IMAGE RETRIEVAL BASED ON UNIFICATION OF HISTOGRAMS WITH TEXTURE FEATURE AND SHAPE FEATURE

Pradeep Kumar Kaushik
Deptt. of Computer Science and Engg.
JB Institute of Technology
Dehradun, India
pradeep.kaushik87@gmail.com

Santosh Kumar Mishra
Deptt. of Computer Science and Engg.
JB Institute of Technology
Dehradun, India
santoshmishra.2006@rediffmail.com

Abstract : In this paper, color histograms, texture using wavelet transform and shape feature using thresholding is used to retrieve images from the database .The database includes 500 images of five different categories. Moreover success of this content based image retrieval depends on the method used to create feature vector and relativity measure, the accuracy of wavelet transform engaged. Retrieving images can be increases the accuracy of the system based on color, feature and shape relativity. For relativity measure between the database images and query image Mahalanobis, Minkowiski, Chebyshev, Cosine Relativity, Spearman correlation are used ,at the end aggregation of mean and relative deviation is done and aggregation is then arranged in increasing order i.e. minimum to maximum. This Arranging order shows images having minimum values are more accurate retrieved image. The Proposed system can better the retrieval accuracy that has been shown by the experimental results. The system is tested on 500 images of five different categories downloaded from the internet.

Index Terms - *Histograms, Support Vector Machine; Mahalanobis, Minkowiski, Chebyshev, Cosine Relativity, Spearman correlation*

I. INTRODUCTION

In new generation, very broad store of images and videos have grown speedily and increasing day by day. In equally with this progress, content-based image retrieval and querying the indexed store are required to access visional information. As a dynamic technique, content-based image retrieval systems have to provide easy-to-index data arrangements as well as quicker query execution facilities. To index and answer the queries that the users act to explore visional information, the content of the images and videos must be abstracted. Content-based image retrieval is a technique which uses visional contents to exploration images from broad scale image databases according to users' interests. Content based image retrieval uses the visional contents of an image such as shape, color, texture and spatial design to exhibit and index image. [1] In archetypical content-based image retrieval systems Figure 1.1, Multi dimensional feature vectors abstracts and describes visional contents of images in database. A Feature database is formed by the feature vectors of images in database. The visional content, or generic content, of images and video frames can be classified as follows: spatial, morphological, and low-level.

Spatial-The spatial content of an image is the relative position of the objects residing in the image.

Morphological-The morphological content is the actual context of the image that a user obtains when anybody looks at the image.

Low-level- The low level feature composes low level content such as color, shape and texture.

Utilization-Content-based image retrieval has assorted applications in structural and engineering design, art store, criminality avoidance, geographic information and remote sensing systems, medical diagnosis, armed forces, photograph library, trade catalogs, nudism-detection filters, face searching, face identification, computer vision, content based image retrieval also used by exploration engine for exploration images from broad database.

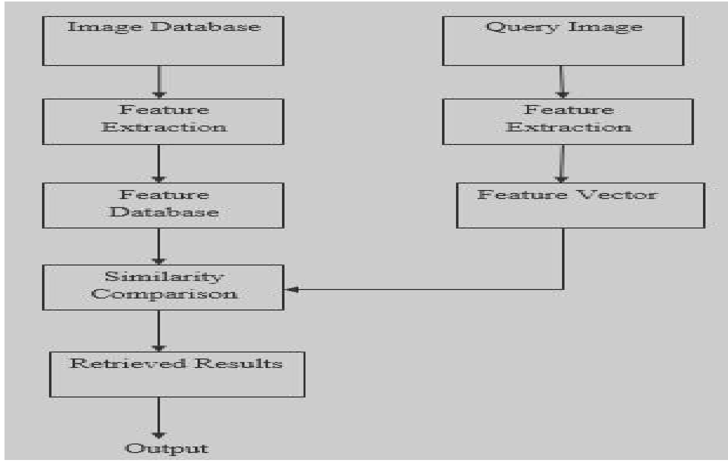

Figure1.1. Diagrammatic representation of content-based image retrieval system [2]

Techniques for abstracting contents

Following are some widely used techniques for abstracting color, texture and shape:

2.1 Color: Image retrieval used the most extensively visional content color. Its three-dimensional values make its discrimination potentiality superior to the one dimensional gray values of images. Color space must be decisive first before selecting an appropriate color description [3].

