An Efficient K-Means Cluster Based Image Retrieval Algorithm using Learning: An Innovative Approach from Relevance Feedback

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Abstract— **Content-based image retrieval (CBIR) systems are capable to use query for visually related images by identifying similarity between a query image and those in the image database. The CBIR systems can be classified broadly into two classes as Low level feature based system and High level Semantic feature based system. Image contents are plays significant role for image retrieval. The most common contents are color, texture and shape. An efficient image retrieval system must be based on well-organized image feature extraction. K-means clustering is used to group similar and dissimilar objects in an image database into k disjoint clusters whereas neural network is used as a retrieval engine to measure the overall similarity between the query and the images. Relevance feedback is a query modification technique in the field of content-based image retrieval to improve the retrieval performance.**

Keywords: **Content-based image retrieval, Feature Extraction, Relevance Feedback, k-means.**

I. INTRODUCTION

Content-based image retrieval has been an active research area in recent years. The interest in this research area has inspired from the need to search and well manage large volumes of Multimedia information [1, 6]. CBIR extracts low-level features which is Inbuilt in the images to present the contents of images. Each image has Visual features such as classified into three main classes: color [2, 11], texture [9, 11] and shape [2, 10] features. Color is an important image feature such as used in Content-Based Image Retrieval [2, 9, 13]. These features have potential to identify objects [10] and retrieve similar images on the basis of their contents. These methods do work very efficient in object recognition and Web searching [14].An efficient and effective query reformulation is essential for finding the relevant images from the database. Relevance feedback (RF) is an interactive process which refines the retrieval results to a particular query by utilizing the user's feedback on previously retrieved images [5, 8]. One of the simplest unsupervised learning algorithms is k-means, it solve the well known clustering problem. The procedure follows a simple and easy way to classify a given data set using a certain number of clusters [4].

II. Related Work

Similarity matching is significant issue in CBIR. So many image retrieval applications are based on shape feature and color feature [2, 10]. As well, lots of others have proposed CBIR method in the literature [2, 5, 8, 11, 12]. Estimating local texture based on pixels of the intensity image and a fuzzy index to point out the presence of major colors [11]. It is based on the texture co-occurrence matrix; a few apprehensible features have been proposed to deduct the comparison cost. They also used the relevance and performance cost.

Relevance feedback in Content Based Image Retrieval (CBIR) has been an active field for research [5]. Many schemes and techniques of relevance feedback exist with many assumptions and operating criteria. Yet there exist few ways of quantitatively measuring and comparing different relevance feedback algorithms [8].

K-means clustering for the classification of feature set obtained from the histogram refinement method. Histogram refinement provides a set of features for proposed for Content Based Image Retrieval (CBIR) [2]. They used global histograms for image retrieval, because of their effectiveness and insensibility to minor changes, are broadly used for content based image retrieval [7].

Color feature plays important role in image retrieval system and comparing all the colors in two images would however be time consuming and difficult problem to overcome this problem they introduced a method of reducing the amount of information. One way of doing

this is by quantizing the color distribution into color histograms [3, 12]. Using color histogram easier way for color distribution or they used histogram divide in to different classes for matching.

III. Proposed Work

Each image has three features Color, Shape and Texture. For fast and improve Image retrieval performance we are using color feature extraction. Using color feature extraction firstly we converted color image into grey level, this is containing values from 0 to 255.

