International Journal of Scientific Research and Engineering Development-– Volume2 Issue 3, May –June 2019

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Content Based Retrieval and Classification of Images Using Hybrid of HMMD Color Space

Jasmeet Singh

Department of Computer Science Engineering, Calorx Teachers' University, Ahmedabad, India

----------**********----------

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.. 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 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.

Keywords— **CBIR, HMMD,Content based image classification, Feature Extraction, Color Features, Naive Bayesian Classifier.**

----------**********----------

I.INTRODUCTION

Content-based image retrieval has been an active research area since the early 1990's. 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. Therefore, in content based image retrieval system the use of shape-describing feature is necessary. High retrieval potency is essential characteristics of CBIR system. CBIR is one of the retrieval processes that rely on the visual content of the image data. The straight forward image to image searching mechanism is not considered in CBIR because these types of mechanisms are not practically feasible to consider in real time applications as the image data is larger in size. So in CBIR, suitable feature extraction techniques are required to form the image data so that relevant images can be retrieved based on those extracted image features. A number of CBIR techniques were developed based on considering the significant feature like color, texture and shape. Color feature is widely used in CBIR techniques since it is one of the most prominent low level features and it is also invariant to rotation, scaling, and other spatial transformations on the images. 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. CBIR is used for automatic indexing and retrieval of images depending upon contents of images known as

features. The features may be low level or High level. The low level features include color, texture and shape. The high level feature 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.

As a result, the capacity of digital image libraries obtained through different category of sources like social networking Sites, multimedia cameras, multimedia mobiles, internet etc. so there requirement for proper searching techniques to retrieve meaningful image data form that large volume of digital image libraries. Image retrieval techniques are used maintain and retrieve the image in the database. Color feature and texture carry significant information. But two separate images with similar color histogram can show very different things. Therefore, in content based image retrieval system the use of shape-describing feature is necessary. High retrieval potency is essential characteristics of CBIR system. CBIR is one of the retrieval processes that rely on the visual content of the image data. The straight forward image to image searching mechanism is not considered in CBIR because these types of mechanisms are not practically feasible to consider in real time applications as the image data is larger in size. So in CBIR, suitable feature extraction techniques are required to form the image data so that relevant images can be retrieved based on those extracted image features. A number of CBIR techniques were developed based on considering the significant feature like color, texture and shape. Color feature is widely used in CBIR techniques since it is one of the most prominent low level features and it is also invariant to rotation, scaling, and other spatial transformations on the images. 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.

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. 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. To record the finished projects photos are used in architecture, including exterior and interior shots of creating as well specific features of design. In architecture, photographs are used in architecture to record interior and exterior shots of buildings, design features and to record finished projects. 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.

A brief overview of the paper is as follows: Section II summarizes some of the related works in the topic of CBIR and the primary research issues. The recently developed methods are described with a brief explanation, analyzing their advantages and limitations and future scope. In Section III research methodology is represented. It provides problem definition and hypothesis and design methodology. Section IV represents the results and discussions. It provides brief summary of datasets, feature extraction methods and performance evaluation parameters. Lastly comparative analysis of feature extraction methods is discussed. Section V represents the conclusions and future work.

II. RELATED WORK

SwapnaliniPattanaik, Prof.D.G. Bhalke(2012): In [1] "Beginners to Content Based Image Retrieval" author 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. **Youssef, Sherin M. (2012)**:- In [2] "ICTEDCT-CBIR: Integrating curvelet transform with enhanced dominant colors extraction and texture analysis for efficient content-based image retrieval." author

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. Curve let has proposed for picture de-noising 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.

Youssef, Sherin M., SalehMesbah, and Yasmine M. Mahmoud (2012):- In [3] "An efficient content-based image retrieval system integrating wavelet-based image sub-blocks with dominant colors and texture analysis." author proposed that a content-based picture retrieval application for computer vision schemes to the picture returning problem of finding for digital photos in huge databases. With the increasing of available bandwidth the rapid developments are contained in memory, processor, and saved technologies or the variation of image and video data in a digital form, this create the CBIR technique which has crucial alternative to the traditional image searching, these CBIR technique systems greatly enhanced the speed and accuracy of returned information. CBIR technology generates full use of picture content features like, texture, color, and shape, etc. which are extracted and analyzed to take the effective retrieval. The color space of HSV is closer to human the understanding of colors, so it provides better results in various CBIR systems.

