retrieval in the datasets of high-dimensional vectors. The multi-indices produce much finer subdivisions of the search space without increasing the query time and the preprocessing time compared to inverted indices. Multi-indices provide faster and more accurate retrieval and approximate nearest neighbor search, especially when dealing with very large scale datasets. It replace the vector quantization inside inverted indices with the product quantization (PQ). PQ proceeds by

splitting high-dimensional vectors into dimension groups , then effectively approximates each vector as a concatenation of several code words of smaller dimensionality.

R. Arandjelovic and A. Zisserman [3] proposed Root SIFT method instead of SIFT for improved retrieval performance. It provides a performance boost at no cost. It is very easy to implement, It does not increase storage requirements as SIFT. Using a square root (Hellinger) kernel instead of the standard Euclidean distance to measure the similarity between SIFT descriptors leads to a dramatic performance boost in all stages of the pipeline.

Based on the reviews of the various existing content based image retrieval(CBIR) techniques it can be divided into following different types:

1. Retrieval based on color
2. Retrieval based on texture
3. Retrieval based on shape
4. Retrieval based on mixed contents.

1) Retrieval based on color

Shrivastav, Tygi *et. al*. [4] presents a new image retrieval technique which retrieves similar images in three stages. A fixed number of images firstly retrieved based on their color feature similarity. The significance of the retrieved images is further improved by matching their shape and texture features. This eliminates the need of fusion and normalization techniques, which are commonly used to calculate similarity matching. This reduces the computation time and increases the overall accuracy of the system.

Kousalya, Thanamani, et al.[5] introduced color features concepts for retrieving similar images. CBIR aim at measuring color for specific images that are similar to a given query color. This approach include color features are generally represented as a histograms of intensity of the pixel colors. The Objective is to extracting color from specific images and retrieving the similar pixels using Euclidean distance measures.

2) Retrieval based on shape

Sheikh, Mansor, Lye, Fauzi, et al. focus on marine life images and also highlighting on shape matching. The main focus of this research is to identify marine species without huge amount of man power. The objective of this work is to compare automated segmentation and manual segmentation with without segmentation. It uses two feature extraction techniques color & shape for indexing and recognition [6].

Acharya, Devi [7] proposed a new technique of incorporating visual attention model to segment and extract the Region of Interest(ROI) from an image and then use the result for image retrieval purposes. The main advantage of this concept lies in the improvement of the performance of the retrieval scheme in terms of Precision and Recall.

3) Retrieval based on Texture

K.P, Mary, Vasuki et al.,[8] introduced the semantic based image retrieval system which is based on the texture feature[9]. generalized linear model constraints(GLMC) method is used for texture feature extraction which gives semantic analysis of images .The paper works for reducing the semantic gap between the low level feature and high level feature. The extracted features are assigned into semantics.

4) Retrieval based on shape Mixed (combination of color, texture, shape) Content

Kannan, Mohan, Anbazhagan, *et al*. proposed a combined approach of image mining and content based image retrieval and a new clustering technique to increase the speed of the image retrieval system. The objective of this approach is to reduce loss of information in images and extracting meaningful features [10].

Maheshwari, Silakari, Motwani [11] focuses on image clustering based on color and texture features. For extracting the information from the image dataset used Color moment and Gabor filter. For image data clustering used K-means and hierarchical data mining clustering algorithm of the image dataset[12][13].This approach provides a group of image data set into various clusters.

III. PROPOSED SYSTEM

Proposed System provide compact image representation and relevant result to the user query. Using various Descriptors no. of features are extracted from an image which will provide high accuracy in image retrieval. Principle component analysis method provide compression of image features without loss of data. Each local descriptor is mapped into a high dimensional vector. The aggregation step integrates all the embedded vectors of an image into a single vector which obtains a compact representation for image retrieval. Using, k-means algorithm is used, clusters are formed and images are trained.

In re-ranking step, Euclidean distance is used to find similarity and provide efficient searching.

