ISSN : 2393-8188 (print)
2393-8196 (online)
www.milliyasrcollege.org.journal.php

AN IMPLEMENTATION OF CONTENT BASED IMAGE RETRIEVAL TECHNIQUES USING WAVELET, LBP, GLCM, DCT TEXTURE DESCRIPTOR

Sarda Aditya Subhashchandrji, Syed Akhter Hussain
Department of Computer Science Aditya Engineering College Beed
adityasarda_500@gmail.com; akhter.it@gmail.com

ABSTRACT

The purpose of this project was to implement of content based image retrieval using DCT, DWT, LBP and curvelet transform texture descriptor. Wavelet transform has performed better for one dimensional signal as it is good in representing point discontinuities. The discrete cosine transform (DCT) helps separate the image into parts (or spectral sub-bands) of differing importance (with respect to the image's visual quality).A local binary pattern (LBP) texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. In this work, different type of hundred images were collected and stored as the database. Then Color images were converted into gray color by using gray level co-occurrence matrix. After that it performs decomposition up to three levels by using discrete wavelet transform and For discrete cosine transform it takes cosine transform (returns real values of images) so we get frequency features. For local binary pattern which checks the difference in pixel values within a block. Here we got local features. For discrete curvelet transform wrapping based method was their and features are extracted. Then indexing, similarity matching was done by using Euclidian distance method. The results obtained demonstrate that the curvelet transform based retrieval are more efficient then DCT, DWT, LBP based retrieval. The results obtained are in accordance with the expected predictions of the existing theory of curvelet transform.

KEYWORDS- Discrete wavelet transform**.** Wrapping based discrete curvelet transform, local binary pattern, discrete cosine transform, Mean Weighting defect.

1. INTRODUCTION

Worldwide networking allows us to communicate share and learn information in the global manner. Digital library and multimedia databases are rapidly increasing so efficient search algorithms need to be developed. Retrieval of image data has traditionally been based on human insertion of some text describing the scene which can then be used for searching by using keywords based searching methods. This is very time consuming and difficult for describing every color, texture, shape, and object within the image. We know that an image speaks thousands of word. So instead of manually annotated by text-based keywords images would be indexed by their own visual contents such as color, texture and shape so researchers turned attention to content based retrieval methods. The Discrete Cosine Transform provides a mathematical and computational method of taking spatial data dividing it into parts of differing importance with respect to visual quality and compressing it into an accurate and overall high quality image but it also had Mean Weighting defect. to overcome the limitation of wavelet, Gabor filters and DCT local binary patterns introduced as a

gray scale invariant to obtain good classification result.The local primitives such as curved edges, points, spot, flat areas etc .But it was limited to detect large-scale textural structures which can be considered its main shortcoming. The small local neighborhood also affects the rotation invariant version as local artifacts tend to decrease its performance Curvelet transform has been developed to overcome the limitations of wavelet and Gabor filters. Though wavelet transform has been explored widely in various branches of image processing it fails to represent objects containing randomly oriented edges and curves as it is not good at representing line singularities. Gabor filters are found to perform better than wavelet transform in representing textures and retrieving images due to its multiple orientation approach. However due to the loss of spectral information in Gabor filters they cannot effectively represent images. This affects the CBIR performance. Consequently a more robust mechanism is necessary to improve CBIR performance. To achieve a complete coverage of the spectral domain and to capture more orientation information curvelet transform has been developed.

2. BRIEF LITERATURE SURVEY

To better understand DCT, DWT, LBP and discrete curvelet based image retrieval system. It is beneficial to examine some of the current literature on these topics. In Paper [1] the author Ramesh babu duraic proposed a system wich extract features on MRI scanned brain images using discrete cosine transform and down sample the extracted features by alternate pixel sampling. The dataset so created is investigated using WEKA classifier to check the efficacy of various classification algorithms on dataset.

