IMAGE RETRIEVAL IN COMPRESSED DOMAIN USING BINARY PLANE TECHNIQUE

[1] T. Esther Ratna, [2] Dr. N. Subash Chandra
[1] Research Scholar, [2] Professor
[1] Department of Computer Science,
[1] Rayalaseema University, Kurnool, Andhra Pradesh, India

Abstract : The use of Content based image retrieval methodology is increasing in various domains such as Data Mining, Education, Medical Imaging, Crime Prevention, Weather forecasting, Remote Sensing etc. Retrieving a relevant image in short duration of time has enhanced the research in the field of CBIR. This paper presents a new approach for retrieval of images in compressed domain using Binary Plain technique. The results obtained using the proposed approach shows the performance with an enhanced precision rate and recall to retrieve the most relevant images from the stored database that resemble the query image.

IndexTerms **- Binary plane technique, Lossy image retrieval, color quantization**

I. INTRODUCTION

The last decade has seen advancement in internet and multimedia technologies. A huge amount of data in the form of audio, video and images has been used in various fields like medical treatment, video and still images repositories, digital forensics, satellite data and surveillance system. This has created an ongoing demand of systems that can store and retrieve multimedia data in an effective way. However, it poses difficulty to access, search and retrieve this information unless it is organized in an efficient way. Traditional methods of indexing images in database depend on a number of descriptive keywords, associated with each image. However, this approach is subjective and with a rapid growth in the size of the database, it is becoming outdated. To overcome these difficulties, content-Based Image Retrieval (CBIR) methodology emerged as an efficient means for describing and retrieving images. According to its objective, instead of being manually annotated by text-based keywords, images are indexed by their visual content, such as color, texture, shape, and spatial layout.
Content-based image retrieval (CBIR) makes use of the representation of visual content to identify relevant images which reduces the problems of intention gap and the semantic gap problems. Numerous techniques have been proposed and developed for content-based image retrieval in the last decade [1].

The need to have a versatile and general purpose content based image retrieval (CBIR) system for a very large image database has attracted focus of information-technology-giants and leading academic institutions for development of CBIR techniques. These techniques encompass diversified areas, viz. image segmentation, image feature extraction, representation, mapping of features to semantics, storage and indexing, image similarity-distance measurement and retrieval - making CBIR system development a challenging task evolved during recent years covering various methods for segmentation; edge, boundary, region, color, texture, and shape based feature extraction; object detection and identification [2].

In standard methods of image compression such as JPEG, retrieval of images has not been considered [3] and successful methods like Vector Quantization (VQ) despite its suitable power in compression and retrieval, have low speed for compression [4]. To put it simply, the problem is how to show an image with high efficiency in the binary form. Binary plane technique [5] [6] is one of the solutions that can be incorporated with color feature based CBIR systems to attain higher precision at faster rates. This paper is organized as follows; section 1 presents the need and necessity of the best compression technique. Section 2 presents the earlier research work conducted for retrieval systems; section 3 presents the generalized structure of the work explaining each step in detail. Section 4 presents the experimental results and its performance analysis ending up with conclusions.

II. RELATED WORK

In this paper the research articles related to color features and retrieval systems for compressed data which are proposed in later 2000 are focused

In [5] S.Mahaboob Basha, Dr. B. Sathyanarayana and Dr. T. Bhaskara Reddy proposed a binary plane technique which is used to take advantage of repeated values in the consecutive pixels positions.
In [6] Subhash et.al proposed BDH based approach which presents the effect of using the Difference coding in between the Binary Plane technique and Huffman coding technique.

In [7] H.B. Kekre, Sudeep D. Thepade presented BTC based CBIR as BTC-RGB and Spatial BTC-RGB. In BTC-RGB feature vector is computed by considering red, green and blue planes of the image independently. While in Spatial BTC-RGB, the feature vector is composed of four parts. Each part is representing the features extracted from one of the four non overlapping quadrants of the image and the results show that the precession is improved in BTC-RGB and is even better in Spatial BTC-RGB.