A. Problem statement

- The aim of this system is image retrieval using feature extraction. Using various descriptor visual features are extracted.
- To reduce the extracted feature size using PCA (Principle Component Analysis).Normalize the feature value and form a high dimensional vector
- .Using K-means algorithm clusters are formed and images are trained.
- Ranking apply based on distance of query image and trained images.

B. Statement of scope

The system performs the feature extraction using different descriptors along with local descriptors. The aggregation step combine all the inserted vectors of a image into a single vector which gets a reduced representation for image. Also k-means clustering is utilized, groups are shaped and images are prepared. In ranking stage, similarity measures are utilized to find similarity and provide efficient searching.

C. Outcome

The system extract multiple features from given query images using various descriptors. Reduce those feature size by applying principle component analysis. Formation of clusters and similarity matching between query image and dataset images are done. After that re-ranking of images are done and relevant images are displayed.

D. Hardware resources required

TABLE I.

Sr.No.	**Resources**		
	Parameter	***Minimum Requirement***	***Justification***
1	CPU Speed	2 GHz	To run Visual Studio
2	RAM	2 GB	To run Visual Studio device

E. Software resources required

Platform :

1. Operating System: Microsoft Windows
2. IDE: Visual Studio
3. Programming Language: C.Net Framework

F. Architecture

The proposed system can be roughly divided into following three blocks: Feature Extraction using various Descriptors Feature Space Reduction using PCA Cluster Formation Using K-means and Similarity Measure The details of steps performed in proposed system are as follows:

- Step 1:Get feature vectors of Training images in the dataset The collection of feature vectors of images in the database called as feature database.
- Step 2: Extract Features like CLD, EHD, SCD of images Number of features are extracted from an image using descriptors.
- Step 3: Aggregate / Combine all these features Combine all extracted features of image such as color, shape, texture and other information into a vector.
- Step 4: Apply PCA on these features This method perform dimension reduction in feature spaces. Principle component analysis(PCA) consist of image color reduction while 3 color component are reduced into one containing a major part of information and then object orientation is done. It mainly concerned with identifying correlation in the data. Using standard deviation, variance, co-variance feature size is reduced.
- Step 5: Calculate trained Matrix from PCA output By applying PCA on features of an image the feature size is reduced, then calculate trained matrix from generated PCA output.

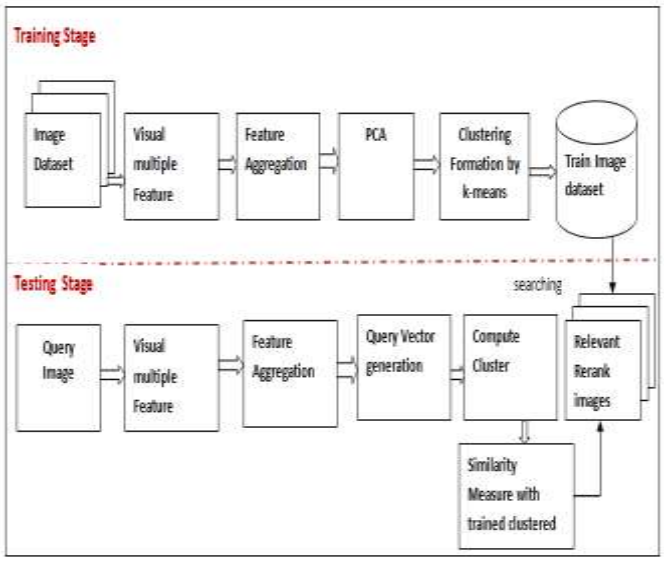

Fig.1 : *System Architecture*

- Step 6: Train K-means for clustering K-Means is a least-squares partitioning method that divide a collection of objects into K groups. The algorithm iterates over two steps: Compute the mean of each cluster. Compute the distance of each point from each cluster by computing its distance from the corresponding cluster mean. Assign each point to the cluster it is nearest to. Iterate over the above two steps till the sum of squared within group errors cannot be lowered any more.
- Step 7: Query Image User provides image as an input to the system.
- Step 8: Extract feature of query images Feature extraction done on given input image.
- Step 9: Classify cluster of image Using k-means algorithm classify images in the database as compared to query image
- Step 10: Re-rank images. Using similarity measure ranking of images is done.
- Step 11: Retrieve relevant images

G. Descriptors

1) Local Descriptor: A descriptor encodes an image in a way that allows it to be compared and matched to other images[14]. A local descriptor describes a patch within an image. Local features are small square, sub-images extracted from the original image [15][16][17].

