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Impact of clustering in image retrieval techniques

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Abstract— In this paper image retrieval system is explained in which features of input query image are not compared to the features of whole database image, Here hierarchical and k-means clustering is applied on database images so that query image's low level features as texture, shape and spatial are compared to only clustered images features rather than whole database image's features to improve speed, accuracy and efficiency. In this research work accuracy and time have been analyzed due to clustering in database images for retrieval.

Keywords— CBIR, K-means, hierarchical, clustering, spatial, texture, similarity

I. INTRODUCTION

In Content based image retrieval system, images are retrieved from large database based on similarity in features with input query image rather than entering the description details as tags, annotations of any particular image[1]. Here in this thesis work, before searching similar images clusters are computed based on color similarity then some low level features as texture, shape and spatial of query image are extracted which are compared to only clustered images features only. Without clustering, texture, shape and spatial feature extraction took more time with giving some inaccurate result while after applying clustering speed is improved with accurate result. Here hierarchical clustering is used to form clusters of similar color features for fast retrieval and then k-means clustering is applied on those clusters for more accurate image retrieval [2]. In this paper, section 2 proposed techniques are described, in section 3 time analysis due to clustering is shown and in section 4 conclusion and future scope has been described.

II. PROPOSED TECHNIQUE

Here in this research paper retrieval of images is implemented in MATLAB based on multiple feature extraction after clustering. In this proposed technique after loading of data base images clusters are formed by applying hierarchical clustering followed by k-means clustering [3]. Firstly hierarchical clustering is performed to group the similar images having similar color feature in image database for fast image retrieval and then k-means clustering is applied to find out the center images of these clusters so that query images features are only compared to cluster's center images, which cluster's center image having more similarity with query image, that whole cluster images are compared to query image. So there is no need to compare query image to database's all images [4]. For measuring the color feature similarity representation of color distribution of images are calculated as mean, variance and skewness for red, green and blue 3 color components. For these clustered images texture features are extracted using modified gabor transform strategy by analyzing the frequency content of images [5]. Then texture feature of input query image is compared to only clusters centered image's texture feature, if having more similarity according to threshold limits, whole cluster images texture feature is compared to query image texture feature. In the same manner shape and spatial feature similarity is measured with clustered images. For shape feature extraction invariant moments are implemented and for spatial feature extraction quad tree decomposition algorithm is used here. Finally in combination option one feature extraction algorithms are followed by each other. Texture features are extracted on retrieved images based on color feature similarity so in similar manner shape feature are extracted on retrieved images based on texture feature similarity then spatial features are extracted on retrieved images based on similarity in previous extracted features [6]. Due to considering the concept of relevance feedback user can select the relevant images from the retrieved images [7] .So that precision (accuracy), recall and time can be measured for comparative analysis due to clustering. Algorithm which is implemented for this CBIR system is explained here as follows-

Step 1.Form similar image groups from image database based on color feature similarity using hierarchical clustering approach.
Step 2.Find the centroids of these image clusters using K-means clustering technique.
Step 3.Extract color, texture, shape and spatial feature of query image.
Step 4.Extract texture, shape and spatial features of clusters formed in image database.
Step 5.Compare color, texture, shape and spatial feature of query image to clusters center images.
Step 6.Compare these features of query image to whole cluster images whose center image having more similarity to query image features.
Step 7.Perform relevance feedback analysis on retrieved images based on user's requirement.

III. RESULT AND ANALYSIS OF CLUSTERING

Without cluster formation query image is being compared to database all images for similar image retrieval firstly query image and database all images features as texture, shape and spatial features are extracted and then query image is compared to all database image based on feature's similarity. In this case more time is consumed and irrelevant images are also retrieved. But in proposed technique, after loading the database firstly clusters are formed then only for these clusters texture, shape and spatial features are extracted. so it takes more less time than computing feature extraction and similarity matching time between query image and database all images that has been shown in figure. Here database of 100 images are used .In figure 1, bar graph has been shown for color feature extraction time analysis with and without clustering. As similar in figure 2, for texture feature extraction time analysis, figure 3 for shape feature extraction and for figure 4, spatial feature extraction time analysis bar graph is shown. In each feature extraction time required is minimum in case of clustering than without clustering case.

