Retrieval and Classification of Images Using Hybrid of HMMD Color Space and Naïve Bayes Classifier

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Abstract: **With the development of the Internet, and the availability of image capturing devices such as digital cameras, image scanners, the size of digital image collection is increasing rapidly. Efficient image searching, browsing and retrieval tools are required by users from various domains, including remote sensing, fashion, crime prevention, publishing, medicine, architecture, etc. For this purpose, many general purpose image retrieval systems have been developed. In CBIR, images are indexed by their visual content. Content based image retrieval consists of three parts: feature extraction, indexing and retrieval part. The techniques which are used to extract features of an image are called feature extraction techniques. The choice of features plays an important role in image retrieval. Some of the features used are color, texture and shape. Combination of these features provides better performance than single feature. Here we are extracting color mean features and color standard deviation featurewith the proposed method consists of HMMD (Hue Min Max Difference) color plane. It is proved in research work that HMMD along with color mean features and color standard deviation feature is tend to reduced the size of feature vectors, storage space and gives high performance than, RGB-color mean feature. Further, HMMD color space model will be used to improve the feature extraction and improve the precision. At the end, results are presented to show the efficacy of the proposed method.**

Keywords: CBIR, HMMD, RGB, Color mean

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INTRODUCTION

Image retrieval on the basis of image features, textures and color has become one of the most researched areas in the field of computer vision. The major utilization of all the techniques used to retrieve images based on content relies on how well the features are being extracted. With advances in feature extraction methods, the field is getting more and more sophisticated. There is a great use of content-based image retrieval in applications such as fashion, graphic designers, medical diagnosis, geographical information, publishing and advertising, crime prevention, etc. Various regional and national newspaper publishers need to maintain their libraries of multiple photographs, or use them on the Reuters, Press Association and other agencies. Electronic techniques of access and storage are showing along with developments and designs in automated techniques of production of the newspaper, that greatly improve the accuracy and speed of the retrieval process. CBIR performs image retrieval based on the similarity measure of image features such as color feature, texture feature, shape feature and spatial location. These features are extracted from image content. Color feature and texture carry significant information. But two separate images with similar color histogram can show very different things.

In general the histogram matching based CBIR techniques is relatively simple and faster. To retrieve image, it is essential to separate objects and background, since the objects are the key contents and the background usually weakens the retrieval accuracy. The low level feature of CBIR contains color, texture and shape. The high level feature of CBIR describes the concept of human brain. The system is said to be efficient if this semantic gap (difference between the user's information need and the image representation) is minimum. Content-based image retrieval (CBIR) has become an outstanding analysis topic as a result of the proliferation of video and image knowledge in digital type. the enlarged information measure convenience to access the net within the close to future can enable the users to go looking for and browse through video and image databases placed at remote sites. Therefore, fast and improved retrieval of pictures from against database is a vital downside that must be self-addressed. In typical image databases, pictures area unit text-annotated and image retrieval relies on keyword looking out. The transmission primarily based application became standard due to the rapid advancement of Internet technology and therefore the digital devices. Feature Extraction may be a technique of extracting helpful info from a picture. This info is employed to unambiguously establish a picture [3]. Similar reasonably pictures have similar signatures. Within the figure given below, it's seen that the feel and therefore the white colour of the building square measure the properties of the image. What's more, the scale of the objects within the image is often taken into the thought. It's very important to determine that options square measure important for representing a picture and that approaches square measure effective to extract the options of a picture. This section introduces 3 features: texture, shape, and color, that square measure used most frequently to extract the options of a picture.

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It is seen in world that humans usually distinguish things supported their color. This can be the rationale that color is usually wont to differentiate pictures in content-based image retrieval. Color is that the feature that makes the thing identification method terribly straightforward and is stable against direction variations, size of image and background complexness. To extract the color options from the content of a picture, a correct color house and a good color descriptor need to be determined. The color house is employed for the specification of the colors. There square measure numerous color areas developed like RGB, HSV, CIE L*a*b for completely various needs and different functions. Shape from an image is quite a powerful representation as it characterizes the geometry of the object. The object's shape plays a critical role in searching for similar image objects (e.g. texts or trademarks in binary images or specific boundaries of target objects in aerial or space images, etc.). In a specific, picture regions are obtained by an object to be founded in an order to define the shape, and known segmentation methods combine with low-level color detection and region-growing of texture features or merge and split processes. After dividing the objects, their shapes have to be described, indexed, and compared.

