ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 5, Issue 12, June 2016

CBIR on Biometric Application using Hough Transform with DCD ,DWT Features and SVM Classification

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Abstract*—Content based image retrieval (CBIR) has been possibly the greatest significant enquiry areas in computer science for the last decade. A retrieval way which mix texture, color and shape feature is future in this paper. In this research, implemented a novel method for CBIR using Hough Transform ,DCD and DWT feature with Support vector machine (SVM) as a classifier. In the process of feature extraction, firstly extract texture feature using discrete wavelet transform (DWT), extract color feature using dominant color descriptor (DCD) on RGB and HSV color space for improving computation and efficiency and for line detection use Hough Transform of images. The experimental dataset contain 444 images including facial images. The match size is considered utilizing weighted Euclidean distance (WED). For improving effectiveness of the system, classify data using RBFSVM. Performance analysis is depend on precision, accuracy and F-measure.

***Keywords*—CBIR; DWT; Hough Transform;DCD;RGB and HSV color.**

I. INTRODUCTION

The rapid growth of various types of digital images has made it necessary to develop systems that organize and index the images for easy access. Manual annotation or textbased indexing is one method of doing this. However, due to certain disadvantages of text-based indexing the other methods of organizing and indexing of images like Content-Based Image Retrieval (CBIR) has been proposed. Common CBIR systems perform retrieval on the basis of features present in the image such as colour, texture, and shape. The feature vectors of the query image and database images are compared with each other to retrieve visually similar images [1]. This approach involves no manual annotation and retrieves visually similar images. Hence content-based image retrieval is the need of the hour.

Color, being a powerful descriptor, has been exploited a lot as a feature for image retrieval. Color based methods use tools such as histogram and color correlogram for indexing. Texture is another feature which has been in use. Texture represents structural arrangement of region and describes smoothness, roughness, coarseness of the region. Shape is also a commonly used feature for retrieval. Image retrieval using shape feature generally requires segmentation of objects for shape retrieval [2]. Lack of good segmentation algorithm makes this task a little difficult. Single feature is not enough to serve the purpose of efficient retrieval. Hence a new trend of combining two or more features to carry out efficient retrieval has emerged. Combination of multiple features performs efficient retrieval as this is able to find more distinctive features in an image to construct feature vector.

II. COLOR FEATURE

Color features are the most intuitive and most dominant low-level image features which are very stable and robust in comparison with other image features such as shape and texture.[3].In this work the color feature that are used are Dominant Color Descriptor and Color statistics of RGB and HSV model. In DCD, first, each color is divided to numberof partitions named course partitions.The center of each partition is calculated. Then, all pointsin the same partition are assumed to be similar and near to eachother. Partition centers are the average value of all pixels ineach partition.In this research the DCD features are extracted in both RGB and HSV domain.

For each image, as the simplest statistic features, the first order (mean, denoted my M) and the next order (standard deviation STD) are calculated.

III. HOUGH TRANSFORM

The Hough transform [4] is a feature extraction technique used in image analysis, computer vision, and digital image processing. It is done using a voting procedure which is carried out in a parameter space. The classical Hough transform was concerned with the identification of lines in an image. The key idea of Hough Transform is to know that a line can be uniquely determined by the slope parameter *m* and the intercept parameter *b*. Based on this observation, a straight line$y = m\ x + b$ in the image space can be represented as a point (b, m) in the parameter space. However, we may see unbounded values of the parameters *m* and *b* if a line is perpendicular to the *x* axis. To avoid this, one can use a different pair of parameters, denoted *r* and , for the lines in the Hough transform. The parameter *r* represents the distance between the line and the origin, while is the angle of the vector from the origin to the closest point on the line (see figure 1). Using this parameterization, the equation of the line can be written as follows. $r = x \cos\ + y \sin$.

It is therefore possible to associate with each line of the image a pair (r,) which is unique if 0 < . The (r,) plane is sometimes referred to as Hough space for the set of straight lines in two dimensions. For an arbitrary point on

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ISO 9001:2008 Certified
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the image plane with coordinates, e.g., (x0, y0), the lines that go through it are

r( ) = *x0* cos + *y0* sin .