Techniques for abstracting contents: color

It has been studied from past exploration color Histogram is the good technique for abstracting color content in an image and two histograms of different images can be in comparison easily. So we decide histogram as a abstracting technique for color (i.e. visional low level feature) feature of an image and color space is finalize HSV amid (RGB, Munsell, CIE L*a*b*, CIEL*u*v*, HSV (or HSL, HSB),YCbCr, NTSC) by cause of it has been studied from past exploration that HSV color space is the good color space and gives better results.[2]

But So many techniques are available for abstracting color contents:-

- Color space
- Color Histogram
- Color Moments
- Color Coherence Vector
- Color Correlogram

Color space, each pixel of the image can be exhibited as a point in a 3D color space. So Many Color space is used for exhibited color. Some are RGB, Munsell, CIE L*a*b*, CIEL*u*v*, HSV, YCbCr, NTSC. Each color space use different process for exhibit color content. But Human can separate between images which are exhibited in RGB color space easily.

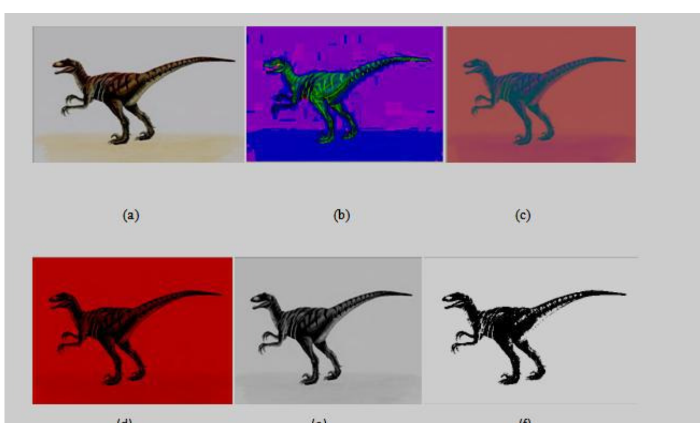

Figure 2.1: Conversion of RGB to Other color space of Dinosaur Image. (a) Initial image. (b) Image after implementing RGB to HSV color conversion. (c) Image after implementing RGB to YCbCr color conversion (d)Image after implementing RGB to NTSC color conversion (e)Image after implementing RGB to GRAY conversion (f)Image after implementing RGB to BLACK & WHITE conversion

2.2 Texture

Techniques for abstracting contents: - texture

A Texture is periodically described as bland or harsh, soft or hard, coarse or fine, matt or glossy and etc. The word texture refers to facial attribute and actualization of an object given by the size, shape, density, adjustment, admeasurements of its elementary parts in a generic feel. [4].Texture might be divided into two categories namely tactile and visional textures. Tactile textures refer to the immediate tangible feel of a facial. Visional textures refers to the visional impression that textures produce to human viewer which are related to regional spatial fluctuation of simple stimuli like color acclimatization and intensity in an image.

But So many techniques are available for abstracting texture contents:-

- Tamura features
- Wold features
- Simultaneous auto-regressive(SAR) Model
- Gabor filter features
- Wavelet transform features
- LBP(Local binary pattern)

2.3 Shape

Techniques for abstracting contents: - Shape

Basically Shape is the geometrical property of an object or shape is the form of an object or its external boundary, outline, or external surface, as opposed to other properties such as color, texture, or material composition.

So many techniques are available for abstracting shape contents:-

- Thresholding
- Blob Extraction
- Template matching
- Hough transform

3. Techniques used for retrieval accuracy

Support vector machine – an overview: Support vector machine has become the classifier of elect of diverse examination and practitioners for certain real-world appropriation problems in practice. This is by cause of support vector machine is capable of generalizing well (anticipate the hidden or unknown patterns with a good degree of accuracy) as in comparison to many usual classifiers (neurological network, etc.) It offers convinced properties which are archetypically not found in other classifiers:

- Computationally much less speed up
- act well in higher dimensional spaces
- Loss of exercise data is often not a hard problem
- Based on decrease an evaluation of test error rather than the exercise error
- Able-bodied with noisy data
- Does not suffer as much from the curse of dimensionality and anticipate over applicable

