Retrieval of Images Using Color Mean Feature Extraction and Image Classification Using Artificial Intelligence Techniques

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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. Here we are extracting color mean features and color standard deviation feature with 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.*

Key Words: CBIR, HMMD, Classification, Naïve Bayes, Neural Network

1. INTRODUCTION

In text-based image retrieval, images are labeled or indexed using keywords, subject headings or codes. These keywords become the criteria to search and retrieve images. Text-based is not standardized system because different users use different keywords to search according to their knowledge and understanding. Furthermore, it is not possible to annotate complicated features of an image. Text-Based Image Retrieval requires humans to describe each image manually. Manual annotation of images by human requires large amount of time. This is impractical for very large databases, or for images that are generated automatically, e.g. from surveillance cameras. Content based image retrieval has been developed to solve the problems associated with text-based image retrieval.

The content based image retrieval works directly with image content rather than text annotations. The word "content" might refer to shapes, colors, textures, or some information which can be inherited from the picture itself. CBIR is valuable because founds that rely surely on metadata have dependent on fixed quality and completeness. The word "content-based image retrieval" looks to have established in 1992, used by T. Kato to define the experiments on image automatic retrieval from a database that based on shapes and colors present. Initially the CBIR systems have invented to find databases based on texture, image color, and shape properties. After some the development of systems, the user-friendly interface is needed to become apparent. Thus, efforts are in the CBIR field has started to involve human-created design which tried fulfill the needs of user to perform the specific search. This means the inclusion of these query methods are allow to queries, descriptive semantics, which may include user's feedback that can include systems or machine learning that should be understand user's satisfaction level. A basic content-based image retrieval system is split into off-line feature extraction and on-line feature extraction [4].In off-line feature extraction, the system extracts visual options like color, shape, texture, and abstraction info etc of every image within the info and stores them during a completely different info at intervals the system known as feature info. The scale of the feature information is incredibly little as compared to the image information. In on-line image retrieval, the user will submit a question example so as to retrieve the required pictures. Future step is that the similarity lives. The space between the feature vector of the question image and therefore the feature information is calculated in terms of the distances.

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. . 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. In hospitals, decision making process requires the medical practitioner to search and review similar X-ray or scanned images of a patient before giving any solution. In crime prevention, police needs to confirm the face of a criminal by matching his image features with the images in the database. The most important application is the Web. Now, various experimental and commercial CBIR systems are available, and several search engines are tied with CBIR facilities, example Alta Vista, Google and

Yahoo. In teaching, visual content is very helpful in giving knowledge to educational industry. In the commerce department, there is need to find out about the trademarks whether they exist in database before using them.

2. RELATED WORK

Harshada Anand Khutwad [1] author proposed the color is mostly extensive used visual for image retrieval. The 3D color values make its decrementation potentiality higher to the one dimensional gray color values of picture. Before choosing a fixed color space, color description have determined first. Returning pictures are based on the color similarity which is adopted by computing color value histogram for an each picture which identifies the size and proportion of pixels. The mean 1st order, the variance second order and skewness is a third order color moments that must have proved to be effective and efficient in displaying color distributions of pictures. Texture is an intuitive and vastly used but there has no specific definition.

Liu, Guang-Hai [2] author proposed that neuron biological and psychophysical studies indicate that human visibility system is more responsive to edge orientation and color. It describes the uniform of color difference b/w edge and colors orientations wrap on rich type of visual data and information. It is more helpful information and works as a vital role in picture understanding and analysis.

S. Arivazhagan [3] proposed that wavelet is used to transform a picture from spatial into the frequency domain. The transform displays a superposition function of family of the basis of functions, these are called wavelets. The Wavelet transforms explore the information from signal at distinct scales crossing the signal via high pass filters and low pass. Wavelets provide a good energy compaction and multi solution capability. Wavelets are powerful with the respect to image color shifts. DWT compressed a signal into multiple Wavelet Functions and Basis Functions. The transform of a 2-dimensional picture is also a multi solution method that applies sub-sampling and recursive filtering.