In [8] Dr. H.B.Kekre et al. presents improved content based image retrieval (CBIR) techniques based on multilevel Block truncation coding using multiple threshold values that showed the performance improvement (higher precision and recall values) with feature vector method compared to BTC Level-1

In [9] Chu-Hong Hoi et al., proposed a modified support vector machine (SVM) technique called soft label support vector machine (SLSVM) to construct the LRF algorithm in CBIR to improve the retrieval performance of semantic image retrieval.

In [10] N S T Sai and R C Patil presented the method developed to search and retrieve the similar image using bit plane image using bit plane slicing. Mean, standard deviation and third moment of row and column pixel distribution of bit plane image is used as a feature vector and used simple Euclidean distance to compute the similarity measures of images.

In [11] presents a new approach to index color images using the features extracted from the error diffusion block truncation coding (EDBTC). It generated good capability for image compression and also offered an effective way to index images for the content-based image retrieval system.

In [12] Lu et.al , presented color image retrieval using color features and bit map which is used to represent the local characteristics of the image for increasing the accuracy of the system. It is also proved that the method consumes less memory for storing the features of the image.

In [13] Ratna et.al presented, the process of bit map generation using BTC and EDBTC (Error diffusion block truncating coding) and their application for image retrieval.

In [14] Anil Balaji Gonde proposed a novel fusion approach using Colour Histogram (CH) and Block Bit Plane (BBP). Distance between CH features and BBPs are compared bit by bit using Hamming distance and Particle swarm optimization is used for optimizing these weights which showed an improvement in precision and recall.

III. PROPOSED FRAME WORK

Figure 1 & 2 depicted below represents the process of feature vector calculation and similarity measurement for the retrieval process.