I.   RELATED WORK

Jun Yue, Zhenbo Li , Lu Liu , and Zetian Fu(2011) :- In [1]"Content-based image retrieval using color and texture fused features" author proposed the common feature of low-level including reflecting texture, color, salient and shape points in picture. Due to the effectiveness, robustness, low storage merit advantages and implementation simplicity. Color contains the most effective and useful feature or all CBIR systems take colors. CIE or HSV Lab and LUV gaps are used to display color combination of RGB space. Normally, the division of color was displayed by color formed and histograms in the images' of feature vectors.

Liu, Guang-Hai, et al. (2011):- In [2]"Image retrieval based on micro-structure descriptor." Author proposed that human visual attention can increase with a process of interactions competing among neurons that choose a few elements of suppresses and attention of irrelevant materials. The close relationships are human attention system and down-level visual characteristics, and however the search to use the visual mechanism for picture retrieval is a crucial now challenging problem. In order to release the features through simulating texture, visual procedures and shape features, integrate color and image color of layout information as entire for picture retrieval.

Lin, Chuen-Horng, Rong-Tai Chen, and Yung-Kuan Chan (2009) :- In [3]"A smart content-based image retrieval system based on color and texture feature." Author proposed that a better picture recognition effect that can be get with multiple features used, but this is not true. However, all features are not useful for picture recognition. But Ill characteristics are interfering into signals that create a drop in color recognition rate, specifically it effects on the ill features that effective ones. The features can be useful to manage the retrieval of picture with huge featured area. Although, all individual ill characteristics can be searched into distinct cartoon images, image data, texture images, natural images, gray texture images, colorized and categorized images.

Torres, Ricardo da S., et al. (2009):- In [4]"A genetic programming framework for content-based image retrieval." author proposed a featured extraction algorithm that encodes picture properties into vector and similar function calculates the equality between two picture as function of difference between their featured vectors. A picture database created a index with using several pairs of characteristics releasing algorithms and similar functions. We include a pair of database descriptor that tells how the pictures are divided into the distance space. With the replacement of similarity function, we can create groups of related pictures with less or more compact, decrease or increase their separation. These are normally selected in domain-dependent, generally and fashion is combined in order to users' needs.

RitendraDatta, Jia Li, and James Z. Wang(2008): In [5] "Content-Based Image Retrieval - Approaches and Trends of the New Age" author proposed the featured shape with images, reliability segmentation was critical that the shape approximates are hugely meaningless. Even then the normal problem of these segmentation in context of human being perception is large from being resolved, some interesting newest directions, most crucial segmentation on the Normalized Cuts criteria. It based on the spectral clustering, that has been expressed to textur picture segmentation with using cues of texture and contour differences.

Sumana, IshratJahan, et al. (2008):- In [6]"Content based image retrieval using curvelet transform." author proposed a newest texture characteristic based on curve let transform. The method uses curvelet transform that shows the newest research conclusion on multi solution analysis. With the difference of them, the merits of two methods, picture edge information is recorded more correctly than some spectral methods such as Gabor and wavelet filters. The curvelet has proposed for picture noise and display promising performance. As it records linear and edge information correctly, that has shown final results in the recent character recognition.

Young Deok Chun, Nam Chul Kim, and Ick Hoon Jang (2008):- In [7] "Content-Based Image Retrieval Using Multiresolution Color and Texture Features" author proposed that color is the most vastly used visual characteristic and variant to picture orientation and size. The conventional features are used in CBIR, these are the color correlogram, color histogram, scalable color descriptor, color structure descriptor. Lately two are Color histogram and MPEG-7 color descriptors are the most used color representation, but it doesn't involve any relevant information. On the other side, color correlogram defines the

probability of searching color combination pairs at fixed pixel difference and give relevant information. Thus correlogram give the yields good return correctness in the comparison to histogram color.

Perronnin et al. [8] proposed the use of fisher vectors for representing the images. The Fisher vectors can be represented compactly and requires no labeled training data, but computing them is costly. These descriptors represent images compactly and they can be computed efficiently. SURF algorithm detects interest points on a gray-scale image by using the determinant of the Hessian matrix. At these interest points, on a 16 _16 neighborhood, 4 _4 sub-regions are considered and sum, absolute sum of gradients is taken in x and y directions. This procedure outputs a 64 dimensional descriptor at each of the interest point. These descriptors are robust to image rotation, scale, illumination and small changes in viewpoint.

