Image Retrieval Using Color and Texture Features

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***Abstract*— The purpose of this paper is to retrieve the images from a database using texture and color features of an image. Features like Gray Level co-occurrence Matrix (GLCM) with color features are extracted in RGB, HSV, and YcBcR color spaces. Images are retrieved using similarity measures with the help of Euclidean, Manhattan and Canberra distances. Wavelet decomposition method is used to pre-process the images in both training and testing phase. Accuracy of 80% is achieved when color features are added to texture features using Manhattan distance and Canberra distances.**

***Keywords*— Texture ,Gray Level co-occurrence Matrix (GLCM), colour spaces, Wavelet decomposition, Euclidean, Manhattan, Canberra distance.**

I. INTRODUCTION

As increase in the size of the image as well as increase in the size of the image database, there is a problem of retrieval of images from large database, so to overcome these difficulties, in 1990s a system was introduced called as contents based image extraction.

In old methods many of the retrieval system for image were depends on only one feature i.e., color, using this feature method the results for images retrieval are not efficient and exact, so Harlick R M discussed three more image features from which images can be extracted exactly and efficiently than single color feature, those features are texture feature, shape feature, and spatial relationship feature. Each image in characterized by three properties, via, Color, Texture and Shape. In order to retrieve any image from a data base we need to specify one or more of these properties. This paper describes the both color and texture properties to extract the input image.

A. *Texture Feature*

Texture Feature plays very important role in the extraction of an image. It provides us the structural arrangement information of objects and surfaces of images. Some of the examples of image texture are shown in Fig 1 and Fig 2.This feature is one of the features to identifying objects or area of an image. It is a property to represent the surface and structure of an image.

Texture analysis is performed via texture recognition which is possible through feature extraction. Texture analysis is used for classification or segmentation of an image.

Fig.1 a) Natural texture b) Artificial texture images

B. *Color Feature*

Color is also one of the very important features for image representation and it is the visual feature, it assumes very essential in the human visual recognition process. Color space is the representation of colors in terms of intensity values. Color is the most obvious and intuitive feature of an image. Color is robust and very stable. It is also insensitive to scale changes and translation and rotation as well. The color-based method is simple in calculation and very commonly used where there is difficulty in region identification and segmentation.

Three different colour spaces are:

1) *RGB:* It can be presented as total of green, red and blue gray level intensity values.
2) *HSV:* HSV refers for Hue, Saturation and Value. Here saturation and hue characterizes the chrominance where as value characterizes the luminance.
3) *YCbCr:* Here 'Y' is the luma part, C_R and C_B are the red and blue contrast chroma segments.

II. LITERATURE SURVEY:

Content based image retrieval:

Alphonsa Thomas et al [1], increase in the size of the image as well as increase in the size of the image database, there is a problem of retrieval of images from large database, so to overcome this difficulties, in 1990s a system was introduced called as contents based image extraction, Where image extraction is made using some distance measures based on matching of features of input image with that of images in the database.

Fatures of images such as image textures, colours, shape or features of spatial are retrieved and these retrieved features are defined by vectors feature. Later vector features are stored in a feature database for both images in the database and for query image. After storing, extract the features of query image and form a vector features for the corresponding images. Already stored vectors in the image feature database are matched with the extracted vector features of query image.

The distance among the vector functions of the input image and those of the database images are then calculated. If the query image is in the database means its distance with itself is zero. The distances of all images will be sorted in increasable order and retrieval of images can be performed based on indexing method.

Vaishali D. Dhale [2], Colour is one of the important features for visual in image extraction. Purpose of the colour indexing is to extract all relevant images whose colour composition is same as to the colour composition of the query image.

Local binary pattern:

T. Ojala [3], it is a more flexible one: it could be effortlessly adapted to exclusive kinds of issues and it also can be used for other image descriptors.

It is an effective and simple gray-scale texture invariant element that can be obtained from a preferred texture definition in a local neighbourhood. Ojala et al proposed use of nearby Binary sample for rotation invariant texture category.