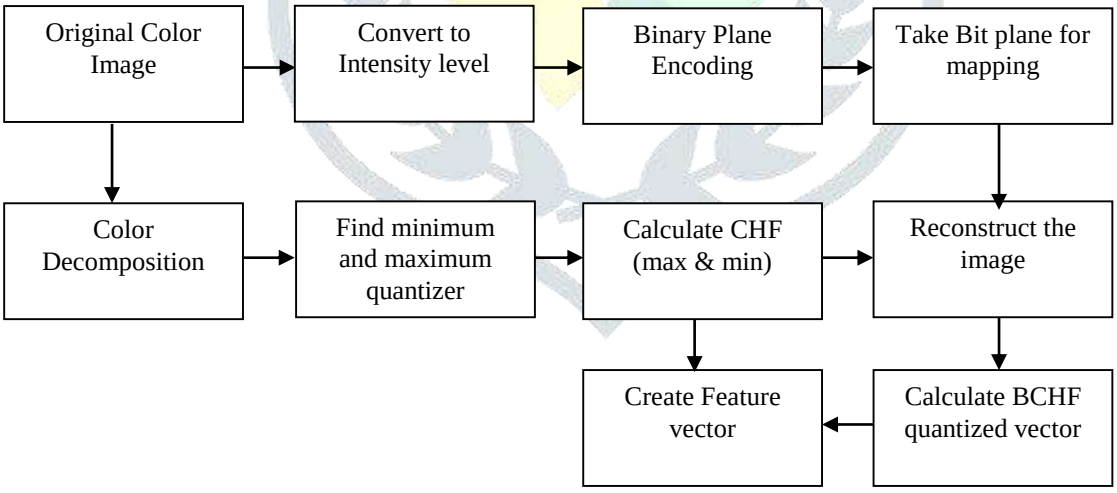


Figure 1: Block diagram to extract the feature for retrieval

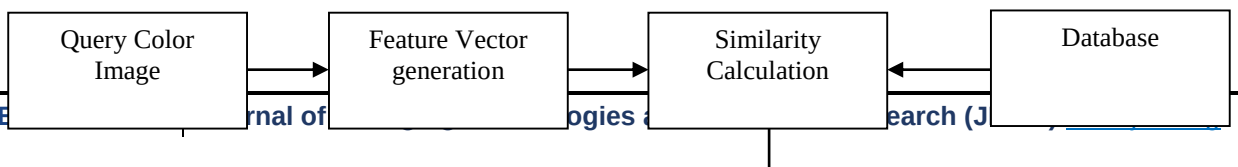


Figure 2: Block diagram for similarity measurement

The original color image is initially converted into gray scale image whose intensities varies in [0 255], thus obtained gray scale image is processed for Lossy binary plane technique approach which is explained below. The Method is based on Spatial Domain of the Image. The main aim of the technique is to use the repeated values in consecutive pixels positions. For a set of repeated consecutive values only one value is retained. In the Binary Plane technique two codes are used to build the bit plane. The codes have been given below

Code 1(one) is used to indicate the current pixel, which is different from the previous pixel. In this case the current pixel is moved to the data table.

Code 0 (Zero) is used to indicate the current pixel in exactly the same way as the previous pixel. This eliminates the storage of the current pixel. [15]

In the Lossy binary plane technique a scalar

(PP-TV/2)>=CP<=(PP+TV/2-1)

Where PP is previous pixel, CP is current Pixel, TVis Threshold value then the range of data table will be modified as shown in the Table1.

For eg: let us consider a numerical example, if the image file contains the following pixels

130 60 60 60 200 50 50 180 180 180 180 TV=4 ε [-2, +1]

P	PP	RANGE	BP	DT
130	0	(-2,1)	1	130
60	130	128-131	1	60
60	60	58-61	0	-
60	60	58-61	0	-
200	60	58-61	1	200
50	200	198-201	1	50
50	50	48-51	0	-
180	50	48-51	1	180
180	180	178-181	0	-
180	180	178-181	0	-
180	180	178-181	0	-

DATA TABLE: 130 60 200 50 180

BINARY PLANE: 11001101000

Pseudo code for retrieval process

- *The images are collected from standard databases which are resized to 256x256 and stored forming a database for analysis.*
- *The image is converted using binary plane coding; the outcome of this coding process contains Binary encode image and Data table*

- *The probability distributions of quantized vectors are calculated, thus forming minimum and maximum color histogram feature (CHF) vector.*
- *The obtained bit plane from bit plane coding is used to map the maximum and minimum color quantized values forming biplane based color histogram feature(BCHF)*
- *CHF_{max}, CHF_{min} , BCHF all put together form the feature vector for retrieval process.*

The feature vectors are stored in the database, and to retrieve the relevant images a similarity measurement is claudicated using the following

$$SC = \alpha_1 \sum_{k=1}^{Nc} \frac{\left|chf_{min}^{query}(k) - chf_{min}^{target}(k)\right|}{\left|chf_{min}^{query}(k) + chf_{min}^{target}(k)\right|} + \alpha_2 \sum_{k=1}^{Nc} \frac{\left|chf_{max}^{query}(k) - chf_{max}^{target}(k)\right|}{\left|chf_{max}^{query}(k) + chf_{max}^{target}(k)\right|} + \alpha_3 \sum_{k=1}^{Nc} \frac{\left|bchf^{query}(k) - bchf^{target}(k)\right|}{\left|bchf^{query}(k) + bchf^{target}(k)\right|}$$

Sort the SC values in decrement order chose 'k' best values from the sorted vector. Index those values and retrieve the respective image from the image dataset.

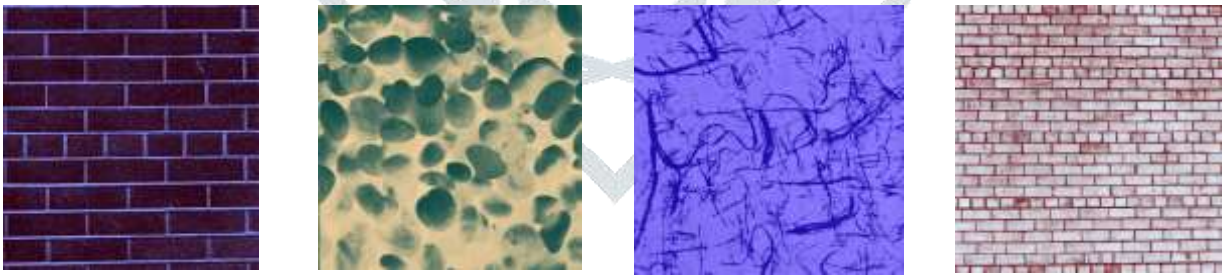
The proposed method has several advantages like it requires less memory to store the details, as it concentrates on spatial domain itself the point dissimilarities which are often observed in transform domain are not present there increasing the precision value in short duration of time.