2) Global Descriptor: A global descriptor describes the complete image or whole image. MPEG-7 Family of global descriptors consist of color layout descriptor, scalable color descriptor, Edge Histogram Descriptor[18][19][20].

H. Feature Values

The dataset is processed by the computer system by providingquery image as input file. Later on features are retrieved by using various descriptors such as color layout descriptors, scalable color descriptor and edge histogram descriptor.

Screenshot of feature values of these descriptors are shown below:

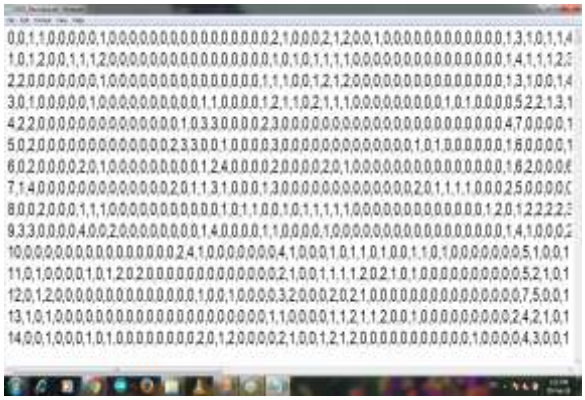

Fig.2: Feature values of CEDD descriptor

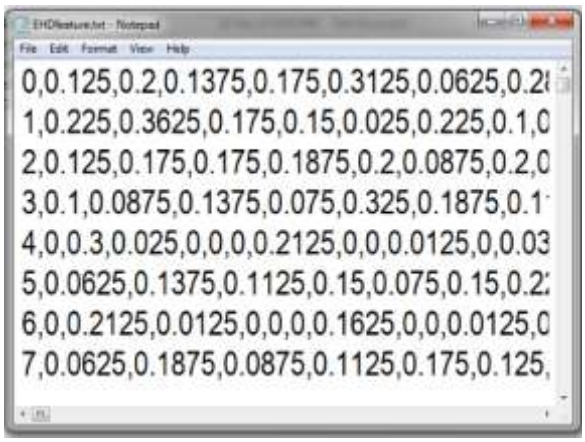

Fig.3: Feature values of EHD descriptor

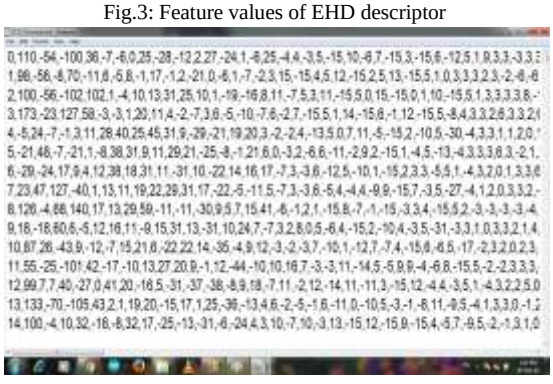

Fig.4: Feature values of SCD descriptor

Fig.5: Query Image

Fig.6: Result

It can be observed from the result shown above the output images are the only images which matches with the query over threshold value.

IV.CONCLUSION

In this paper, a unique unsupervised hashing technique called MCR has been used for large-scale image retrieval. The proposed method can achieve competitive performance with a more accuracy. It is more feasible for realistic applications with limited resources.

With the increase in demand in multimedia capabilities, Image retrieving process is a vital part of information analysis. It would be very convenient to have an automated image processing system. Sooner requirement of human skills will be eliminated. Thus, efficient designs for interactive systems should be identified. Also a systematic analysis of features and their combinations for different domain specific applications such as space, medicine *etc* is required.

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