A discrete cosine transform (DCT) expresses a sequence of finitely many data points in terms of a sum of cosine functions oscillating at different frequencies. DCTs are important to numerous applications in science and engineering from lossy compression of audio and images. Where small high-frequency components can be discarded. The discrete cosine transform (DCT) helps separate the image into parts (or spectral sub-bands) of differing importance (with respect to the image's visual quality). The DCT is similar to the discrete Fourier transform: it transforms a signal or image from the spatial domain to the frequency domain this was efficient techniques it returns real values. It had Mean Wieghting defect [2] the author Yo mohamed eisa specified that the LBP works on Variations of texture caused by changing illumination and imaging conditions A local binary pattern (LBP) operator offers an efficient way of analyzing textures. It has a simple theory and combines properties of structural and statistical texture analysis methods.LBP is invariant against monotonic gray-scale variations and has also extensions to rotation invariant texture analysis by using this technique we can retrieve our result [3] the author Lenina birgale specified that the novel approach combines color and texture features for content based image retrieval. Features like color and texture are obtained by computing the measure of standard deviation in combination with energy on each color band of image and sub band of wavelet. Wavelet transform is used for decomposing the image into 2x2 sub bands. Feature database in content-based image retrieval of 640 Visual texture (VisTex) color images is constructed. It is observed that proposed method out performs the other conventional histograms and standard wavelet decomposition techniques. Application of World Wide Web (www) and the internet is increasing exponentially, and with it the amount of digital image data accessible to the users. A huge amount of Image databases are added every minute and so is the need for effective and efficient image retrieval systems. In Paper [4] The author Manesh kokare discussed that the rapid expansion of the Internet and the wide use of digital data have increased the need for both efficient image database creation and retrieval procedure. The challenge in image retrieval is to develop methods that can capture the important characteristics of an image which makes it unique and allow its accurate identification. The focus of this paper is on the image processing aspects that

in particular using texture information for retrieval. We present a unique wavelet transform based texture features for content-based image retrieval which is comparable with standard existing methods. We propose the use of pyramidal and tree structured wavelet features using 8-tap Daubechies coefficients for texture analysis and provide extensive experimental evaluation. Comparison with various features using Broadtz texture database indicates that the combination of energy and standard deviation of wavelet features provide good pattern retrieval accuracy for tree structured wavelet decomposition while standard deviation alone gives better result in pyramidal wavelet decomposition. In most of the existing retrieval methods the most commonly used Euclidean distance function or measure of dissimilarity between feature vectors is used but we observed that it is not always the best metric. We have done the comparison of results using Euclidean distance and Manhattan distance for both the tree structured and pyramidal wavelet decomposition methods and found that Manhattan distance gives better result than Euclidean distance metric.

3. SYSTEM DEVELOPMENT

In the following system design in figure 1 a database of hundred images is created and first each image of the database is decomposed up to three level by using DCT, DWT, LBP and Curvelet after this texture feature such as mean and standard deviation are extracted for each image and feature vector is created which contains mean values for the database images. Similarity matching is done by using Euclidian distance metric and performance is measured with respect to time and efficiency of the proposed system.

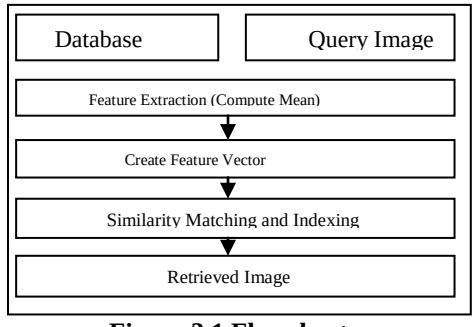


Figure 3.1 Flowchart

3.1 PROPOSED METHODOLOGY

In this project we are going to do a comparative study of DCT, DWT, LBP, and Curvelet transform. To obtain desired result we gone through different transformation techniques due to the limitations of DCT,DWT and LBP the images contains arcs, edges and curves are not sharp. Curvelet transform provides a good opportunity to extract more accurate texture features suitable for use in image retrieval. Curvelet transform provides more detailed information of the image in the spectral domain using more orientation information at each scale. Therefore our main objective is to employ curvelet texture features for content based image retrieval.