Cerra, Daniele [4] proposed a compression-based measure, the (FCD) Fast Compressing of Distance that associate the correctness of NCD by the decreased complexity of PRDC. In an initial offline step, the pictures are quantized in a specific color space or changed into the strings, after the changed to reserve textural information in process; representative, subsequently dictionaries are expressed from an each object. There are some similarities in b/w different images which are calculated by the comparing with an each couple of dictionaries.

Soman, Sagar et al. [5] proposed the content based photo Retrieval, in which the retrieving process of pictures is based on the visible features like texture, color and shape. The main reasons for the development are various huge picture database, trendy techniques of picture indexing have shown to be laborious, insufficient and time consuming. These old techniques of picture ranging, indexing from the saving of a picture in database and identifying it with a number and keyword, with become obsolete, categorized description.

Swapnalini Pattanaik [6] proposed that Pictures are manually changed by text descriptors that are used by DBMS to perform photo retrieval. It contains two disadvantages. Firstly, consider a level of human labor which is required for modified annotation. Second one is the annotation incorrectness causing the subject of human perception. To control the above demerits in text retrieval system, and content based picture retrieval was defined in an early 1980s. In the CBIR, pictures are arranged by visual based content, like texture, color, shapes.[6]

Youssef, Sherin M. (2012):- In [7] proposed that a texture based feature on the curve let transform. The method creates the uses of curve let transform that displays the newest research result on multi solution analysis. Curvelet has proposed for picture denoising that shown conclusion performance. With combining the merits of the two techniques, picture information is recorded more correctly than spectral methods such as Gabor and wavelet filters. In the implementation of a curve let, combine a vector codebook clustering for color extraction with Curvelet-based texture extraction.

2. PROPOSED METHODOLOGY

The RGB color model algorithm used in the present work is not sufficient for better color description. Therefore the HMMD (Hue Min Max Difference) color space, is can be used in order to efficiently describe the colors in an image.

2.1 HMMD Color Space Model

The hue has the same meaning as in the HSV space, and max and min are the maximum and minimum among the R, G, and B values, respectively. The diff component is defined as the difference between max and min. Only three of the four components are sufficient to describe the HMMD space. This color space can be depicted using the double cone structure as shown in the figure. In the CBIR core experiments for image retrieval, it is observed that the HMMD color space is very effective and compared favorably with the HSV color space. Note that the HMMD color space is a slight twist on the HSI color space, where the diff component is scaled by the intensity value.

2.2 Naïve Bayesian Classifier

Naïve Bayesian classifier is a simple probabilistic classifier which works by applying the Baye's theorem along with naïve assumptions about feature independence. It assumes value of any feature is independent of values of other features. This assumption is also known as Conditional Independence. Despite the naïve assumption and over simplification, Naïve Bayesian classifiers have proved to be quite useful in complex real world conditions. Naive Baye's classifiers are highly scalable, requiring a number of parameters

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.

2.3 Neural Network Classifier

The network once coaching, the performance of the network should be tested. As in discriminant analysis, a primary indication is given by the proportion of correct classifications of the coaching set records. All the same, the performance of the network with a take a look at set (set of comparable information unused throughout training) is a lot of relevant. In the take a look at step, the computer file square measure fed into the network and therefore the desired values square measure compared to the network's output values. The agreement or disagreement of the results offer the performance of the trained network.

Algorithm 1

Step 1: Image is obtained from training dataset.

Step 2: Calculate the R, G B value from image

Step 3: Separate Red, Green and Blue pixel values

Step 4: Calculate the color mean features as:

linear in the number of variables (features/predictors) in a learning problem. It is not a single algorithm for training such classifiers, but a family of algorithms based on a common principle. All naive Bayes classifiers assume that the value of a particular feature is independent of the value of any other feature, given the class variable.