III. MATERIALS USED:

The implementation is done on MATLAB (R2013a version) platform. In this implementation images of JPEG-format are loaded on disc, and then we have to read it into Matlab. The Database used to store the images is Wang Database of each image size 384*256.

IV. TEXTURE FEATURE EXTRACTION METHODS

Many techniques are using for measuring texture such as Co-occurrence matrix, Gabor Wavelet, local binary pattern, and wavelet transform. There are a lot of researches in visual features extraction: because texture has been considered as one of the important feature for image extraction that refers to relationship between objects and their encompassing environment in an image [4]. In this paper some of the extraction techniques and models are used to measure textural properties.

A. Co-occurrence Matrix Technique (GLCM)

In 1970 Harlick added the co-occurrence probabilities usage of GLCM for extracting numerous texture features [5-7]. Feature extractions are based on relation between the pixels and its neighbours. GLCM [8] is a popular statistical method of extracting textural features from images.

0	1	1	2	3
0	0	2	3	3
0	1	2	2	3
1	2	3	2	2
2	2	3	3	2

Fig.2 (a)

F(i, j)	0	1	2	3
0	1	2	1	0
1	0	1	3	0
2	0	0	3	5
3	0	0	2	2

(b)

(a) An image having of 4 Gray scales

(b) A co-occurrence matrix of an image

Here in the above Fig.2 (a) the image consist of 4 gray scales 0, 1, 2, & 3 and Fig.2 (b) show the co-occurrence matrix of an image. GLCM calculates how many times the pixel intensity value of i in horizontal relation with value of j.

Haralick, Shanmugam, and Dinstein introduced a set of 14 texture features calculated from an image's co-occurrence matrix (GLCM), some of these are Energy, Entropy, Contrast, Homogeneity, Correlation etc.

B. Wavelet Transform

Since the values in the image are the intensity values, spatial values of the pixels may not give accurate classification results. Therefore this spatial domain has to be transformed to frequency domain using Haar Wavelet Transform.

Wavelet Transform is a signal processing method. For texture classification it is one of the important features and is not based on spatial domain like GLCM method instead it is based on frequency domain of the images. That is due to the fact the information at the frequency domain is generally extra solid in comparison to the spatial domain.

Hence having the features of slower and complex it gives high accuracy for the images. This method has many of the sub wavelet transforms such as discrete wavelet, Haar wavelet etc [9, 10].

Table 1 Comparison of various methods for texture feature extraction

Techniques	**Features**	**Advantage**	**Disadvantage**
Gabor Filter	Signal Processing Method.	1. Multi-scale, multi-resolution filter. 2.orientation invariant	High Computational cost.
Wavelets Transform	Signal processing method,	Higher accuracy.	Complex and slower.

Gray level co-occurrence matrix	Frequency of occurrence of combinations of pixel brightness values	1. Smaller length of feature vector. 2. Estimate image properties related to second-order statistics.	1.Computation complexity 2. Not rational invariant.
Local Binary Patterns (LBP	1. Works on image pixel thresholding.	1.Robustness 2. Computational simplicity.	1. This independence is not warranted in practice.

V. PROPOSED METHODOLOGY

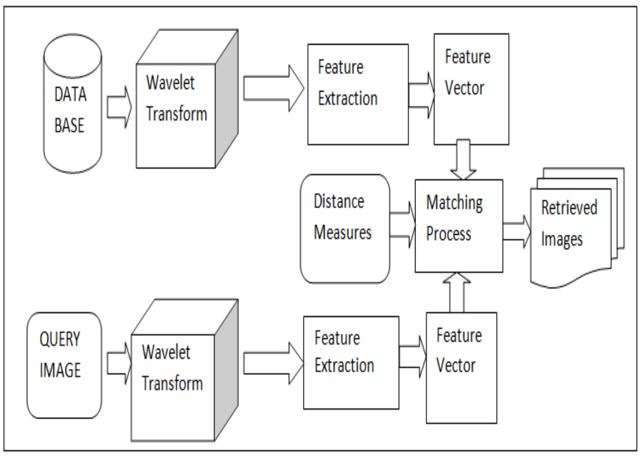

Fig.3 an Algorithm Using Discrete Wavelet Transform

1) Feature Vector decomposes every image in Discrete Wavelet Transform Domain.