In the context of superintended allocation, *machine learning* and *pattern recognition* is the abstraction of conformity or some sort of arrangement from a store of data. Neurological networks and bayesian classifiers are the archetypical examples to learn such conformation from the given data diagnosis. Support vector machine is an analogously new classifier and is based on hard base from the broad area of diagnostic learning theory. Since its inception in early 90s, it has found usage in a wide range of pattern recognition problems, to name a few: handwritten character recognition, image allocation, financial time series forecasting, face detection, bioinformatics, biomedical signal examination, medical diagnostics, and data mining.

It is the first diagnosis that exploration action in pattern recognition areas has lost out so far on this dynamic allocation method. So, an overview of Support vector machine is presented in this section .So in this paper we used Support vector machine to evaluate the retrieval accuracy. [4, 5, 6, 7, 8]

SVM (Support Vector Machine) is used to evaluate data and recognize the image class; we use the database of 500 images for testing purpose downloaded from http://wang.ist.psu.edu/docs/related/ the database include images of five different category and each category have 100 images. We form class as per five different categories.

S.No.	Image Category	Class
01	Africa	Class 1
02	Beach	Class 2
03	Monuments	Class 3
04	Buses	Class 4
05	Dinosaurs	Class 5

Table 3.2:-Image Category and class of database images

We have used Box Constraint, Kernel Function, rbf, rbf sigma to create SVM Model and train SVM Model from dataset. We have used one to one SVM to evaluate and check the accuracy. We create confusion matrix from test data, gathered from one to one SVM.

1. Create confusion matrix from test data
2. Accuracy = 100*sum (diagonal (confusion matrix))/Total Sum of Confusion matrix

We get a Confusion matrix and we are using a database of 05 different category and the total Sum of Confusion matrix is 500(i.e. 50 Each Row).[9]

4. IMAGE RETRIEVAL BASED ON UNIFICATION OF HISTOGRAMS WITH TEXTURE FEATURE AND SHAPE FEATURE

4.1 OVERVIEW OF SYSTEM

Within the Structure of a diagnostic approach to the problem of text examination, a content-based image retrieval system has been implemented to query upon digital images. Recommended retrieval method is divided into four steps: feature abstraction of query and database images, relativities matching, Retrieval Accuracy and retrieving images.

(a)Feature Abstraction: In this step all the images of database as well as the query image is resized to 384x256,then HSV histogram is calculated After that colorautoCorrelogram, colormoments is calculated for color feature. For Texture Feature the query image is converted into gray scale from RGB. Then mean Amplitude and Ms Energy is calculated using Gabor wavelet, the number of scales is 4 and number of acclimatization's is 6 in Gabor wavelet. Then wavelet transform query image into wavelet moments. For shape feature thresholding is performed and the output of abstraction is stored in the form of feature vector of query image.

(b)Matching: To calculate the difference between the query image and all the images in database we can use Mahalanobis, Minkowiski, chebychev, cosine, correlation, and spearman. Finally use relative deviation to handle the results after relativity measure.

Mahalanobis : Mahalanobis distance is a measure of distance between a point P and a circulation D, introduced by P.C. Mahalanobis in 1936.The Mahalanobis distance of anexamination $x = (x1, x2, x3 \ldots\ldots, x_n$ from a group of examinations with mean $\mu = (\mu1, \mu2, \mu3 \ldots\ldots, \mu_n$ and covariance matrix S is characterized as:

$$D_M(x) = \sqrt{(x-\mu)^T} \; S^{-1} \qquad \text{eq. 4.1}$$

Minkowiski: Minkowiski distance is a measure in a normed vector space which can be considered as a generalization of both the Euclidean distance and the Manhattan distance. The Minkowiski distance of order p between two points is given as: $A = (x1, x2, \ldots\ldots, x_n$ and $B = (y1, y2, \ldots\ldots,)$ $\in R^n$

