Automatic Content Based Image Retrieval using Re-ranking

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***Abstract*— the digital image data is rapidly expanding in quantity and heterogeneity. The traditional information retrieval techniques do not meet the user's demand, so there is need to develop an efficient system for content based image retrieval. The content based image retrieval is becoming a source of exact and fast retrieval. There are lots of research works going on searching, and retrieval of images from the image database. This increment in data attracts many researchers to find relevant images from the database. There are many approaches as discussed in literature and referred in this report for CBIR. There are few problems, which we say the research gap, like retrieval of irrelevant images in the existing work, have been resolved in this current approach. So, as per the solution of problem, image retrieval using re-ranking is proposed. In re-ranking, images are ranked based on the graph technique. Local and global features are used by which we can generate related graphs of images. Here images are divided in many categories and re-ranked based on their graphs. The graphs of query image are compared with the graphs of database images and result into subsequent retrieval of relaxant images. Furthermore, similar and close looking graphs are modified using filtering process to improve the retrieval results.**

***Index Terms*— CBIR, Re-ranking, Retrieval, Graph Based, Multimodal Graph.**

I. INTRODUCTION

In now days, collection of digital images is increasing day by day. There are numbers of the areas are including the application related image retrieval system without it unorganized to allow effective finding and retrieving system. There is one major problem is that the issue of locating a related image in more and categories data storage. While it imperfectly feasible to identify a desired image from a small collection simply by browsing, more effective techniques are needed with collection containing thousands of item [1] . The image retrieval field is very interested among researchers in the field of image processing, media, satellite GPS and other related areas.

Since 1970s image retrieval is very popular system in image retrieval, there two main things are involved database management and computer vision. Therefore, image retrieval is defined as system of finding an images from image database. Client want to get similar images as according to the query image in starting pages.

- Image retrieval techniques are classified in to main three categories as below,

1.Text based image retrieval (TBIR)
2.Content based image retrieval (CBIR)
3.Semantic based image retrieval (SBIR)

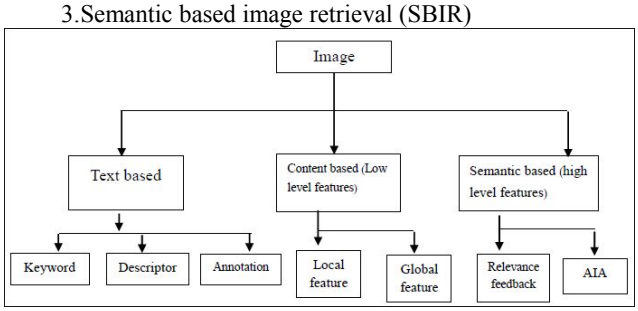

Fig. 1: Image retrieval techniques [1]

1. Text based image retrieval(TBIR)

This technique is invented in starting of the retrieval system as in 1970s. In this method of TBIR first images are annotated the images by text and after it used text based database management system for perform image retrieval. TBIR is used automatically annotate the images in the database with annotations, keyword or description. The process is used to prevent information about both image contents and other database of the image like, image file name, format of image, size of image, and also dimension of images [1]. The user gives image or textual query for retrieve all images which are satisfying some of criteria based on the given annotation.

2. Content Based Image Retrieval (CBIR)

This technique content based image retrieval is invented in 1992**.** In CBIR are images are retrieval from database which are based on colour or shape**.** The base of collecting similar images from a large database of the images on the basis of symmetrical image features**.** The retrieving process system are invited from area such as statics, pattern recognition, and Signal processing and computer vision**.** On the basis of visual content of the images descriptor are categories**.** Many of the CBIR techniques prevented with approximate queries where the main thing is to search the images visually same to a specified object image**.** In many of the issue the main thing of CBIR systems is to prevent basis of human attraction of image similarity as well as closer**.**

3. Semantic Based Image Retrieval (SBIR)

This method is nothing but the difference between high level image and low level image**.** In other words, we can say that the SBIR is the mainly different between two image features**.** As shown in fig**.** SBIR can done by extraction of low level features of images to prevent meaningful and interesting object based on the same properties of the visual features**[**1**].** After that, the image feature will go into the semantic image

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extraction to get them semantic description which images is to be stored in the database.Query can be done based on the number of textual words which will go into semantic features translator to get semantic features from the query[3]. The semantic mapping process is used to search concepts to prevent the clustered or segmented object based on the low level features. This mapping will complete though variant or invariant learning tools to combine low level features with object concept and will be annotated with the textual word through image annotation process.