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.

1. Ravg $= \frac{\sum_{i=1}^{h} \sum_{j=1}^{w} R(i,j)}{h*w}$
2. Gavg $= \frac{\sum_{i=1}^{h} \sum_{j=1}^{w} G(i,j)}{h*w}$
3. Bavg $= \frac{\sum_{i=1}^{h} \sum_{j=1}^{w} B(i,j)}{h*w}$

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

Step 7: Use Neural Network for classification of images and training the neurons:

The architecture for Neural Network can be shown as:

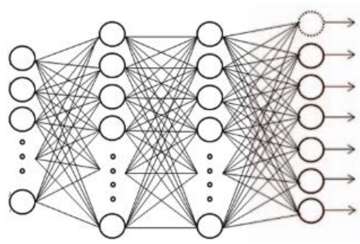

Fig-1: Neural network architecture

1. The activation function of hidden units is the logistic sigmoid

$$g(z) = \frac{1}{1+exp(-z)} .$$

2. In the function, z=Wx, where x is the input vector and W is the weight parameter.

3. The output is given by:

$$h_W(x_i) = \begin{bmatrix} p(y_i = 1 | x_i; W) \\ p(y_i = 2 | x_i; W) \\ \vdots \\ p(y_i = m | x_i; W) \end{bmatrix} = \frac{1}{\sum_{j=1}^{m} e^{W_j^T x_i}} \begin{bmatrix} e^{W_1^T x_i} \\ e^{W_2^T x_i} \\ \vdots \\ e^{W_m^T x_i} \end{bmatrix}$$

Algorithm 2
Step 1: Now, image is obtained from testing data set.

Step 2: Extract the feature of image.

Step 3: Apply the features as input to the trained classifier, using the equation

$$h_W(x_i) = \begin{bmatrix} p(y_i = 1 | x_i; W) \\ p(y_i = 2 | x_i; W) \\ \vdots \\ p(y_i = m | x_i; W) \end{bmatrix} = \frac{1}{\sum_{j=1}^{m} e^{W_j^T x_i}} \begin{bmatrix} e^{W_1^T x_i} \\ e^{W_2^T x_i} \\ \vdots \\ e^{W_m^T x_i} \end{bmatrix}$$

Step 4: Find the class to which the image belongs using the output of the classifier

Step 5: Pick random images from the selected category.

3. RESULTS

The experimental database contains 500 images which is in 5 datasets including peoples ,beaches, buildings, buses, dinasour taken from Corel dataset. Experimental examples are shown in below figures.

In figure 2, The primary image retrieved is same as 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.