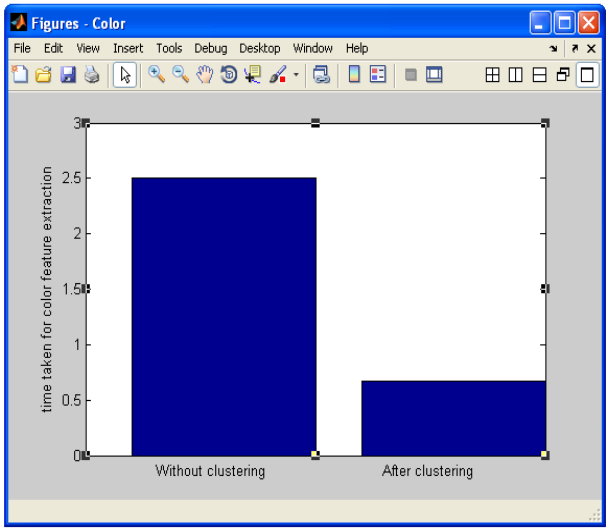

Fig. 1 Time analysis of color feature extraction

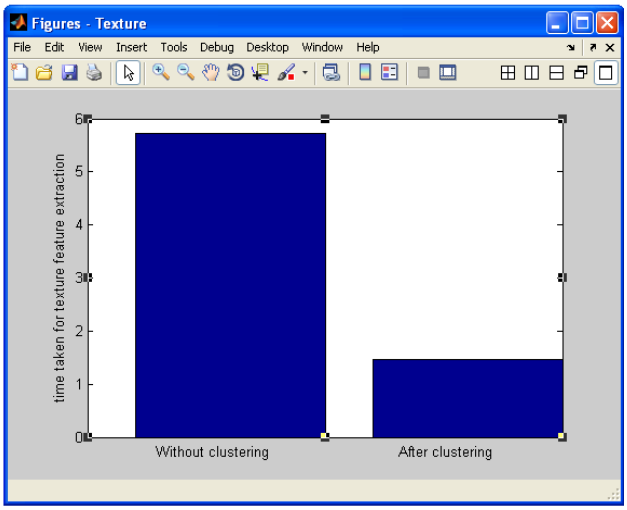

Fig. 2 Time analysis of texture feature extraction

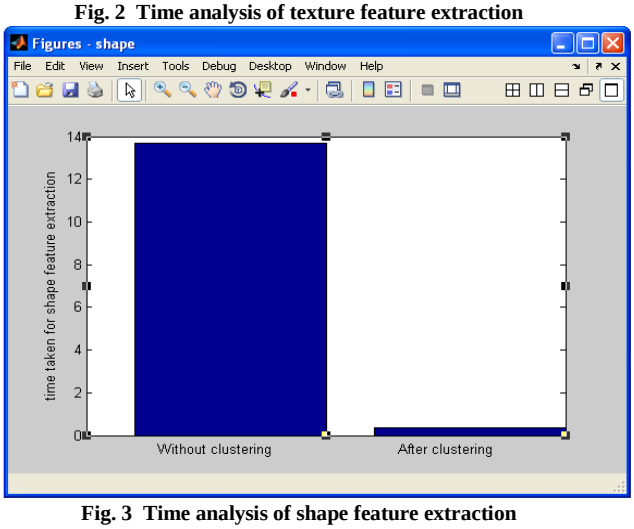

Fig. 3 Time analysis of shape feature extraction

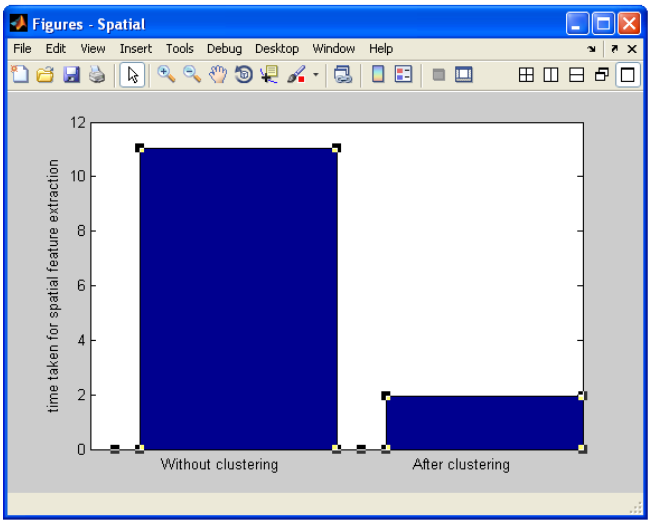

Fig. 4 Time analysis of spatial feature extraction

IV. CONCLUSION AND FUTURE WORK

In this research work impact of clustering is not analyzed on only single feature but also multiple low level features are considered simultaneously for improved, accurate and fast image retrieval.

For future point of view this image retrieval system is not sufficient because of having some semantic gap which can be overcome by including some object recognition techniques for semantic retrieval of images in this system.

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