This equation corresponds to a sinusoidal curve in the (*r*,) plane, which is unique to (*x*0, *y*0). For a straight line in the image space, there are many sinusoidal curves corresponding to the points on the line. But all the sinusoidal curves intersect at the same point. Thus, the problem of detecting collinear points in image space can be converted to the problem of finding concurrent curves in the parameter space using a voting process. To find the longest line (not necessary connected) in the image, we just need to find the point in the parameter space that has the most sinusoidal curves passing through it. We denote the number of sinusoidal curves passing through a point in the parameter space *k*-value of the point. The bigger *k*, the longer the line is in the image space. Hough transform usually is calculated based on the gradient of the given image intensity. This is because the local gradient at a point will necessarily be orthogonal to a line passing through this point.

IV. DISCRETE WAVELET TRANSFORM

Discrete Wavelet Transformation (DWT) DWT is widely used for multi-scale image analysis. It decomposes an image into four sub-bands: an approximated image and horizontal (DH), vertical (Dv), and diagonal (Dd) detailed images. The detailed images measure variations along the columns (horizontal edges), rows (vertical edges), and diagonals (diagonal edges) respectively. More than one decomposition level may be utilized for face recognition task to give reduced but meaningful information describing face image. The approximated image is decomposed again to wavelet sub-bands. Two or three decomposition levels may be used. The final resultant approximated image is used as a feature vector. It has three levels, one, level two, and level three of decomposition respectively. A color space is a model for representing colors in terms of intensity values. RGB color space is fundamental color space in imaging.[5]

V. SIMILARITY MEASURMENT

Similarity dimension is the procedure of searching the similarity and difference among the database pictures and the query picture with features. The database picture list is then arranged along with the ascending order of distance to the query image and images are retrieved from the database according to that order.Weighted Eucledian distance is used for similarity matching in this work.

$$d(Q,T) = w_i \sum_m \sum_n d_{mn}(Q,T)$$

w_i is a sweight percentage of pixels in image

$d_{mn}(Q,T)$ is the square distance between feature vector.

VI. SUPPORT VECTOR MACHINE

Support vector machine is a classifier that is used to classify the images.A SVM classifies an input image into one of two classes with decision boundary which gives minimum classification error and maximum margin.For non linearly seperable data,SVM used the Kernel method which is implicitly present in SVM.In this work,Radial Basis Function Kernel is selected as squared exponential kernel defines a function space that is a lot larger than that of the linear kernel or the polynomial kernel.

VII. LITERATURE SURVEY

Mrs. K.Jayanthi, et.al (2015)[6] This paper describes more number of various features in CBIR system and compare the four different Color and texture based existing low level Feature Extraction Techniques such as Tamura Texture Features, RGP Color Histogram, Gabor Features and Joint Picture Editor Group (JPEG) Coefficients Histogram.

CHEN Hongkai, et.al (2015)[7] Hough Transform to detect straight lines and adaptive dynamic K-means clustering to get closed lines for optimizing. Then, the busbar can be marked in image and it can be used for further checking whether there are foreign things hanging on the busbar. Experiments on some images taken in several substations demonstrate that our method is effective.

Ekta Gupta, et.al.(2015) [8] CBIR (Content-Based Image Retrieval) uses the visual contents of a picture like global features-color feature, shape feature, texture feature, and local features-spatial domain present to signify and index the image. CBIR method combines global and local features.

Swati Agarwal, et.al (2014) [9]Color is one of the most important low-level features used in image retrieval and most content-based image retrievals (CBIR) systems use color as an image features. However, image retrieval using only color features often provide very unsatisfactory results because in many cases, images with similar colors do not have similar content. As the solution of this problem this paper describes a novel algorithm for Content Based Image Retrieval (CBIR) based on Color Edge Detection and Discrete Wavelet Transform (DWT). This method is different from the existing histogram based methods.

Khamees Khalaf Hasan, et.al. (2013) [10]In this paper, flexible hardware architecture of multi-level decomposition Discrete Wavelet Transform (DWT) is proposed for image compression applications to eliminate redundant information from the transmitted images or video frames over the wireless channel. This architecture of DWT is described and synthesized with the Very High Speed Integrated Circuit Hardware Description Language based methodology.

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Shuhua Lai, et.al. (2012) [11] In this paper our propose a new algorithm for generating image hash values based on Hough transform. Our new approach can do well even for images with big changes. Furthermore, for anti-piracy purposes, a secret key can be added to the hash value calculation process such that the hash function has favorable security properties.