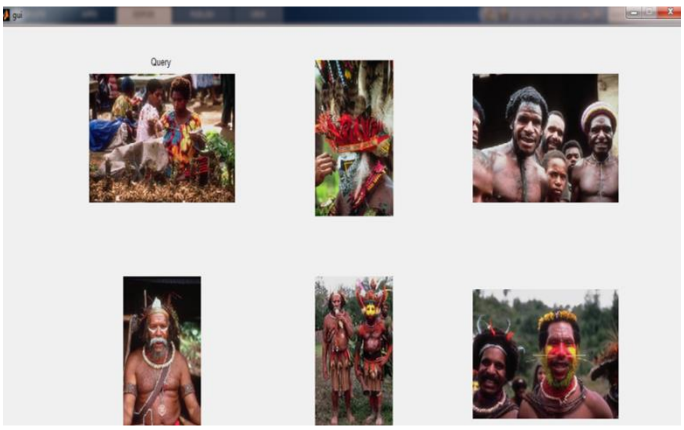

Fig-2(a): Image retrieved with Naïve Bayes classifier

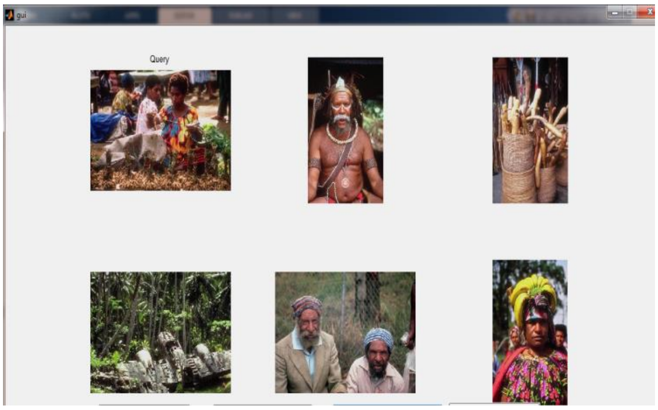

Fig-2(b): Image retrieved with Neural Network

Fig. 2(a), 2(b): Retrieved images of peoples using HMMD color features for Query Image by naïve bayes classifier and neural network

Figure 3 indicates that the primary image retrieved is same with the question image. This shows the effectiveness of the method which can then be quantified in terms of Precision and Recall.

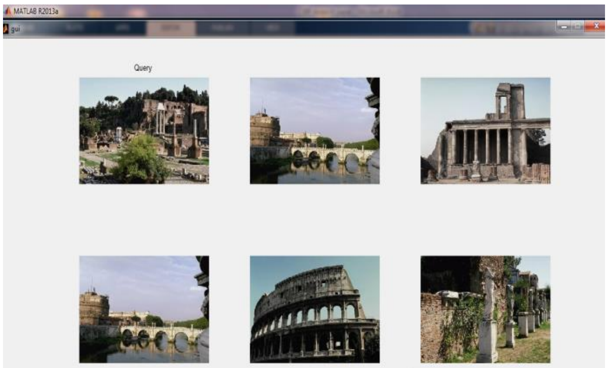

Fig-3(a): Retrieved images of buildings using Naïve Bayes classifier

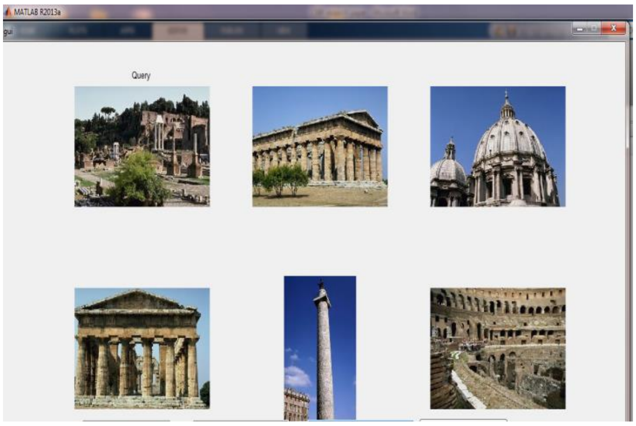

Fig-3(b): Retrieved images of buildings using Neural Network

Figure 4 indicates that the primary image retrieved is same with the question image. This shows the effectiveness of the method which can then be quantified in terms of Precision and recall.

Figure 4 indicates that the primary image retrieved is same with the question image. This shows the effectiveness of the method which can then be quantified in terms of Precision and Recall.

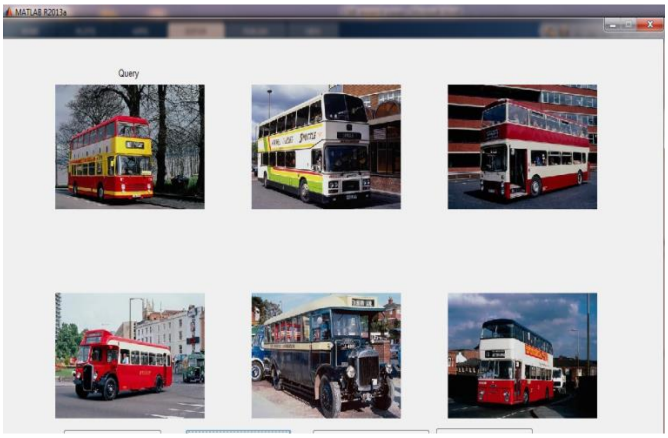

Fig-4(a): Retrieved image of buses using HMMD color feature with Naïve Bayes classifier

