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An Efficient Content Based Image Retrieval with Low Level Fuzzy Color Histogram and Gabor Transform Features

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Abstract: ***Due to the acceptance of community interacting and broadcasting allocation websites records of imageries uploaded and common on the internet have improved. It prompts the accessibility of greatly extensive amounts images that need aid labeled toward clients. Content Based Retrieval system contingent upon low level features. Content based Image retrieval utilization the machine learning approach on take care of the image Category features issues. So, there is need to utilized color texture based feature to extract image characteristic. Different Categories of images are presents in the datasets so it's challenging task to find separation between them. Here comparison between Fuzzy Color Histogram (FCH) and Color Moment are done with Euclidean distance metric. For Texture Feature Gabor Wavelet Transform (GWT) is use with above two feature fusion and find batter among them. The time required for feature extraction and retrieval using Euclidean distance for our proposed system's feature extraction technique and Existing feature extraction techniques GWT and Color Moment also done.***

Keywords: Fuzzy Color Histogram, Color Moment, Gabor Wavelet, Retrieval, Euclidean

I. INTRODUCTION

Image retrieval systems have established from "Text based image retrieval" to "Content based image retrieval". In TBIR imageries are recovered from the record established upon the writing related with imageries. While In CBIR systems are established on the pictorial possessions of the images. It uses image low level visual features such as texture, color, and shape spatial information to rescue images from big set of database. Following Fig. 1 shows the general flow of the CBIR system.

Low level features extracted in CBIR systems are not enough to label the user's high level insight for the query image. Therefore the semantic break problem is arises in image rescue systems which is the discrepancy among the user requirements and abilities of image retrieval systems. Human interpret the images using high level features such as keywords, text or tag associated to images. While CBIR system uses low level features to represent the images. Therefore semantic gap is always exists between human and image retrieval systems.

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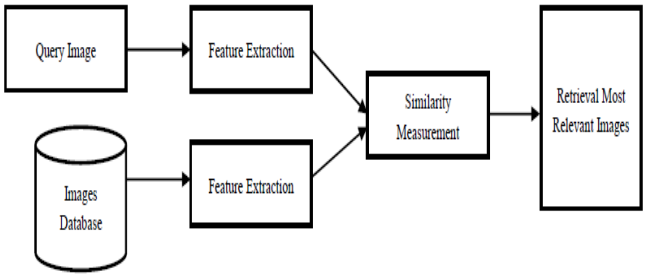


Fig. 1 - General flow of CBIR system.

Various CBIR systems are developed and implemented in past decades such as QBIC, Visual SEEK, Blobworld, SIMPLicity [2] but still semantic gap problem is remains challenging in image retrieval task.

II. DIFFERENT METHODS OF LOW LEVEL FEATURES

2.1 Fuzzy Color Histogram (FCH):"This method is based on the L*a*b color space, which approximate the color in the way that human perceive the color. Here L* attitudes for luminance, a* signifies comparative greenness-redness and b* signifies comparative blueness-yellowness. a* and b* components are divide in to the five regions. a* is separated into green, greenish, the central component, reddish, red respectively. b* is alienated in to blue bluish, the central component, yellowish, yellow. L* represents the shades of the colors that is black, gray and white and is divided into three regions dark, dim and bright areas. The fuzzification of L*, a*, and b* is complete by means of triangular shaped built in membership function (MF). The fuzzy connecting of the three modules (L*, a*, b*) is made affording to 27 fuzzy rules which are assumed in [3] which leads to the output of the system."

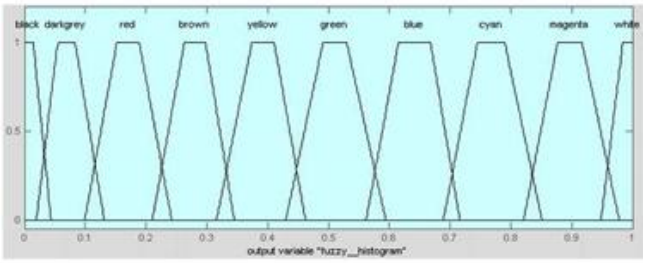


Fig. 2–Output of Fuzzy system

Fig.2 Shows output of the System. The defuzzification procedure is done by utilizing 10 trapezoidal MFs which leads 10 bins final fuzzy histogram. In FCH later only 10 bins are used to label the color features of images.