Is characterized as $(\sum_{i=1}^{n} |x_i - y_i|^{\cdot}{}_{1/A}$ eq. 4.2

Chebyshev: Chebyshev is a measure characterized on a vector pace where the distance between two vectors is the greatest of their differences along any coordinate. It is named on Pafnuty chebyshev. The Chebyshev distance is given by:

$$D_{Chebyshev}(a,b) := \max_i \ (|a_i - b_i| \qquad \text{eq.4.3}$$

Where a, b are two vector or points with ai and bi standard coordinates respectively. This equals the limit of the Lp measures.

$$\lim_{k\to\infty} (\sum_{i=1}^{n} |a_i - b_i| \qquad \text{eq. 4.4}$$

Cosine Relativity: -Cosine Relativity is a measure of relativity between two vectors of an inner product space that measures that cosine of the angle between them. The cosine of two vectors can be given as:

$$a.b = ||a||\ ||b||\cos\theta \qquad \text{eq. 4.5}$$

Given two vectors of attributes A and B, the cosine relativity *cos (θ)* is exhibited using a dot product and magnitude as:

$$Similarity = \cos(\theta) = \frac{A.B}{||A||\,||B||} = \frac{\sum_{i=1}^{n} A_i \times B_i}{\sqrt{\sum_{i=1}^{n}(A_i)^2} \times \sqrt{\sum_{i=1}^{n}(B_i)^2}} \qquad \text{eq. 4.6}$$

Spearman correlation: The Spearman correlation coefficient is characterized as:

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)} \qquad \text{eq. 4.7}$$

Where $d_i = x_i - y_i$ is the difference between ranks. [5]

Lastly summation of mean n relative deviation is done and summation is then sorted in increasing order i.e. minimum to maximum. This sorting order shows images having minimum values are more accurate retrieved image.

(c)Retrieval Accuracy: SVM (Support Vector Machine) is used to check the accuracy of retrieval process along with precision and recall.

(d)Retrieving images: Amid the sorted list of images, 20images with minimum relativities are displayed. These 20 images are the best suited images those are abstracted for the database or images with maximum relativities.

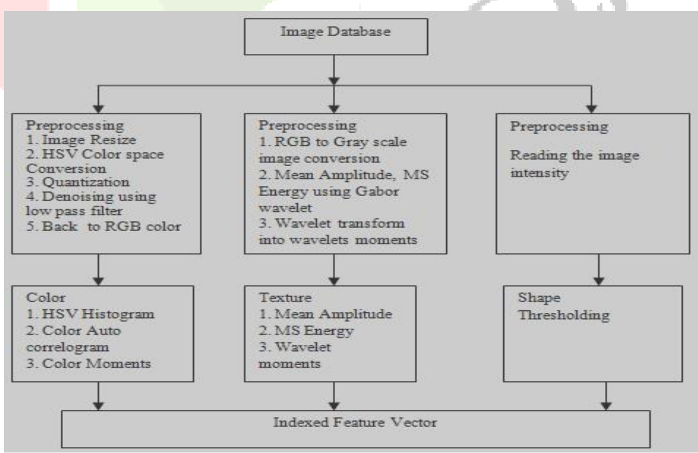

Figure 4.1:- Steps of Recommended Method

The Figure 4.1 shows block diagram which exhibits the process of retrieval *i.e.* in feature abstraction process features of image and that of query is abstracted and stored in the feature database after that matching is perform between the features of query image and all the features of database images and lastly images which are match is then retrieved.