II. LITERATURE RIVIEW

Aruna Bajpai et.al [5] proposed a work on web image Re-ranking by generating text and visual features.in that method they are derive graph based image re-ranking. They are totally focus on the visual and text features. According to the multi graph based learning process they are categories images into the relevant images and irrelevant image.

Xiaoou tang et.al [6] proposed a work on one click internet image search. They are purposed a method on known as intent search. Query image are categories as predefined adaptive weights which attract the user search intention. Based on the visual content of the query image which is selected by the client and clustering, query keywords are expands on the basis of client attraction. After that expanded query words is used to enlarge contain of the more relevant images.

Hilal Zitoni and Sare Sevil et.al [7] proposed a work on Re-ranking of Web Image Search Results using a Graph Algorithm. This method is specially introducing for the web images on the internet searching application. They are use visual features for comparing the image. They are use local descriptor SIFT to detect and describe the interest points of images. On the basis of it they construct a graph for similarity matching.

Meng Wang and Hao li et.al [8] proposed work on Multimodal Graph-Based Re-ranking for Web Image Search. In that method they are use multi graph over single modality. They expanding a features vectors, distance matrix and learning a relevance scores. They are use visual features for re-ranking image as multimodal visual feature fusion. There is distance for single modality and its scaling are makes more effective and good approach.

Jung Shen and Tao Mei et.al [9] proposed work on Image Search Re-ranking with Multi-latent Topical Graph. They used re-rank the top images according semi-supervised machine learning. They are corporate with visual features in RGTG which mine the information of latent feature. The method is divide in two section online and offline. There are MSRA-MM dataset are used for experiment.

Yusuke Uchida and Shigeyuki Satazawa et.al [10] proposed work on accurate feature matching and scoring for re-ranking image retrieval results. They are introducing new re-ranking approach to get good results obtain by using bag-of-visual word. It is simple but more effective technique to reject the irrelevant features matches is given. In order to improve performance with the function known as voting without information of geometric a re-ranking technique based on effective scoring is given.

Mausloud moshab and Bachir Boucheham et.al [11] proposed work on The Vote Operation in the context of CBIR. The algorithm is re-rank the first returned images in order to remove noise can be returned within results and it processing to calculating a vote between the first returned images. This algorithm is very simple as voting process one candidates and electors.

Swati. R. Murumkar and C. M. Jadav et.al [12] proposed work on An Effective Image Search Re-ranking Based on Prototype. In that method the first ranked images are used as (noisy) training data and visual classifier is used to improve the ranking further. Given the keyword as input to the proposed system model, the output contains a set of re-ranked images which leads to increase in probability of exactness of user search requirement.

Praveen Mishra and G. S. Prajapati et.al [13] proposed work on Analysing GLCM and Color Features. Here searching is done on the basis of the visual feature values obtain from the query image on the dataset each image similar visual feature values those images whose similarity is same is consider as relevant and the most similar images is ranked first then next as second, other are done in similar fashion.

III. RE-RANKING IN CBIR

Text based image retrieval is the simplest technique over other. This technique is popular but need very particular description of the query which is complicated and not always possible. Generally, the process of image finding conclude searching of image based on typing of keyword. When query word is given in the search table for finding the images, it is given to the server which is connected to the database. Client give image or text as query on it. Then it is forwarded to the server or database which are connected to the system. The database take the flow of the images based on the tagging of query image from the database and then send back to the client. The search engine thus searching through the database and getting the images. The top ranked image is retrieved from the database.