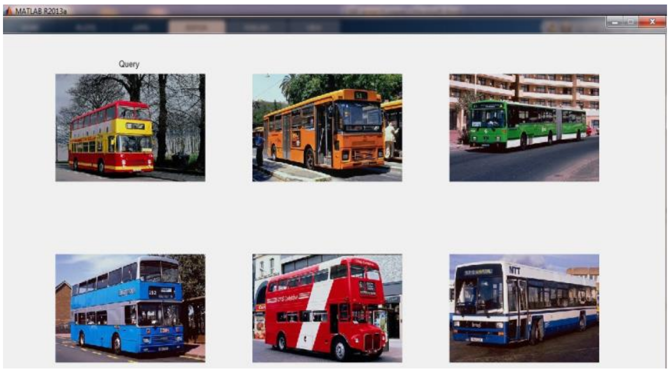

Fig-4(b): Retrieved images of buses using HMMD color feature with Neural Network

Table-1: Precision Recall for proposed method with Naïve Bayes classifier

	Precision	Recall
People	84	8.4
Beaches	76	7.6
Building	68	6.8
Buses	84	8.4
Dino	98	9.8

Table-2: Precision Recall for proposed method with Neural Network classifier

	Precision	Recall
People	69	6.9
Beaches	85	8.5
Building	65	6.5
Buses	92	9.2
Dino	15	1.5

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|

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. 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.

Table-3: 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

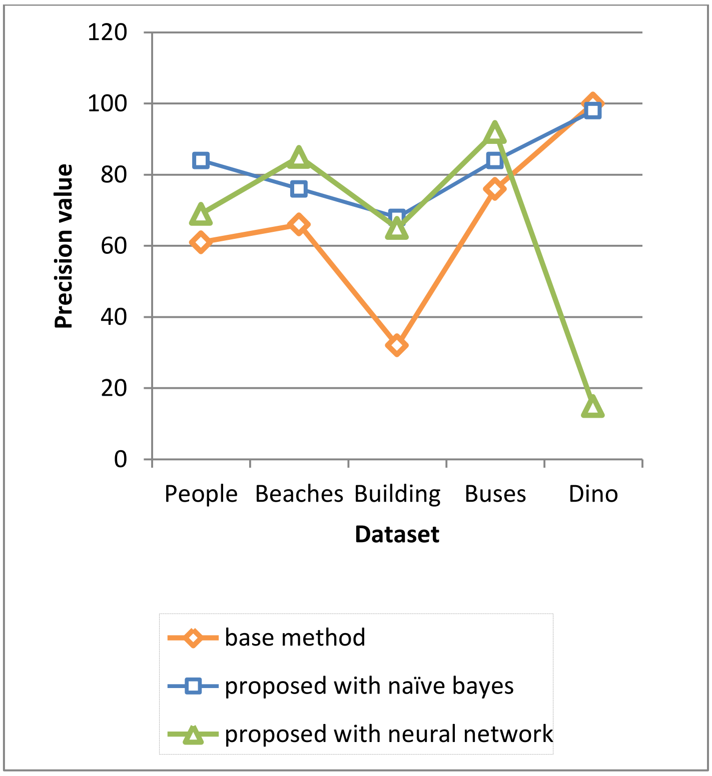

Fig-5: Precision value comparison graph

4. CONCLUSION

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. 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 for the task of image retrieval. Further, it is proved that by combining different features, the performance can be increased. We have performed by 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 which 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.

This 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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