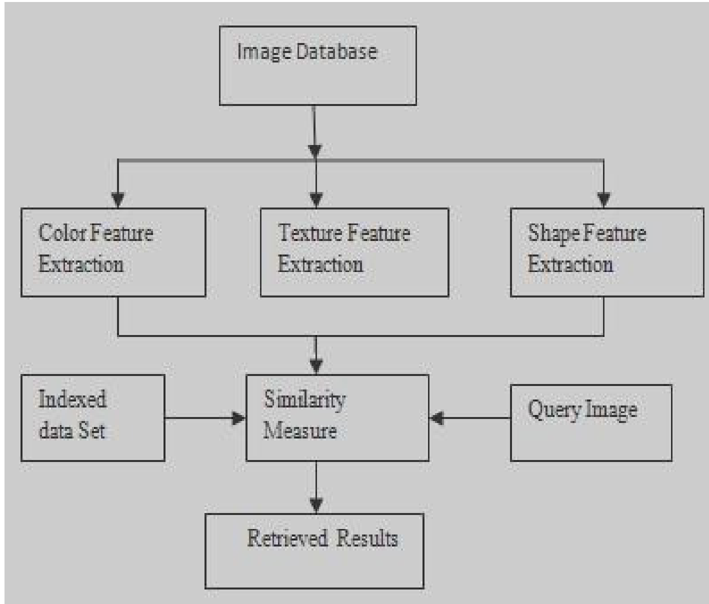

Figure: 4.2:- The Architecture of the Content based image Retrieval

The Figure 4.2 show architecture of the content based image retrieval. The color feature , texture feature and shape feature are abstracted separately from Image database then relativity measure is per compose between query image and Indexed data set which is abstracted from Image database. The retrieved results are shown after relativity measure.

5. RESULTS AND DISCUSSION

To test the performance of our content-based image retrieval system on color in HSV color space, texture in Wavelet transform and shape in thresholding relativity queries, we have used database including more than 500 jpg still images. All the images of database are resized to 384 x256 jpg. In above discussed method HSV histogram (128x128) is used rather (32x32) to decrease the processing time of retrieval. However hist32 shows more accurate result but our main aim to retrieve best images with less processing time. Retrieval process applies on huge database including more than 500 jpg images different categories like Africa, Beach, Monuments, Buses and dinosaurs picture taken from http://wang.ist.psu.edu/docs/related/ [4].Figure5.1Shows the query image of each category. In the experiments, the query image is randomly picked from the database images or from the system, here we pick the query images of five categories Africa, Beach, Monuments, Buses, and Dinosaurs. And then its histogram 128x128 or 32x32 is calculated, but we prefer 128x128 since it decreases the processing time of retrieval with satisfying results. After calculating the histogram of query image Mahalanobis ,Minkowiski, Chebyshev ,Cosine Relativity, Spearman correlation is used to match the histogram from all the images in database. When relativities measure is calculated images are sorted in an increasing order and then finally first 20 images are displayed since they are the images which are best suited to the query image.

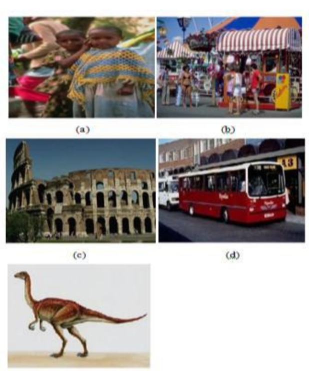

Figure5.1 Query images of different categories (a) Africa, (b) Beach, (c) Monuments, (d) Buses, (e) Dinosaurs