But, there is certain problem like images retrieved are many time duplicated, low precision and irrelevant. Sometimes user have to search lots of pages of image available to land at the perfect one. This problem is very affecting the fast technology, because of day by day the database of image are increased. So, give good efficiency and overcome a problem and complexity “image re-ranking” is popular technique in the retrieval system.

As given in the fig. 2 we showed the implementation and understanding. There are large image database is subjected to feature extraction process for the taking an image both visual such as a texture, shape and color and semantic such as intentional, labels, clicks [14].

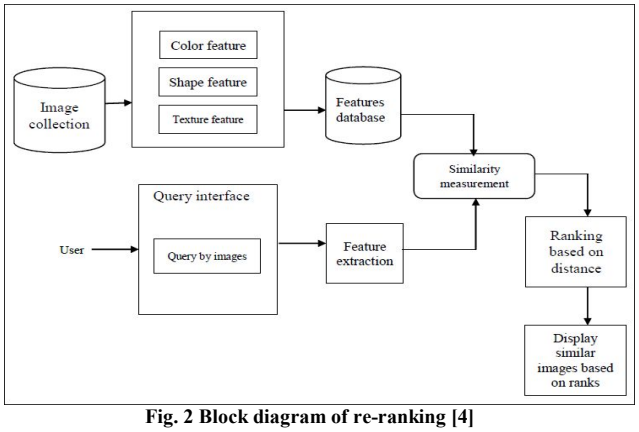

Fig. 2 Block diagram of re-ranking [4]

Which are extracted from the database by using different method query feature is obtained after the query image is subjected to feature extraction process. In the matching process, the query image feature is compare with the feature that is stored in the feature database. The difference between the two features is calculated and weights are determined. The resulted images are stored and re-ranked, so that most similar images can be retrieved to the users. By using of graph structure, the issue of searching more relevant set of images convert into the problem of searching densest component in the graph.

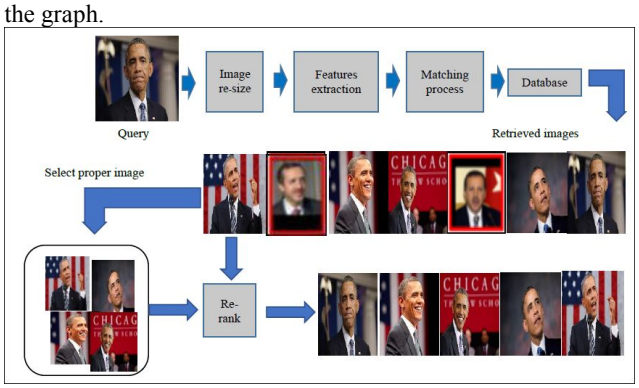

Fig. 3 Process flow of re-ranking

As shown in fig**.** 3, there is image query is given according to the process first it re-size for matching with database image then features of query image are extracted according to the database image features they are matched with each other and after that similar image are retrieved**.** After retrieved process in figure seen that some irrelevant images are retrieved which are shown in red box**.** It cannot good for user so, here including re-ranking process which is re-rank the similar images with query image**.** After that it gives proper images to the user**.**