Zhang et al. (2012)[12] calculated the color histogram in the HSV color space then he quantized the Hue and Saturation into eight bins while the Value channel was quantized into four bins. Color histograms don't capture the spatial relationships of color regions, so they don't robustly match similar image regions

VIII. PROPOSED WORK

Algorithm

1 Input the query image.

2 Resize the image to 256*256.

3 Extract the DCD feature, color statistics(mean and deviation)of RGB and HSV image, Wavelet feature for texture and Hough Transform for shape feature from image.

4 Construct the feature vector.

5 Similar images are retrieved according to Similarity measurement (Weighted Euclidean distance) .

$$d(Q,T) = w_i \sum_m \sum_n d_{mn}(Q,T)$$

w_i is a sweight percentage of pixels in image

6 SVMRBF is applied to classify the images and implemented to predict the results on the basis of confusion matrix.

7 Calculate precision,f-measure, execution time and recall of retrieved pictures.

$$P = \frac{No.\ of\ relevant\ image\ retrieved}{Total\ number\ of\ image\ retrieved}$$

$$Recall = \frac{No.\ of\ relevant\ image\ retrieved}{number of image\ in\ the\ datebase}$$

$$F\_measure = 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

Flowchart

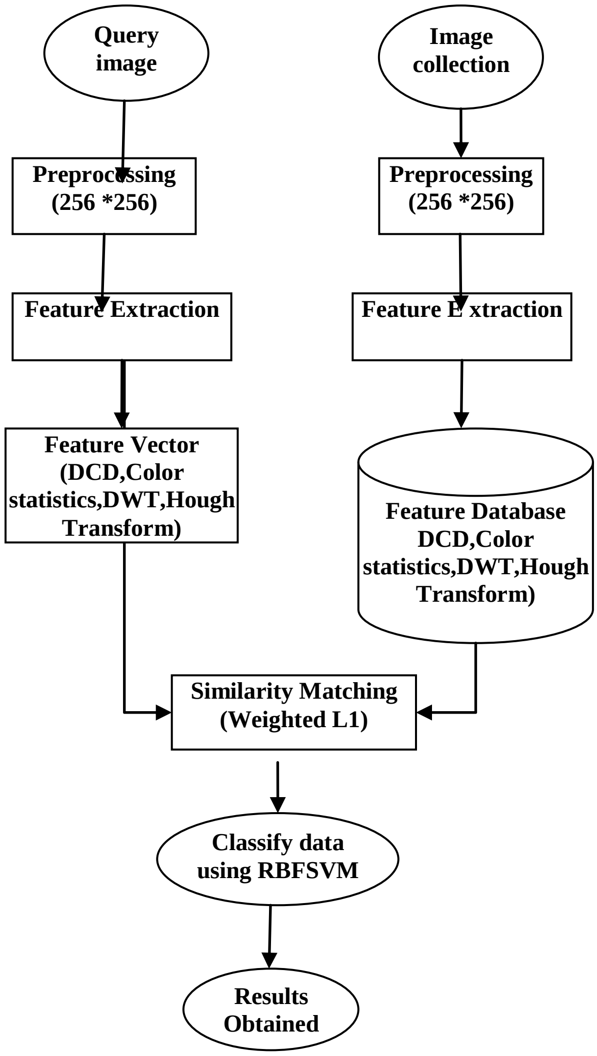

Fig 1. Block Diagram of Proposed Work

IX. RESULT ANALYSIS

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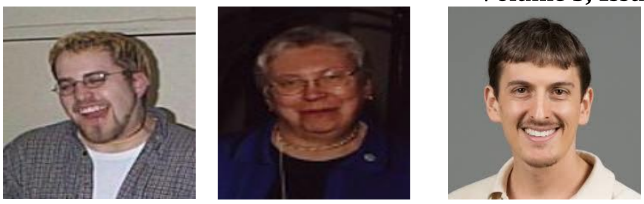