RitendraDatta, Jia Li, and James Z. Wang (2008): In [7] "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 this segmentation in context of human being perception is large from being resolved, some interesting newest directions, and most crucial segmentation on the Normalized Cuts criteria. It based on the spectral clustering, that has been expressed to texture picture segmentation with using cues of texture and contour differences.**Sumana, IshratJahan, et al. (2008)**:- In [8]"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. **YoungDeok Chun, Nam Chul Kim, and Ick Hoon Jang (2008)**:- In [9] "Content-Based Image Retrieval Using Multi resolution 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 correlograms, 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 correlograms defines the probability of searching color combination pairs at fixed pixel difference and give relevant information. Thus correlograms give the yields good return correctness in the comparison to histogram color.

Mehyar, Tamer*et al* (2012) ET AL. [10] the purpose of this paper was to improve the accuracy (precision) of a CBIR application by allowing the system to retrieve more images similar to the source image. The proposed methodology adds a new color features to the already implemented HSV color features and GLCM texture features. The new color features is the Average Color Dominance value (ACD) which represents the average of the top dominating colors. The proposed methodology was tested and experimented on a benchmark database of images. The proposed methodology had increased the average precision from an average of 40.4% (Kavitha methodology) to an average of 45.7% for precision. However, there are still some drawbacks in the image matching algorithm that could be improved to provide better results in general and prevent the precision to decrease when increase the number of output images.**Kushwah, Vinita** et al. [11] in this paper an overview of the functionality of content based image retrieval systems. Combining advantages of query based clustering technique for content based image retrieval to find similar and dissimilar image group and data. This system describes the automatic retrieval of images from a database. In order to evaluate the similar and dissimilar image data, content based image retrieval has been used. **Malik, Fazal, and BaharumBaharudin***et al [12]*(2013) In this paper an algorithm has been proposed for the effective image retrieval. These features are extracted from median, median with edge extraction and Laplacian filtered images. The experimental comparison of the results of the three filter methods are analyzed for the 1000 images of 10 categories in terms of the accuracy of image retrieval. It may be conclude that the enhanced and sharpened Laplacian filtered images using the quantized

histogram texture features give good performance in terms of precision and recall in the DCT domain for compressed images as compared to the retrieval of images in the pixel domain.**Shrivastava***et al.*(2014) [13], in this paper, a new approach has been proposed depending on the choosy region matching. Images present in the database are equally portioned into many regions and every region is allocated a 4-bit region relied on its position respective to central region. The proposed approach is executed on the Corel and MPEG-7 CCD database. The result analysis indicates that the presented techniques improves the precision and minimize the retrieval time

.**Zhang, Xiaofan***et al.*(2015) [14] supervised kernel hashing approach has been presented in this work. Usually, supervised information is developed to link the semantic gap among the high-level diagnostic information and low-level image features. Moreover, in this paper scalable image-retrieval architecture depending on supervised hashing technique has been developed. The performance can be taken in terms of image classification and retrieval tests. The result analysis indicates that our proposed architecture attains 88% accuracy and time efficiency.

III. RESEARCH METHODLOGY

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:

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

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

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

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. The pre-processed data is fed to the classifier being used.

A. *Naive 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 Bayes classifiers are highly scalable, requiring a number of parameters 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. Fig 1 shows the steps of proposed work.

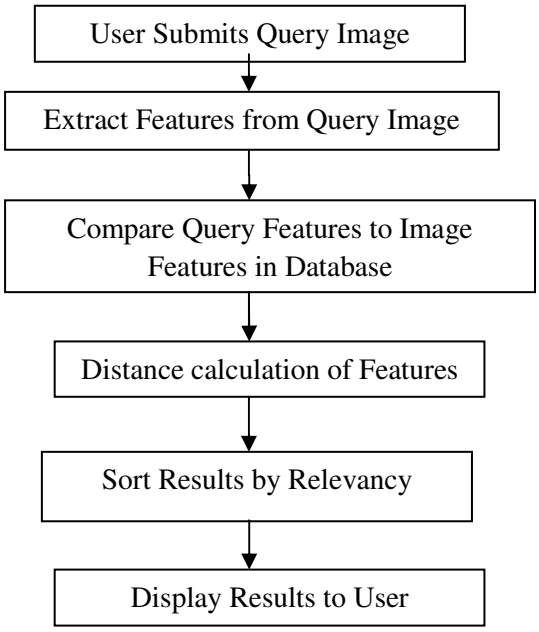

Fig. 1. Generalized Flow Chart Of Proposed Work

B. *Proposed Methodology*

Fig 2 shows the steps involved in proposed methodology:

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.