1.1 Features used for Re-ranking

1. **Color moment**: Image is divided in to the sub-blocks. as per the requirement of application user can deciding the optimal number of sub-blocks. generally, at least 7*7 and not more than 9*9 is a best choice. If we divide an image by using 7*7 sub-blocks. It's gives total of 49 blocks. There are three planes Y, Cb, and Cr. So the total number of blocks are 49*3 means 147. One mean and one variance value are calculated for every blocks, thus total number of sub-blocks are 147*2= 294 value. Now by taking into general terms, suppose we choose number of partitions as N, then total of N*N*3*2 value are available for color moment calculations.
2. **HSV and RGB color histogram**: Color model and color space is a particular known as a coordinate system and a subspace with a system which are represented by distinct color value at single point. In image processing there are number of color space are available for represent the pixel of an image. Extraction of image color histogram are using this pixel representation. On the bases of application and hardware specification there are some advantage and disadvantage of this color space where they are used. RGB, CMY, CMYK, and HSV are some well-known color spaces. The RGB color space has three color components, which are red, green and blue, each of which appears in its primary spectral components.
3. **Gabor wavelet**: Proposed a new approach for rotation invariant texture classification using Gabor wavelets where the features are found by calculating the mean and variance of the Gabor filtered images. A feature vector is generated for an image feature, for example, if a 4×9 Gabor wavelet set is used, then there will be 72 elements in this feature vector.
4. **Color auto-correlogram:** This is also known as cross-autocorrelation or serial correlation, is the correlation of signal with in time itself at different points. Here 144-dimensional color auto-correlogram is used HSV color moments are quantized into 36 bins with 4 different pixels pair distance [5]
5. **Edge distribution histogram**: In the images there are edges an important feature in representing their content. Edge histogram is different for an image and cannot be duplicated by color or any other texture feature. Here 75-dimensional edge distribution histogram is used. Single image is divided into 5 blocks and 15-dimensional EDH features are extracted.
6. **Butterworth low pass filter:** Edges and other sharp intensity transitions like noise in an image contribute significantly to the high frequency content of its Fourier transform. The transfer function of a Butterworth low pass filter of order n, and with cut-off frequency at a distance D_0 from the origin, which is defined as

$$H(u,v) = \frac{1}{1 + [D(u,v)/D0]^{\wedge}2n}$$

IV. SIMULATION AND RESULTS

In order to conduct the experiment an artificial dataset which is a collection of images from different category are utilize. As images are of different format so first it is necessary to make it in readable format for experiment tool MATLAB. Now this collection of images of different category are shown in table 1 for which one can make some important keyword collection for different images. In this way each image has one more feature to identify that is the keys of the images.

Table 1: Dataset of image category

Category	Examples
Human	barrack Obama
Animal	Tiger
Scene view	Sunset
Objects	Pyramid

Fig. 4: Result obtained by work of MLG ref et.al [5] and MMG ref et.al [8] for query of 'Barak Obama'

Discussion about proposed technique: As we can enter the text query for proposed method for text based the results are shown in fig. 5.

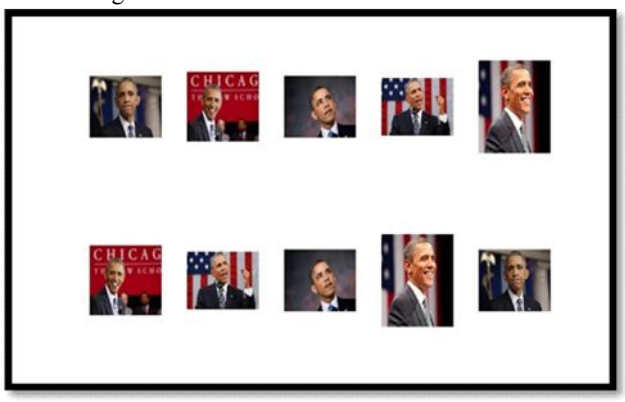

Fig. 5: Result of given text query 'human'

As per given in the fig that user enter query text 'human' and in result images are retrieved of Barak Obama 1st row of 5 images are retrieved images and 2nd row of 5 images are re-ranked images.