Table 3.1 Algorithm for different transformation technique

Name of the technique	Algorithm	Features
DCT	Take Image Convert To Gray Scale Apply DCT Apply Magnitude Component	Mean, Standard Deviation
DWT	Take Image Convert to Gray Scale Take Wavelet Transform	Mean, Standard Deviation
LBP	Take Image Convert to Gray Scale Declare a Window Place the Window Around Each Pixel Check if the Pixel in window>Center Value=1 Else Value =0 Generate Binary	Mean, Standard Deviation

	pattern with Values 1,0 Convert Binary to decimal and replace in center pixel Normalize the Image	
Curvelet	Take Image Gray Scale Conversion FFT Rotate Calculate Curvelet	Mean and standard deviation of 16 Curvelet matrix obtained through 16 rotations

3.2 PERFORMANCE EVALUATION METHODS OF CBIR

The level of retrieval accuracy achieved by a system is important to establish its performance. If the outcome is satisfactory and promising it can be used as a standard in future research works. In CBIR precision-recall is the most widely used measurement method to evaluate the retrieval accuracy. We have found some recent literature use this Pair to measure the retrieval performance. Precision P is defined as the ratio of the number of retrieved relevant images r to the total number of retrieved images n, i.e. p=r/n. Precision measures the accuracy of the retrieval.

$$\rho = \frac{\text{No of relevant images retrieved}}{\text{Total no of images retrieved}} = \frac{r}{n}$$

Recall is defined by R and is defined as the ratio of the number of retrieved relevant Images r to the total number m of relevant images in the whole database i.e. R=r/m. Recall measures the robustness of the retrieval. Recall is defined by R and is defined as the ratio of the number of retrieved relevant Images r to the total number m of relevant images in the whole database i.e. R=r/m [1].

$$\acute{R} = \frac{\text{No of relevant images retrieved}}{\text{Total no of images retrieved from DB}} = \frac{r}{m}$$

Generally precision values fall with increases in the recall values. A retrieval system can be called 'ideal' if both the precision and recall values remain high. However in reality no such image retrieval system has yet been found. Precision-recall pair is a good standard of Performance evaluation. It provides meaningful result when the database type is known and has been effectively used in some earlier research. For other data sets especially those which have been created by collecting user generated images the result may vary due to different human concepts of image classification.

4. EXPREMENTATION

The experimentation is for the comparative study over the database of hundred varied sized images from which the set of test images was created which are as follows.


Image 1


Image 2

Image 3


Image5


Image 4


Image 6


Image 7


Image 8


Image 9


Image 10

5. PERFORMANCE ANALYSIS

We compare one texture retrieval transformation technique with other three technique one by one the with respect to distance and efficiency of the system. In the table 5.1 there is set of 10 test images which show the different results for DCT. In the table 5.2 there is set of 10 test images which show the different results for DWT. In the table 3 there is set of 10 test images which show the different results for LBP. In the table 4 there is set of 10 test images which

show the different results for discrete curvelet transformation.

Table 5.1. Results for the set of test images using DCT

Sr No	Images	Distance	Efficiency
1	Image1	4.9921	79.3103
2	Image2	5.4512	86.206
3	Image3	5.3605	65.517
4	Image4	5.2241	6.8966
5	Image5	5.2327	6.8966
6	Image6	5.2046	82.7586
7	Image7	5.3434	89.6552
8	Image8	5.2969	10.3448
9	Image9	5.3352	31.034
10	Image10	5.387	65.517

Table 5.2. Results for the set of test images using DWT

Sr No	Images	Distance	Efficiency
1	Image1	0	100
2	Image2	0	100
3	Image3	0	80
4	Image4	0	40
5	Image5	0	20
6	Image6	0	100
7	Image7	0	100
8	Image8	0	20
9	Image9	0	80
10	Image10	0	100