II.   PROPOSED METHOD

Color-feature extraction is very commonly used for extracting spatial features from an image. When the input data to an algorithm is too large to be processed and it is suspected to be redundant then it can be transformed into a reduced set of features. This process is called feature extraction. The extracted features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data. In this report, a mean per block technique has been used to extract features. If the image is divided into N equal sized blocks of height 'h' and width 'w', then the feature values for the block are calculated as follows:

$$\text{Ravg} = \frac{\sum_{i=1}^{h} \sum_{j=1}^{w} R(i,j)}{h*w} \tag{1}$$

$$\text{Gavg} = \frac{\sum_{i=1}^{h} \sum_{j=1}^{w} G(i,j)}{h*w} \tag{2}$$

$$\text{Bavg} = \frac{\sum_{i=1}^{h} \sum_{j=1}^{w} B(i,j)}{h*w} \tag{3}$$

Ravg ,Gavg , Bavg are the means calculated for each component in the block. In this paper, the image has been divided into 16 equal sized blocks and then the mean values of color components are calculated to extract the features.Thepreprocessed data is fed to the classifier being used.

The steps involved in proposed methodology are as follows:

Step 1: Image is obtained from training dataset.

Step 2: Calculate the Hue value from image

Step 3: Calculate the Min and Max value from image

Step 4: Calculate the HMMD transform for image

Step 5: Features of image is extracted and save it in training file.

Step 6: If this image is the last image, then preprocess the training file and train the classifier, otherwise go to step 1.

Step 7: Now, image is obtained from testing data set.

Step 8: Extract the feature of image.

Step 9: If it is the last image then predict the class using trained classifier, otherwise go to step 4.

III.   RESULT AND DISCUSSION

Figure 1: Retrieved images of peoples using HMMD features based on Query Image

.The primary image retrieved is same because the question image. This shows the effectiveness of the method which can then be quantified in terms of Precision and Recall and the results can be mentioned in the form of graphs and a comparison result or graph can be displayed.

Figure 2: Retrieved Images of bus of the query image.

The primary image retrieved is same because the question image. This shows the effectiveness of the method which can then be quantified in terms of Precision and Recall and the results can be mentioned in the form of graphs and a comparison result or graph can be displayed.

Figure 3: Results for retrieved image of buildings using HMMD feature.

The primary image retrieved is same because the question image. This shows the effectiveness of the method which can then be quantified in terms of Precision and Recall and the results can be mentioned in the form of graphs and a comparison result or graph can be displayed.
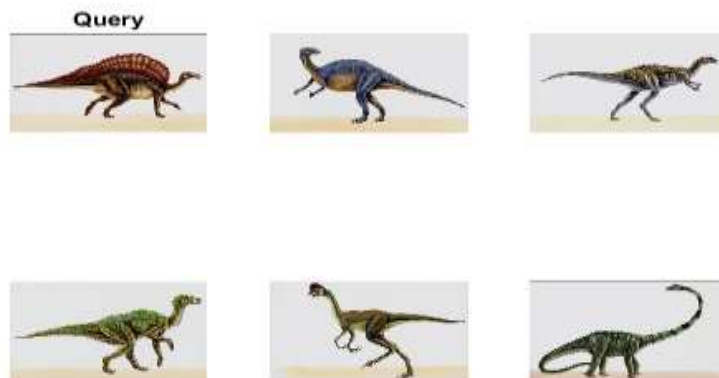

Figure 4: Results for dinosaur image query using HMMD Feature.