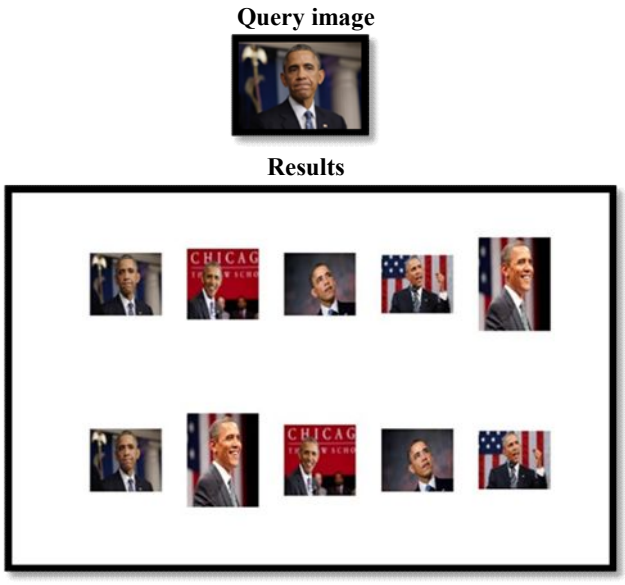

Fig. 6: Given query image of Barak Obama re-ranking results

Same as other can be observed as per requirement. As per mentioned in figure and upper five images are simple retrieval images from the database and the lower 5 images are re-ranked images. This re-ranked images are very closer to the similar image of query. As per the value of NDCG is closer to the 1 from 0, the similarity of query image and databased close.

Table 4.2: Results comparison

Category	MGL ref et.al [8] Image Based Query	Proposed Image based query	MMG ref et.al [5] Text based query	Proposed Text based query
Objects	0.78	**0.9532**	0.905	0.9316
Animal	0.79	**0.9451**	0.91	0.9117
Scene	0.85	**0.9271**	0.87	0.8518
Person	0.76	**0.9851**	0.93	0.9307
Average	0.795	**0.9526**	0.9037	**0.9064**

As we can see in the table the results of image re-ranking are given. As we seen that re-ranking value of proposed method very good according to the given MGL [8] and [5].

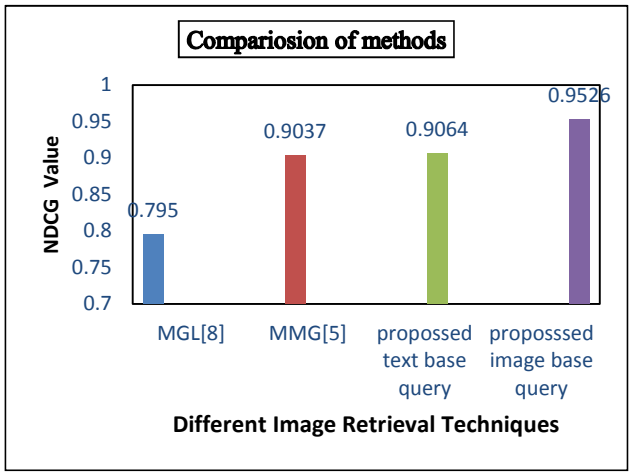

Fig. 7: NDCG levels of various methods

As mentioned in the graph we can see that our methods result of NDCG values are more accurate than the given MGL [8] and MMG [5].

CONCLUSION

With the objective of improving content-based web image retrieval based on the image re-ranking paradigm, we studied the possibilities to enrich the query image using various types of contextual information and to embed this information effectively into image retrieval model that is based on image re-ranking. The experimental results on a collected web image dataset demonstrated the utility of the image re-ranking method and the effectiveness of the proposed method for image retrieval model compared to the text-only or visual-only image retrieval. CBIR retrieval technique has much advantage related with information of particular image like color, texture, and shape. As discussed in literature there exists one problem that when all images are retrieved according to the database among that some irrelevant images are also retrieved. Our approach is based on solving this

problem and make efficient retrieval system by using image Re-ranking in CBIR. Where retrieved images are re-rank according to the similar image with query image or text. As can be seen from the simulation results obtained, the performance parameter value known as NDCG level obtained is 0.95 which is quite higher than the value obtained by existing approach considered in the reference. Furthermore, for similarity matching image, we have carried out filtering process for improving NDCG level. The proposed method uses Gabor wavelet filter for the same. As we can see by comparisons of graph and table we conclude that our method has better performance than Multi modal Graph and Multi Latent Graph methods. For future work we can also add more features and similarity index for get better retrieval.

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