FCH calculates color comparison data by dispersal each pixel's total membership value to each histogram bins. It contains only 10 bins for describing the color feature of each image so it required very less computations. It is also insensitive to noise, rotation and scale.

2.2 Color Moment: This method is used to extract color feature from image. It is used to discriminate the images based on distribution of color in an image. Color moment is used to check the color resemblance between images which is used to retrieve similar images to query images from database. For calculating color moment it is assume that the spreading of color in an image can be interpreted as a probability distribution. Numbers of unique moments such as mean, variance etc. are used to describe the probability distribution. Therefore these different moments are used to identify the distribution of color and used as color features to identify image based on its color [3].

In [2] authors have "used three central moments of image's color circulation. They are Mean, Variance and Skewness. A color can be defined by 3 or more values, HSV scheme of Hue, Saturation and brightness. Moments are considered for each of these channels in an image. An image therefore is considered by 9 moments • 3 moments for each 3 color channels."

2.3 Gabor Wavelet: Wavelet transform provide a multi-resolution aspect to texture analysis and classification [1]. Gabor wavelet proves to be extremely useful texture analysis and is utilized widely. Gabor Wavelets are collection of wavelets in which each wavelet apprehending the liveliness at a exact direction and frequency. So Gabor wavelet gives the local frequency description in images. Textures features can be extracted from these groups of energy distribution. Gabor wavelet is scale and orientation invariant, that make Gabor wavelet to useful for constructing feature vectors for images [2] [1].

Gabor wavelet is the multi-scale and multi-orientation approach for texture feature extraction. "The Gabor function is the Gaussian modulated by a complex sinusoid ω and the standard deviation ∂x and ∂y of the Gaussian envelop as follows [1]."

III. PROPOSED CBIR SYSTEM BASED ON LOW LEVEL FEATURES

Workflow of our proposed image retrieval structure is given in Fig. 2. In proposed work. First decided to use distance as Euclidean for Retrieval. As it can give accurate compare to other distances. In low level feature extraction for color feature FCH required less storage, less computation hence faster and also invariant to rotation, scaling and translation, insensitive to noise so we have extracted color feature using FCH.For texture feature we have decided to use Gabor wavelet for accurately extract the texture pattern in images.

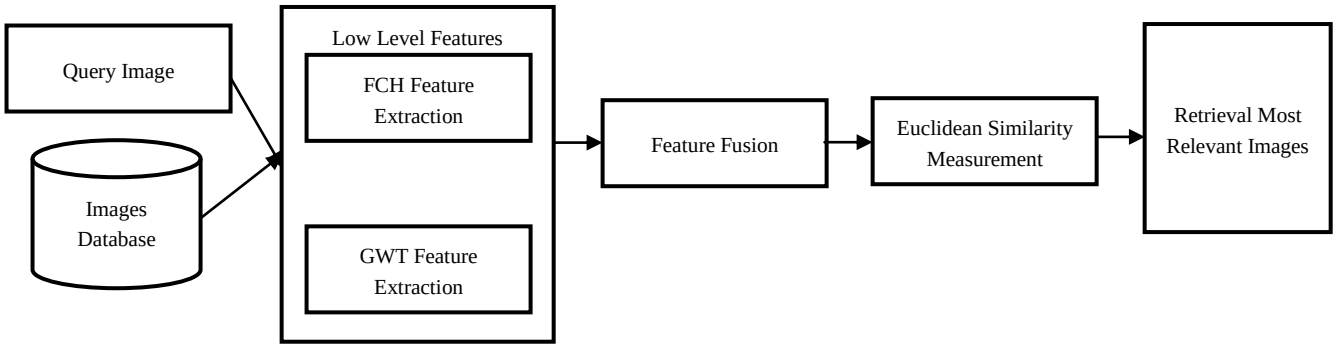


Fig. 3 - Proposed System

Input: Query Image 'I' with associated tags T= {t1, t2… tm}

Output: Top N retrieved images form database D= {I1, I2…In}

FI = Feature vector of query image I

FD = Set of feature vector of n database images= {F1,F2 ….Fn}

Hybrid Image Retrieval Algorithm (I, T)

BEGIN

1.For i=1 to N database images

2.Apply FCH and Gabor wavelet feature extractor to image i, combine them to obtain resultant feature vector Fi.