Fig 2. Experimental Dataset

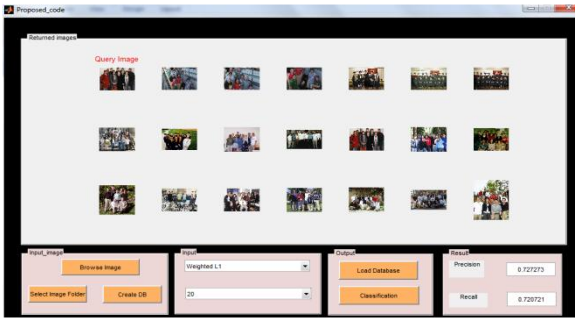


Fig 3. Proposed GUI For Multiple Face

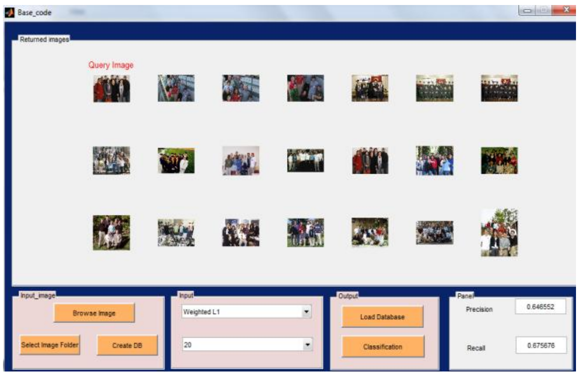


Fig 4. Base GUI For Multiple Face

TABLE I. COMPARISON OF BASE AND PROPOSED PRECISION RESULTS ON DIFFERENT IMAGES

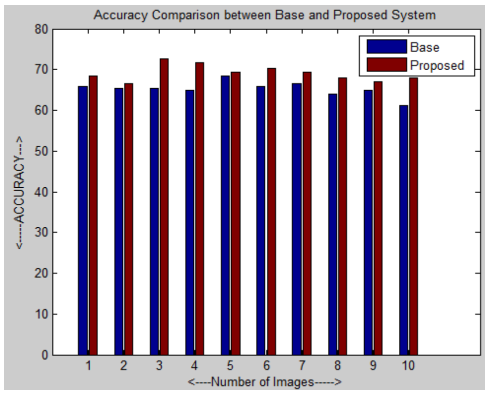
Image	Base Precision	Proposed Precision
1.jpg	0.6605	0.6734
47.jpg	0.6491	0.6728
90.jpg	0.6465	0.7272
153.jpg	0.6386	0.7142
216.jpg	0.6564	0.7311
283.jpg	0.6605	0.7102
302.jpg	0.67	0.6869
364.jpg	0.6448	0.70
405.jpg	0.64	0.68
444.jpg	0.61	0.70

TABLE II. COMPARISON OF BASE AND PROPOSED F-MEASURE RESULTS ON DIFFERENT IMAGES

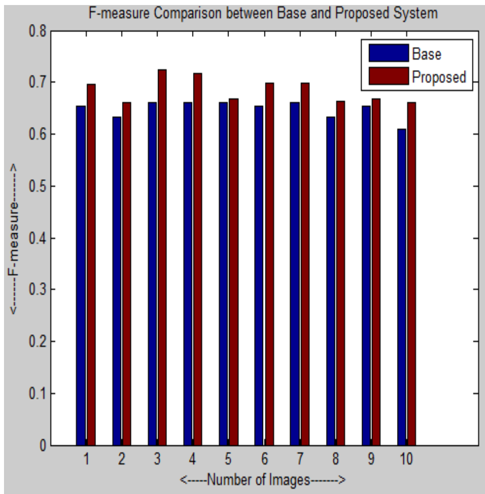
Image	Base F-measure	Proposed F-measure
1.jpg	0.6545	0.6957
47.jpg	0.6316	0.6606
90.jpg	0.6608	0.7240
153.jpg	0.6609	0.7175
216.jpg	0.6607	0.6667
283.jpg	0.6545	0.6972
302.jpg	0.6606	0.6991
364.jpg	0.6330	0.6635
405.jpg	0.6549	0.6667
444.jpg	0.6091	0.6603

TABLE III. COMPARISON OF BASE AND PROPOSED F-MEASURE RESULTS ON DIFFERENT IMAGES

Image	Base Accuracy	Proposed Accuracy
1.jpg	65.76	68.46
47.jpg	65.31	66.66
90.jpg	65.31	72.52
153.jpg	64.86	71.62
216.jpg	68.46	69.36
283.jpg	65.76	70.27
302.jpg	66.66	69.36
364.jpg	63.96	68.01
405.jpg	64.86	67.11
444.jpg	61.26	68.01



Graph1: Shows the Comparison of base [15] and proposed system accuracy



Graph2: Shows the Comparison of base [15] and proposed system F-measure

X. CONCLUSION

In this work, implement a novel method for CBIR using Hough Transform and RBFSVM with Color features from DCD, which is color quantization in HSV and RGB domain and statistic and histogram of images and also DWT for texture feature. Outcomes illustrate that involving Hough Transform with the previous scheme has increase precision, accuracy and F-measure than the previous work.

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