2) For these decomposed image, Energy and standard deviation are calculated.

Energy is given by

$$Energy = \frac{1}{MXN} \sum_{i=1}^{M} \sum_{i=1}^{N} |W_k(i,j)|$$

Standard Deviation is given by

$$(\sigma k) = \sqrt{\frac{1}{(MXN)} \sum_{i=1}^{M} \sum_{j=1}^{N} (W_k(i,j) - \mu_k)^2}$$

3) The resulting from energy and standard deviation is given as F= [$Energy_1$, $Energy_2$,.....,$Energy_n$, σ_1, σ_2,….,σ_n]

From F we can create the feature database for every image in the database.

4) Above step (2) & (3) steps will be applied to Query image and calculate the vector features.

5) Calculate the Similarity Distance measures

6) Finally extract all similar images to given input image supported distance measures such as Canberra distances, Euclidean distances and Manhattan distances.

Similarity Distance Measures

Feature vectors can be extracted from both images in database and given input image. Between the given input image and every image in the database are calculated through distance measures. Procedure is continued till given input image has been comparison with the all of the images inside the database. An array of distances is obtained after computing the distance algorithm, and then it is sorted using indexing method. In the proposed system three varieties of distance measures, are used as presented under:

A. *Euclidean Distances*

Euclidean distances are the important distance measurements. From Euclidean distances formula, the distance between two points with coordinates (x, y) and (a, b) in the plane is shown by

$$D(q,g) = (\sum_i |(f_i(q) - f_j(g))|^2)^{1/2}$$

B. *Manhattan Distance*

$$D(q,g) = \sum_i |f_i(q) - f_j(g)|$$

C. *Canberra Distance*

$$D(q,g) = \sum_{i=1}^{L_f} \frac{|f_{g,i} - f_{q,i}|}{|f_{g,i} + f_{q,i}|}$$

Here,'q' is the given input image, L_f is the vector feature length. $f_{g,i}$ is images in the huge database's i^{th} feature. $f_{q,i}$ is the input image q 's i^{th} feature.

VI. EXPERIMENTAL RESULTS AND DISCUSSION

The implementation is carried out on dataset which includes 1000 images with 10 classes. Every object is containing 100 images. In this paper the experiment is carried on 20 images f diverse classes such as flower, bus and elephant.

Table 2 Precision values for Texture features only

Features	Similarity Distance	Discrete Wavelet Transform
		Class
		Elephant
Energy + Standard Deviation	Euclidean	40%
	Manhattan	40%
	Canberra	20%
GLCM	Euclidean	50%
	Manhattan	60%
	Canberra	60%

Table 3 Precision values for RGB, HSV and YCbCr Color Spaces

Features	Similarity Distance	RGB Class	HSV Class	YCbCr Class
		Elephant	Elephant	Elephant
Energy + Standard Deviation	Euclidean	40%	40%	40%
	Manhattan	50%	50%	50%
	Canberra	50%	50%	50%
GLCM	Euclidean	50%	50%	50%
	Manhattan	80%	80%	80%
	Canberra	80%	80%	80%

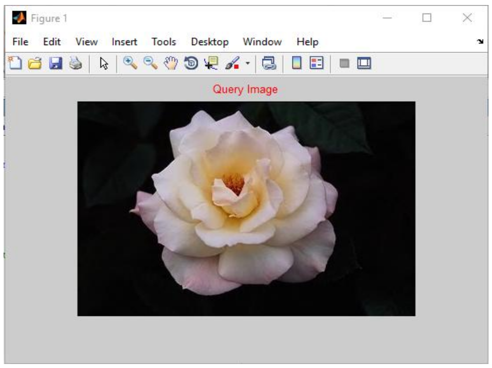

Fig. 4 Query Image

Fig. 4 shows the input image given to retrieve the related images.