3.Apply SVM Trainer to Fi for training and make SVM struck for each class.

4.Apply step (2) on query image I and obtain FI, Give FI to trained classifier to obtain class CI of the query image I.

5.Apply Distance based retrieval System to retrieve query images in query class CI.

END

For Color feature extraction as we have decided to use Fuzzy Color Histogram (FCH). We have use FCH and extracted the color features from the images. For FCH we have used the 27 fuzzy rules and for that used Mamdani type fuzzy inference system given in [19]. It gives the output as fuzzy histogram contains10 bins. Output of the 10 bins histogram consist of red, brown, yellow, green, black, dark grey, blue, cyan, magenta and white respectively. So we got 1-D feature vector of size for each image as a color feature of an image.

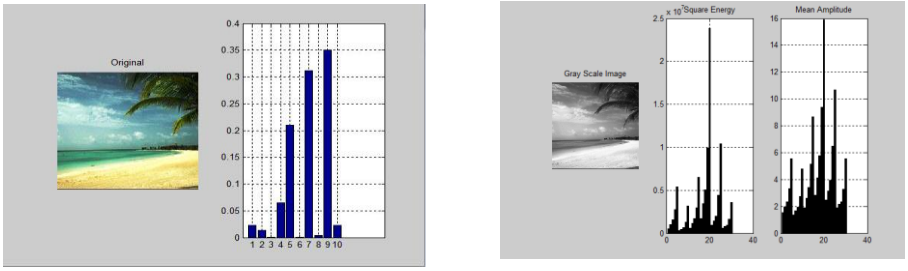
For texture Gabor wavelet transform feature is used. In that first of all images is converted in to grayscale image. Then Gabor filter is constructed using different number of occurrences and diverse phase angles. In last process, STD and mean are considered to store in feature vector. Here we have use 5 different scales and 6 orientations so we obtained total 60 features per image as a texture feature.

Initially in training phase using FCH and Gabor wavelet feature are extracted of database images then combined resultant

feature vectors have given to SVM for training.SVM is trained using predefined classes of image database. After that in testing phase in our system we have taken query image as well as number of related tags or keywords from the use. So first using FCH and Gabor wavelet query image feature are extracted after that combined feature vector has given to SVM for finding the appropriate class for the query image.

IV. RESULTS AND ANALYSIS

In this section we have implemented and evaluated the different steps of our proposed system. The main steps of our proposed system are as follows:
Low level feature extraction
Applying Distance Based Retrieval