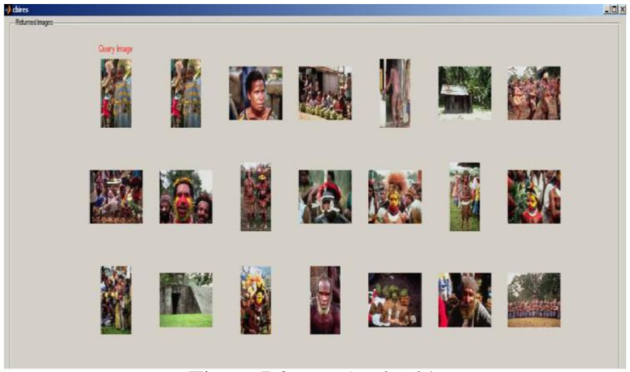

Figure5.2 Result of Africa

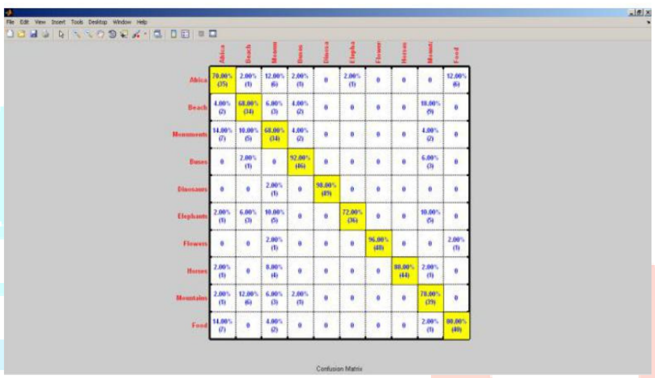

Figure5.3 SVM Plots of Africa

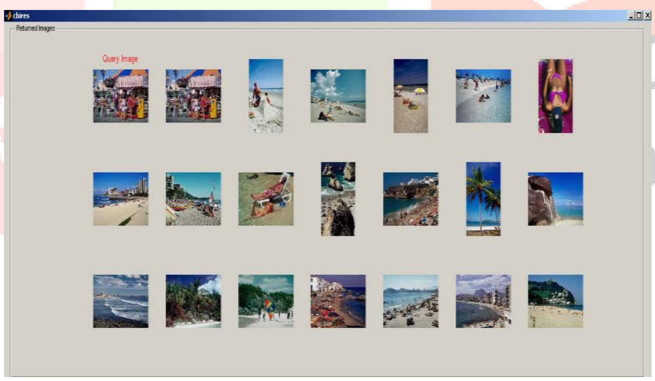

Figure5.4 Result of Beach

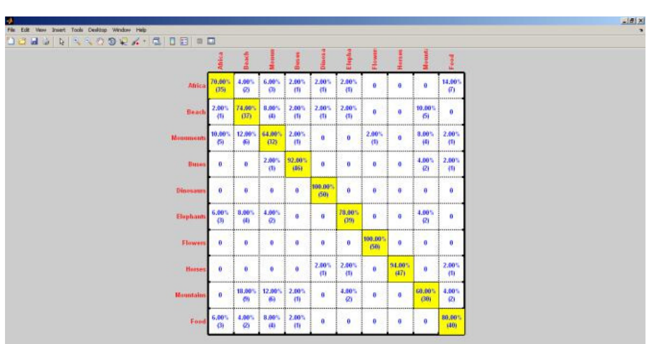

Figure5.5SVM Plots of Beach

Figure5.6 Result of Monuments

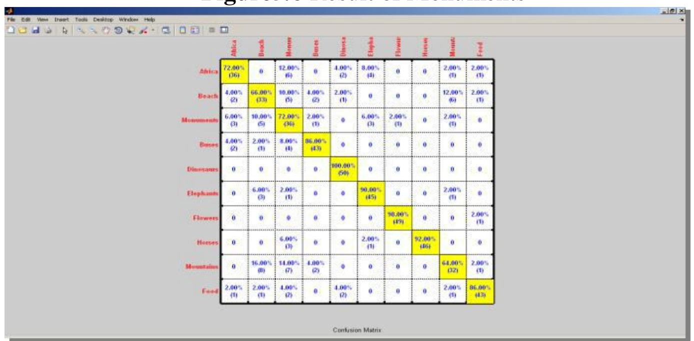

Figure5.7 SVM Plots of Monuments

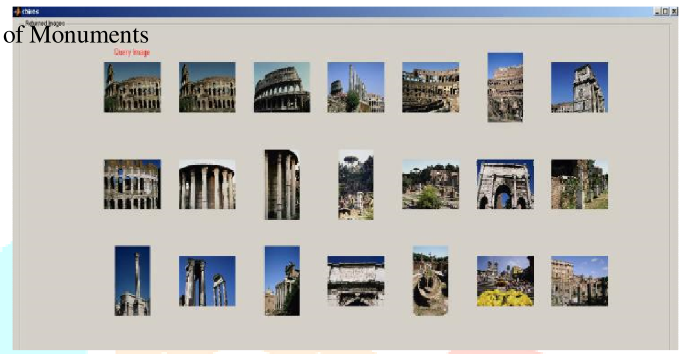

Figure5.8 Results of Buses

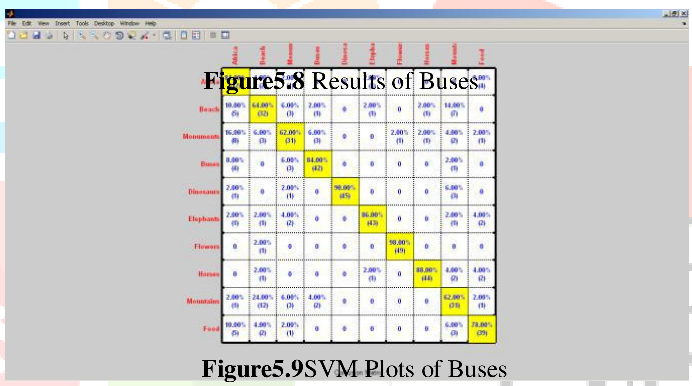

Figure5.9SVM Plots of Buses

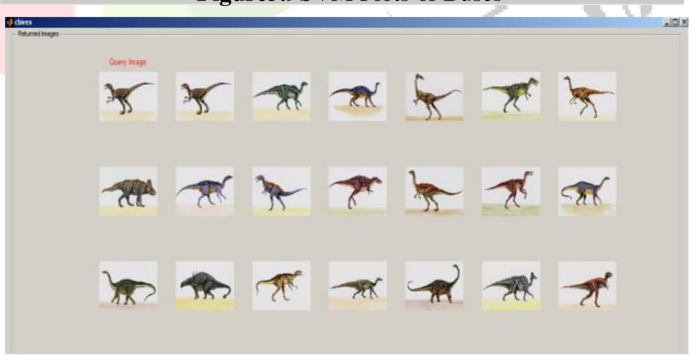

Figure5.10 Result of Dinosaurs

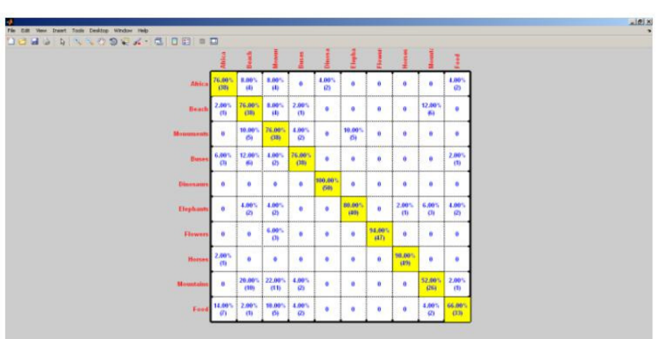

Figure5.11SVM Plot of Dinosaurs

Above are the results of histogram , Wavelet transform and thresholding for each correlative query image and also the plots of 20 images which shown how much retrieved images are related to the query image. Figure5.1 shows the query images of different type, fig5.2, fig5.4, fig5.6, fig5.8 and fig5.10 are results for query images of different types which are shown in figure 5.1. In fig5.3, fig5.5, fig5.7, fig5.9 and fig5.11 are the SVM plots of different query images.

5.1 COMPARISON OF ACCURACY BETWEEN CATEGORIES OF IMAGES

From the above results shown, we have examination that both of the methods given satisfying result in different category like in case of Dinosaurs ,monuments and Buses content based image retrieval gives the 100% precision and 20% recall but in case of Africa Precision is 90% and recall is 18%. In Case of Beach Precision is 95% and recall is 19%.Precision and recall is calculated as:

$$Precision = \frac{No\ of\ relevant\ images\ retrieved}{Total\ no\ of\ images\ retrieved}$$

$$Recall = \frac{No\ of\ relevant\ images\ retrieved}{Total\ no\ of\ relevant\ images\ in\ the\ database}$$

S. No.	Image	Precision	Recall
01	Africa	90%	18%
02	Beach	95%	19%
03	Monuments	100%	20%
04	Buses	100%	20%
05	Dinosaurs	100%	20%