The primary image retrieved is same because the question image. This shows the effectiveness of the method which can then be quantified in terms of Precision and Recall and the results can be mentioned in the form of graphs and a comparison result or graph can be displayed.
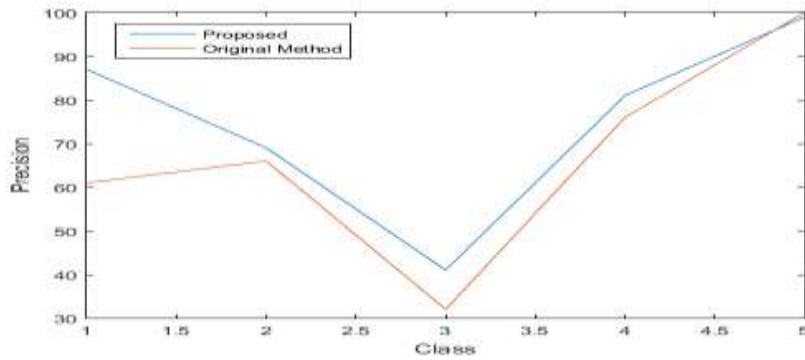
Figure 5 Precision value comparison graph

The following performance metrics are considered in analyzing the performance of content-based image retrieval

(i)Precision: Precision is used for evaluation of most CBIR systems. Precision is the fraction of returned images that are relevant to the query image. If we denote T as the set of returned images and R as the set of all images relevant to the query image, then precision is given by:

Precision = |T∩R| / |T|

(ii) Recall: Recall is the fraction of returned relevant images with respect to the total number of relevant images in the dataset.

Recall = |T∩R| / |R|

The numbers of relevant images are computed and the precision and recall in each number of retrieved images for all query images are obtained. We next consider the average of these precisions and recalls for each number of retrieved images as the precision and recall of each method for each number of retrieved images. The distance is computed between the feature vectors of the query image and the feature vectors stored in the dataset using Euclidian distance. Sort the images according to distances with the smallest distance first. The number of images returned is six in number fixed by the code.

Table 1: Precision Recall for base method

	Precision	Recall
People	61	6.1
Beaches	66	6.6
Building	32	3.2
Buses	76	7.6
Dino	100	10

The retrieved pictures in the results show that the photographs are relevant to the specified or the question image. The performance metrics in terms of confusion matrix has been planned for the one thousand image Corel dataset that shows that there's a scope of improvement within the existing algorithmic program. The results show a brand new methodology is needed so as to enhance the relevance of the retrieved pictures. The projected work is meant for the development within the retrieval method on the grounds of each quantitative and qualitative information.

	Precision	Recall
People	87	8.7
Beaches	69	6.9
Building	41	4.1
Buses	81	8.1
Dino	99	9.9

Table 2: Precision Recall for proposed method

IV. CONCLUSIONS

Content based image retrieval is a challenging method of capturing relevant images from a large storage space. Although this area has been explored for decades, no technique has achieved the accuracy of human visual perception in distinguishing images. Whatever the size and content of the image database is, a human being can easily recognize images of same category. Overall the performance of content based image retrieval depends on features, feature extraction techniques, similarity measures and the size of database. Several feature extraction techniques have been developed to the task of image retrieval. Further, it is proved that by combining different features, the performance can be increased. We have performed performance evaluation of HMMD color model and Naïve Bayes classifier with COREL database for determining the classification rate .It is observed that HMMD is giving desired results. Further, it is seen that in some cases there will be irrelevant images with the result of query image in some cases these irrelevant images are totally different from query image on basis of color and shape. Still, this is not the required image and hence there is a scope of improvement in the existing algorithm future work consists of using some other color space or improved texture extraction technique.

Content based image retrieval consists of four main steps. First, the database is taken which consists of different images. The images are pre-processed to make them in the form that can be input to the feature extractor. Then the features are extracted using HMMD with color mean technique and are stored as feature vectors as a feature dataset. Then these feature vectors are compared using similarity measure with the features of the image given by the user. Further performance evaluation of each of the technique is done on the basis of performance metric discussed in the next section. For matching images in the dataset with the query image, Eucledian distance is used. The query image is the image which is taken from any class of the taken database. It is considered that lesser the distance calculated between the query image and database image, more will be the matching between the images. The matching images are shown by using graphical user interface. Performance analysis of HMMD and Naïve bayes feature extraction is done on the basis of the performance metrics: precision, recall. These metrics when used tells us about the performance of the content based image retrieval. The metrics are explained in next section. The numbers of relevant images are computed and the precision and recall in each number of retrieved images for all query images are obtained. We next consider the average of these precisions and recalls for each number of retrieved images as the precision and recall of each method for each number of retrieved images.

Although the method provides an efficient retrieval of images, the computation time for the whole process is on a bit higher side. Therefore, the future work will be focused on reducing the processing time for the feature extraction so that the complete process is fast enough for real time application.

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