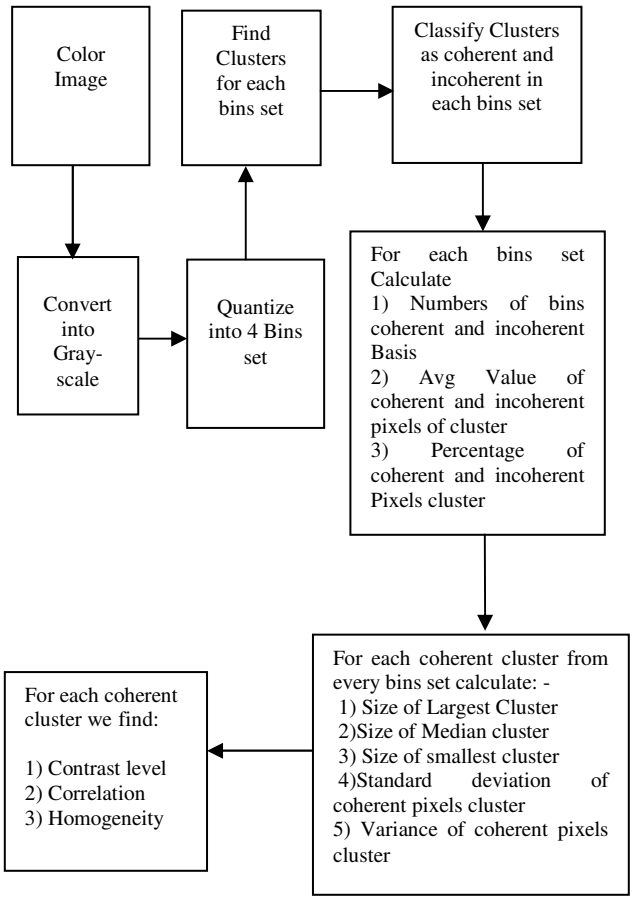

Figure1. Block diagram of algorithm.

After the conversion from RGB to grayscale image, we perform quantization into 4 to reduce the number of levels in the image. We reduce the 256 levels to 16 levels in the quantized image by using uniform quantization.

After the above declared pre-processing stage, we find out the coherent pixels and incoherent pixels. If a pixel is part of a big group of pixels of the same color which form at least 60 percent of the image then that pixel is a coherent pixel and that group is called the coherent group or cluster. Otherwise it is incoherent pixel and the group is incoherent group or cluster.

Then few properties are calculated for each bin. Firstly the numbers of clusters are found for each case, i.e., coherent and incoherent case in each of the bin. Secondly, the Percentages of each bin cluster is computed. Consequently for each bin, there are six parameters: one each for percentage of coherent pixels values and Incoherent pixels values, number of coherent pixels values in cluster and incoherent pixels values in cluster, average of coherent pixels values cluster and incoherent Pixels values in cluster.
As we seen in figure 1.

Let i is distinguished color, the number of coherent pixels as Xi, the number of coherent bonded components as CX_i and the average of coherent bonded component as μX_i. Similarly, let the number of incoherent pixels as Xj, the number of incoherent bonded components as CY_i and the average of incoherent bonded component as μY_i.

For each distinguished color i, the total numbers of pixels bin are X_i+Y_i and the color histogram summarizes the image as

$<X_i+Y_i,\ldots\ldots\ldots\ldots,X_n+Y_n>$.

After calculation of above features, we consider some additional features based on coherent Pixels clusters only. At this stage, incoherent Pixels clusters are ignored. Four features are selected among the coherent clusters. Few properties are based on the size of the clusters while one is statistical in nature. They are; (i) Size of largest bin value in cluster, (ii) Size of median value bin cluster from bins set, (iii) Size of smallest bin value in cluster from bins set, and (iv) Variance of bins value from bins set. Let us denote the largest cluster in each bin as LX_i, the median cluster in each bin as MX_i, the smallest cluster in each bin as SX_i and Variance of clusters in each bin as VX_i. These features are shown in figure 1.

Again more features are selected bases on above referred features of coherent pixels group or clusters. The following features are selected for retrieval for each of the largest value bin cluster, median of value bins in cluster and smallest value bin in cluster in each of the bin and (i) contrast (ii) homogeneity (iii) correlation.

We use set of bins from quantized histogram into four parts and find coherent pixels values and incoherent pixels values distance using Euclidian distance Algorithm and divide into separate cluster which is based on k-means Clustering and next we find out gray level mean, variance, median, standard deviation and various sizes of objects like highest and smallest degree of bins values from image Histogram.

These additional features help in retrieval. Here we use the k-means clustering techniques, due to following reason:-k-means is one of the best techniques available.

IV. Result and Analysis

In this section, some experiments are conducted in order to test the performance of histograms and here we used James Z. Wang et al database. [6] To test the proposed method. Firstly image converted to grayscale image. Then the image were quantized and the features described in section III were calculated which is based on coherent and incoherent clusters. Followed these feature set; images were grouped in similar clusters using K-means clustering method. Histogram filtering method more filters the histogram by dividing the pixels in a given bucket into a number of classes based on color coherence vectors. Several features are calculated for each of the cluster and these features are further classified using the K-means clustering method.

Table1. Example of parameter values for Incoherent pixels.