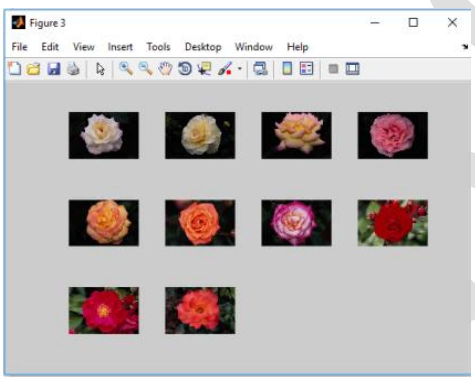

Fig. 5 result of RGB color + GLCM for Manhattan Distance

Fig.5 shows the retrieval result for given input image using RGB color spaces and GLCM using Manhattan Distances.

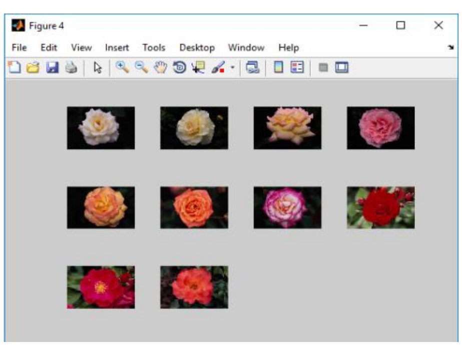

Fig. 6 result of RGB colour + GLCM for Canberra Distance

Fig. 6 shows the retrieval result for given input image using RGB colour spaces and GLCM using Canberra Distances.

VII. CONCLUSION

Retrieving the relevant images from a huge database using only texture features such as Gray Level co-occurrence Matrixes (GLCM) will not give good retrieval result, so in our proposed system we are adding RGB, HSV and YCbCr colour space with GLCM to get good retrieval result. Images are retrieved using similarity measures with the help of Euclidean, Manhattan and Canberra distances. Wavelet decomposition method is used to pre-process the images in both training and testing phase. Accuracy of 80% is achieved when colour features are added to texture features using Manhattan distance and Canberra distances.

REFERENCES

[1]. Alphonsa Thomas et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (6) , 2014, 7847-7850.

[2]. Vaishali D. Dhale, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 10, October 2012.

[3]. T. Ojala, M. Pietikainen, and T. T. Maenpaa, “Multiresolution gray-scale and rotation invariant texture classification with Local Binary Pattern,” IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 24, no. 7, pp. 971-987, 2002.

[4]. M.Rahimi and M.Moghadam, “A texture based image retrieval approach using self- organizing map pre-classification," IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), pp. 415-420, December 2011.

[5]. Miroslav Benco, Robert Hudec, “Novel Method for Color Textures Features Extraction Based on GLCM” Radio engineering, Vol. 16, NO. 4, December 2007.

[6]. Ruziana Mohamad Rasli, T Zalizam T Muda, Yuhanis Yusof, Juhaida Abu Bakar,” Comparative Analysis of Content Based Image Retrieval Technique using Color Histogram. A Case Study of GLCM and KMeans Clustering”. Intelligent Systems, Modelling and Simulation (ISMS), 2012 .Pages 283-286.

[7]. Bingbing Liu, Soo Chin Liew,” Texture retrieval using grey-level cooccurrence matrix for Ikonos panchromatic images of earthquake in Java 2006”.Geoscience and Remote Sensing Symposium, 2007, Pages 286289.

[8]. R.M. Haralick, K. Shanmugam, and L. Dinstein, “Textural Features for Image Classification,” IEEE TSMC, vol. 3, pp. 610-621, 1973.

[9]. Jing YI Tou, Yong Haur Tav, Phooi Yee Lau, "Recent trends in texture classification: A review”, Symposium on Progress in Informaiton & Communication Technology, 2009 pp.63-68.

[10]. S. Selvarajah and S. R. Kodiruwakk, "Analysis and Comparison of Texture Based Image Retrieval", International Journal of Latest Trends in Computing, Vol. 2, Issue 1, March 2011,pp. 108-113.