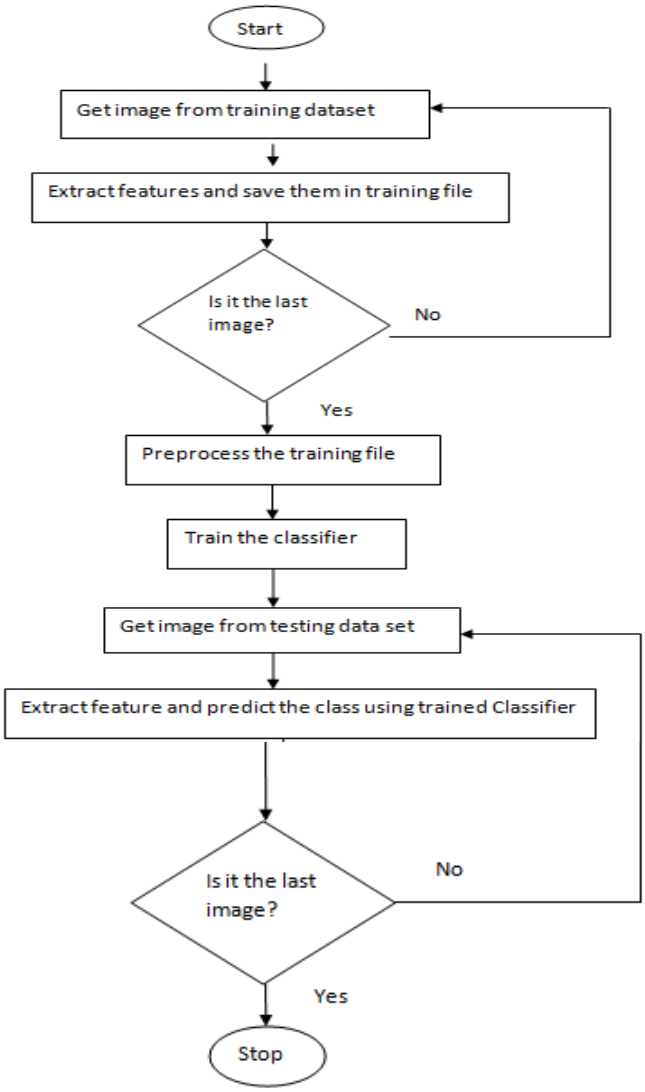

Fig. 2. Proposed Methodology Flow Chart

IV. RESULTS AND DISCUSSION

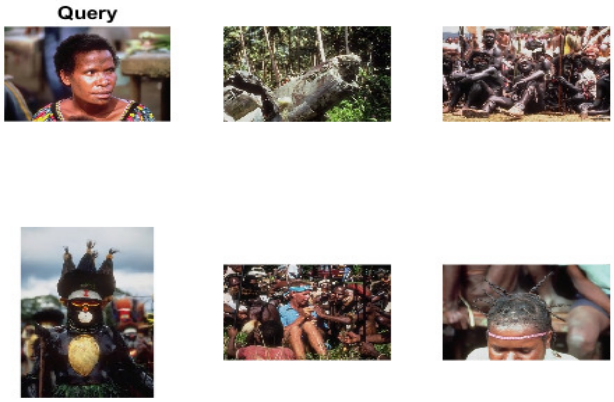

Fig.3. Retrieved Images Of Peoples Using HMMD Features Based On Query Image.

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.

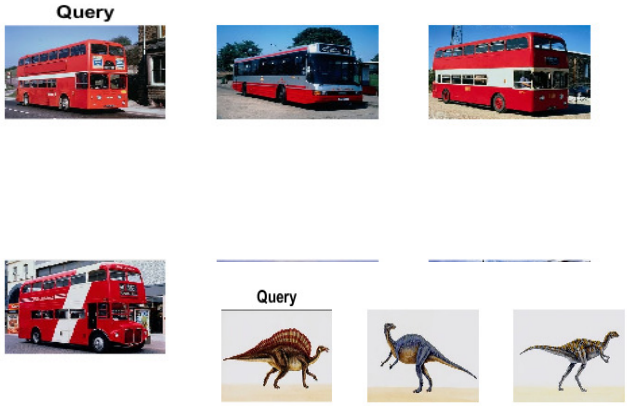

Fig. 4.Retrieved Images Of Bus Of The Query Image.

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 graph can be displayed.

Fig.5. 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 graph can be displayed.