Table5.12:-Precision and Recall of Images from Different Category

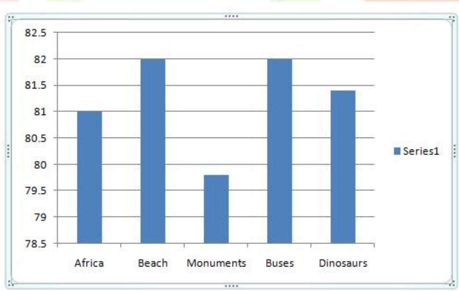

Figure 5.13:-Comparison of Accuracy between different categories of Images

6 FUTURE ABSOLUTIONS TO EXPLORATION

This exploration solely concentrates on using color features in HSV Color space, texture in wavelet transform and shape in thresholding for Content Based Image Retrieval. Color feature can also be combined with curve let texture features to retrieve texture images. For texture features, discrete curve let can be chosen as this is found to be most effective according to new literature. Connecting discrete color features with curve let texture features may better the retrieval outcome. For shape feature Hough transformation can be used for better results but we used thresholding in this paper. In future multi feature can be used to retrieve images where more than three or four features can be used for better accuracy and better results not only mathematically as per human visional judgments also. By cause of our main aim is to build a content based image retrieval system as same as human visional system. Support vector machine is a good technique for measure the accuracy of retrieval process. Rotation invariance is an important issue to better the retrieval performance. Generically, it is assumed that the database images possess same dominant absolution. However, in reality, an image database may include related but rotated images. So, when we intend to use non-normalized features for retrieval, related images with some rotation will not be captured. Finding rotation normalized curve let features can be an important exploration issue.

7. REFRENCES

[1]Naresh Kumar .S.and Vijayarajan .V "A Study on Image Retrieval by Low Level Features" Volume 43-No.18, International Journal of Computer Applications (0975-8887)

[2]Dr. F. Long, Dr. H. Zhang and Prof. D. D. Feng ,"Fundamentals of content-based image retrieval" ,multimedia information retrieval and management, Springer Berlin Heidelberg, January 2003 I. J. Kim, J. H. Lee, Y. M. Kwon, S. H. Park, "Content-based image retrieval method using color and shape features", vol.2, Proceedings of 1997 International Conference on Information, Communications and signal Processing (ICICS), IEEE Conference Publications, 1997

[3]Y. Liu, D. Zhang, G. Lu, W. Y. Ma "Region-based image retrieval with high-level semantic color names",10.1109/MMMC.2005.62,Proceedings of the 11th International Multimedia Modelling Conference, IEEE Conference Publications, 2005.

[5]http://www.nbhkdz.com/read/46140805ce65b7317ad551dd.html

[6]http://www.support-vector.net/, Links & resources

[7]http://www.svms.org/,

[8] C. Liu, Z. Wei, "Multi-feature method: an integrated content based image retrieval system", 2nd International Symposium on Intelligence Information Processing and Trusted Computing (IPTC), IEEE Conference Publications, 2011.

[9]Yang Liu,Wei Zeng and Hongxun Yao "Online Learning Objectionable Image Filter Based on SVM",PCM 2004,LNCS 3331,pp. 304-311,2004,Springer-Verlag Heidelberg 2004

[10] http://wang.ist.psu.edu/docs/related/

[11]M. H. Saad, H. I. Saleh, H. Konbor, M. Ashour "Image Retrieval based on Integration between YCbCr Color Histogram and Shape Feature",10.1109/ICENCO.2011.6153939 International Computer Engineering Conference (ICENCO), 2011.

[12]D. Zhang,"Improving Image Retrieval Performance by Using Both Color and Texture Features", Gippsland School of Comp. and Info. Tech. Monash University, Churchill, Victoria 3842, Australia, 2004.

[13]G. Xiaojuan, Z. Yanli, W. Yufen and C. Jifu "Research and Implement the Algorithm of Image Retrieval based on the Multi-features",vol.2,International conference on Challenges in Environmental Science and Computer Engineering(CESCE), IEEE,2010.

[14]M.H.Saad, H.I.Saleh, H.Konber, M.Ashour" CBIR system based on integration between surf and global features", The 6th International Conference on Information Technology (ICIT 2013), May 2013.

[15]Shamik Sural, Gang Qian and Sakti Pramanik "Segmentation and histogram generation using the HSV color space for image retrieval", International Conference on Image Processing (ICIP 2002), IEEE, 2002.

[16]Harikrishna G.N.Rai, Xiaobo Shen, K Sai Deepak and P.Radha Krishna,Infosys Labs, Infosys Ltd., India" ,Hybrid feature to encode Shape and texture for content based image retrieval", Proceedings of the 2011 International Conference on ImageInformation Processing (ICIIP 2011), IEEE, 2011.

[17]samy Ait-Aoudia, Ramdane Mahiou, Billel Benzaid ,"YACBIR Yet Another Content Based Image Retrieval system",14th International Conference Information Visualisation 2010,IEEE,2010.