IV. EXPERIMENTAL RESULTS

The results were obtained by testing the proposed approach on several standard datasets like COREL [16] , Brodatz texture database [17] and the results were depicted below.

(a) (b) (c) (d)

Figure 3 (a): COREL image dataset sample images



(a) (b) (c) (d)

Figure 3 (b): Color Brodatz texture image dataset sample images

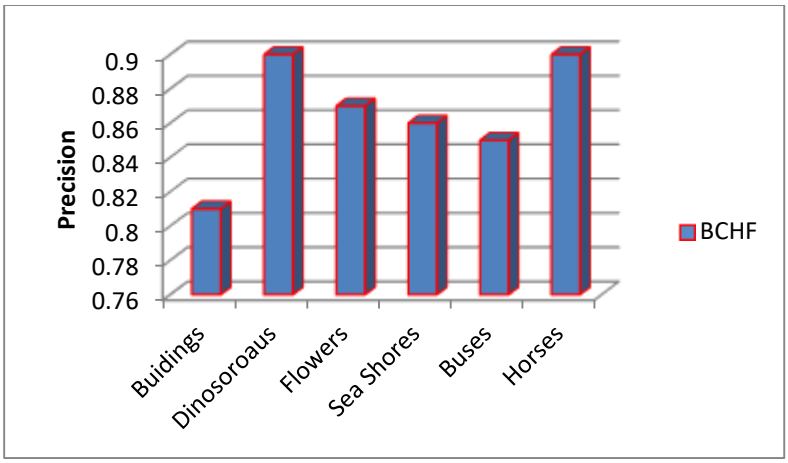


Figure 4: Precision Performance of the proposed approach for COREL image dataset

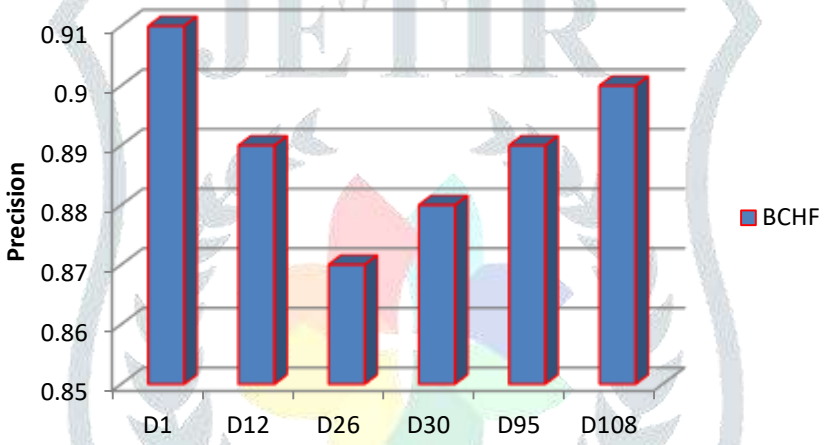


Figure 5: Precision Performance of the proposed approach for color Brodatz texture image dataset

From the analysis it is observed that this approach of compression for retrieval system is attaining a high precision of more than 90 % for standard dataset image in less than 12 seconds. The values that are noted here are in average per object and in this analysis a total of 40 objects were considered.

V. CONCLUSION

In this paper a lossy Binary Plain Technique to compress the images for retrieval system is proposed to retrieve images with high precision and short recall time. The results obtained from the experiments shows that the method is attaining compromising results fulfilling the objective of this work.

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