Fig.6.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 graph can be displayed.

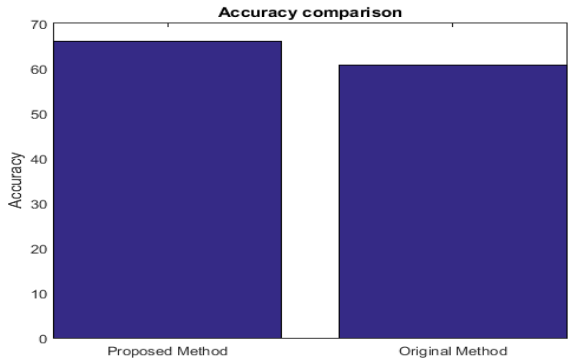

Fig. 7. Accuracy Comparison Graph

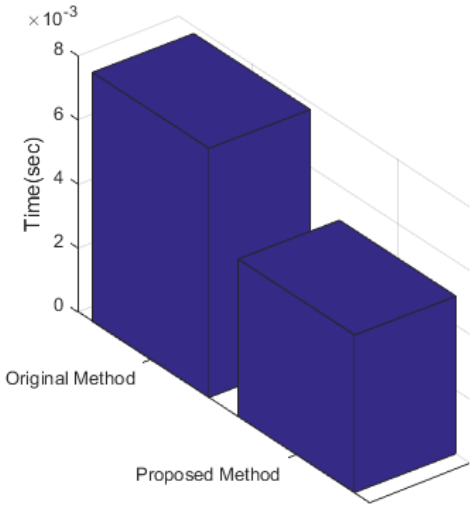

Fig.8.Timing Comparison Of Both Methods.

The accuracy and timing graphs are calculated on the basis of precision and recall. 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.

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.

V. 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. 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, Euclidian 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.

VI. REFERENCES

[1]SwapnaliniPattanaik, Prof.D.G. Bhalke,"Beginners to Content Based Image Retrieval", in the International Journal of Scientific Research Engineering &Technology (IJSRET), Volume 1,2012,Page(s) .040-044.

[2]Youssef, Sherin M. "ICTEDCT-CBIR: Integrating curvelet transform with enhanced dominant colors extraction and texture analysis for efficient content- based image retrieval." Computers& Electrical Engineering 38.5 (2012): 1358-1376.

[3]Youssef, Sherin M.,SalehMesbah, and Yasmine M. Mahmoud. "An efficient content-based image retrieval system integrating wavelet-based image sub-blockswith dominantcolors and texture analysis."InformationScience and Digital Content Technology(ICIDT), 20128th International Conferenceon.Vol.3.IEEE, 2012.

[4]JunYue, Zhenbo Li , Lu Liu , andZetian Fu, "Content-based imageretrieval using color and texture fused features", in Science Direct Journal of Mathematical and Computer Modeling, 2011,Page(s).1121-1127.

[5]Liu, Guang-Hai, and Jing-Yu Yang."Content-based Image retrieval using color difference histogram." Pattern Recognition 46.1 (2013): 188-198.

[6]Torres,Ricardo da S.,etal."A genetic programming framework for content-based image retrieval."Pattern Recognition 42.2 (2009): 283-292.

[7]RitendraDatta, Jia Li, and James Z. Wang, "Content-Based Image Retrieval - Approaches and Trends of the New Age", in ACM Computing Surveys, Volume 40, 2008, Page(s).253-262.

[8]Sumana, Ishrat Jahan, et al. "Content based image retrieval using curvelet transform." Multimedia Signal Processing, 2008 IEEE 10th Work shop on .IEEE, 2008.

[9]Young Deok Chun, Nam Chul Kim, and IckHoon Jang, "Content-Based Image Retrieval Using Multire solution Color and Texture Features", in IEEE Transactions On Multimedia, Volume 10, 2008, Page(s).1073-1084.

[10]Mehyar, Tamer, and Jalal Omer Atoum. "An Enhancement on Content-Based Image Retrieval Using Color and Texture Features." Journal of Emerging Trends in Computing and Information *Sciences* 3, no. 4 (2012): 488-496.

[11]Kushwah, Vinita, and Arun Agrawal. "Study on Query Based Clustering Technique for Content Based Image Retrieval."

[12]Malik,Fazal,and Baharum Baharudin. "The Statistical quantized his to gram texture features analysis for image retrieval based on median and laplacian filters in the dct domain." The International Arab Journal of Information Technology 10, no. 6 (2013): 1-9.