Bin	(X_i)	(CX_i)	(μX_i)	(Y_i)	(CY_i)	(μY_i)
1	42	53	781.6	58	11	5.17E+03
2	51	112	428.5	49	16	3.11E+03
3	78	185	413.7	22	7	3.00E+03
4	52	225	2.28E+02	48	31	1517.32

Here we represent Percentage of Coherent pixels (X_i), Number of Incoherent pixels clusters (CX_i), Average of Incoherent pixels cluster (μX_i), Percentage of Incoherent pixels (Y_i), Number of Incoherent pixels clusters (CY_i), Average of Incoherent pixels cluster (μY_i).

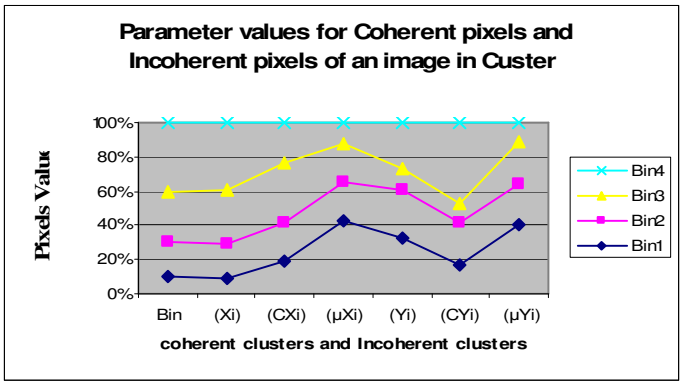

fig1(a).Parameter value coherent and incoherent parameter

As we seen in fig1(a) it shows differences between coherent pixels clusters values and Incoherent pixels clusters values and we see that in fig1(b) there some additional features parameter values for improving retrieval results.

After calculation of above features, we consider some additional features based on coherent bins cluster only. At this stage, incoherent Pixels cluster is ignored. These features are preferred.

Similarly, we have additional parameter values related with the coherent bins in clusters including size of largest bin in cluster (LX_i), size of median bins in cluster in each bin (MX_i), size of smallest bins in cluster in each bin (SX_i) and variance of coherent bins value in clusters (VX_i) and standard deviation of coherent bins in clusters (DX_i). Also, Correlation, Homogeneity and contrast level (TX_i), for each of the largest, median and smallest bin cluster value.

Table2. Additional features among the coherent Pixels cluster. Three of them are based on the size of the Cluster.

	Binset1	Binset2	Binset3	Binset4
(LX_i)	2150	1777	1990	957
(MX_i)	750	437	276	194
(SX_i)	0	0	0	0
(VX_i)	316627	132612.2	210355.1	35401
(DX_i)	562.6	364.16	458.64	188.15
(TX_i)	1.39e+03	8.29e+01	1.70e+04	2.55e+04

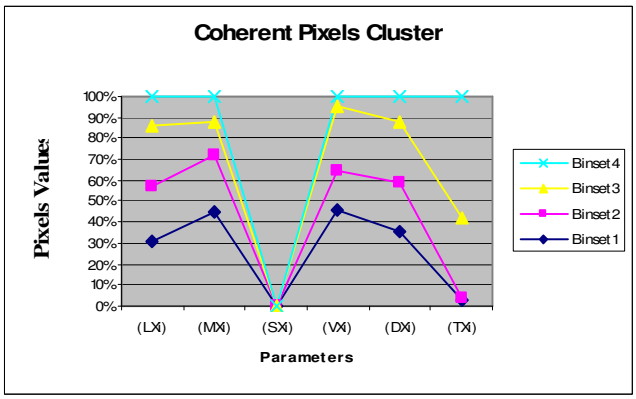

Fig 1(b). Additional features

As we seen that in fig1 (b) it shows differences between coherent pixels clusters values and Incoherent pixels clusters values and we see that in fig1 (b) there some additional features parameter values for improving retrieval results.

The grayscale values mean, variance, median, various sizes of the objects, standard deviation are considered as appropriate features for retrieval.

(a)Query Image

(b)Retrieval Result

V. Conclusion

The algorithm is based on the color and texture features of images. The grayscale values mean variance, contrast level and various sizes of the intensity values are considered as appropriate features for retrieval. We have shown that k-means clustering is quite useful for relevant image retrieval queries. One achievable way for future work is to further improve the cluster picking method by investigating heuristic functions.

VI. References

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