FCH Feature **b. GWT Features**

Fig. 4 –FCH and GWT Features Extraction

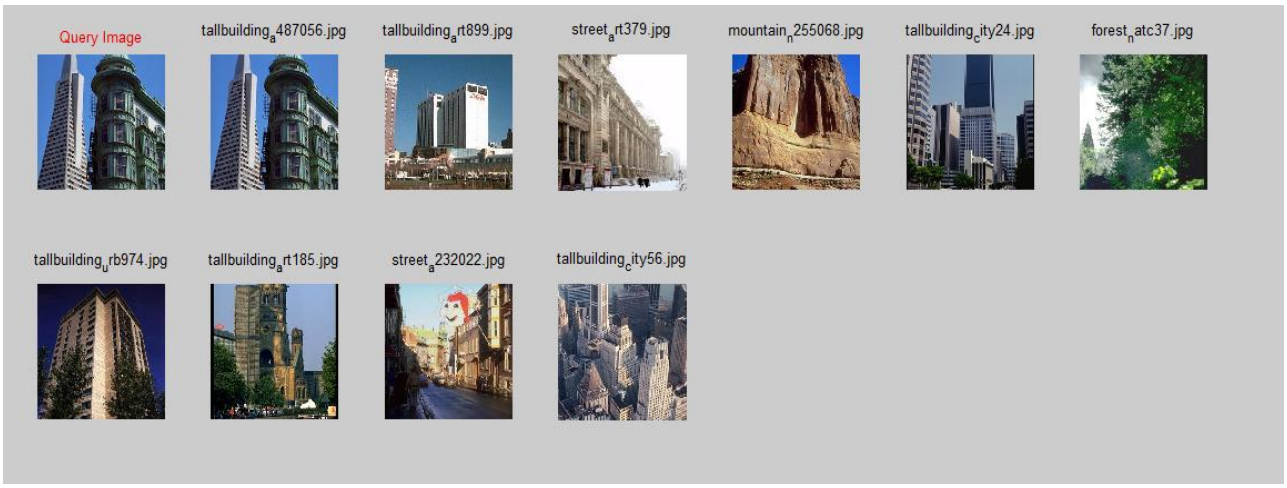


Fig. 5 - Result using FCH +GWT and Euclidean Distance for tallbuilding_a487056.jpg

Comparison between average precision and recall for proposed feature extraction techniques and existing feature extraction technique is shown in following Table 1. It conclude that the FCH and GWT gives better precision and recall than the existing GWT and Color moment features.

Fig. 6 - Result using CM + GWT and Euclidean Distance for tallbuilding_a487056.jpg

Table. 1 –Comparison of average precision and recall for feature extraction techniques

Categories	GWT + Color Moment [2]			GWT + FCH		
	Precision	Recall	F1 Score	Precision	Recall	F1 Score
Cost	0.20	0.05	0.35	0.40	0.114	0.44
Forest	0.50	0.074	0.65	0.60	0.100	0.76
Highway	0.50	0.064	0.62	0.50	0.100	0.55
Inside City	0.30	0.093	0.34	0.60	0.187	0.67
Mountain	0.40	0.064	0.46	0.60	0.177	0.64
Open Country	0.40	0.190	0.53	0.50	0.240	0.58
Street	0.50	0.142	0.54	0.60	0.171	0.64
Tall Building	0.50	0.10	0.56	0.70	0.127	0.72
Symbols	0.50	0.25	0.54	0.60	0.30	0.64
Average	**0.422**	**0.114**	**0.51**	**0.566**	**0.168**	**0.62**

The Euclidean distance is used for finding the matchingis donefor query and record images. We have also Alize the time required for feature extraction and retrieval using Euclidean distance for our proposed system's feature extraction technique and Existing feature extraction techniques GWT and Color Moment. Following Table 2 gives time for various query images for GWT +FCH and GWT +CM.

Table. 2 –Comparison of Retrieval time using Euclidean distance for feature extraction techniques

Query Image Name	Image Retrieval Time using Euclidean Distance (S)	
	GWT + Color Moment [2]	GWT + FCH
coast_n203069.jpg	3.58	5.72
forest_for22.jpg	2.18	5.28
highway_bost169.jpg	2.08	5.17
insidecity_bo109.jpg	2.36	5.13
mountain_moun44.jpg	2.19	5.30
opencountry_file37.jpg	2.91	5.10
street_art764.jpg	1.99	5.37
Tallbuilding_a487092.jpg	2.25	5.05
Average	**2.44**	**5.26**

V. CONCLUSION

In our proposed system evaluated the performance of our feature extraction techniques i.e. FCH and GWT using precision and recall metric and compared the result with existing feature extraction approaches i.e. color moment and GWT. Implementation results show that the feature extraction techniques for the proposed system are better than the existing techniques. Evaluation is done using precision and recall. From the results, we have analyzed that our proposed system gives high precision and recall value despite of large size of image database. Our proposed system easily appreciate the social requirement of query image using query tags and higher precision is obtained compare to image retrieval approach using FCH+GWT and CM+GWT. Proposed FCH+GWT gives batter precision and recall using Euclidean distance.

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