Table 5.3. Results for the set of test images using LBP

Sr No	Image	Distance	Efficiency
1	Image1	0	80
2	Image2	0	100
3	Image3	0	100
4	Image4	0	60
5	Image5	0	40
6	Image6	0	100
7	Image7	0	100
8	Image8	0	80
9	Image9	0	80
10	Image10	0	100

Table 5.4. Results for the set of test images using Curvelet

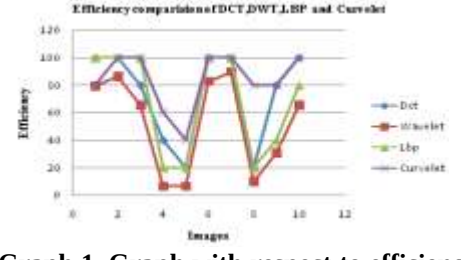
Sr No	Images	Distance	Efficiency
1	Image1	0	100
2	Image2	0	100
3	Image3	0	100
4	Image4	0	20
5	Image5	0	20
6	Image6	0	100
7	Image7	0	100
8	Image8	0	20
9	Image9	0	40
10	Image10	0	80

Efficiency

For the efficiency of the system is if the resultant image and original image's mean square error is less than 0.25 then we can say that it's a perfect match or one otherwise zero. For indexing the resultant images we are using the threshold value of 95 percent for accuracy and on the basis of these criteria we can plot the first five exact matches. For each technique we have given the same set of images as given for, DCT, DWT, LBP and discrete Curvelet transformation and the differences in the results can be observed from the table 5.1,table 5. 2, table 5.3 and table 5.4.

Graph

The following graph (a) is plotted on the basis of the number of images and efficiency obtained after retrieval of each image from set of test images which is shown in Table 5.1, Table 5.2, Table 5.3 and Table 5.4. Where the x axis shows the number of images and y axis denotes the efficiency of the system. From the graph we can observe that the overall curvelet transform is more efficient then the other three techniques.

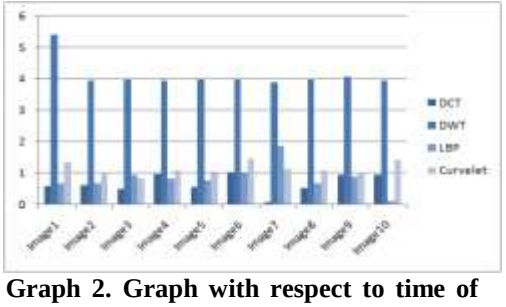


Graph 1. Graph with respect to efficiency of the system

The following Table 5 shows the time comparison for DCT, DWT, LBP and curvelet based system. For this time evaluation we have used the matlab function called tic toc which gives the total elapsed time to retrieve an image. The table shows the elapsed time for the same set of test images.

Table 5.5 Image retrieval analysis for DCT, DWT, LBP and Curvelet transforms techniques With respect to time.

Images	DCT	DWT	LBP	Curvelet
Image1	0.5605	5.4054	0.6557	1.3432
Image2	0.5997	3.9548	0.6645	1.0298
Image3	0.4736	3.9590	0.9366	0.8140
Image4	0.9471	3.9265	0.7998	1.0765
Image5	0.5250	3.9762	0.7610	0.9754
Image6	0.9789	3.9766	1.010	1.4212
Image7	0.0701	3.8736	1.8568	1.1163
Image8	0.5173	3.9772	0.6614	1.0648
Image9	0.9367	4.0602	0.8525	1.0212
Imag10	0.9354	3.9500	0.0839	1.3998



Graph 2. Graph with respect to time of the system

6. Conclusion and Future Work

In this paper we Implement different transformation techniques on the basis of their efficiency and time. Discrete Cosine transform has a powerful capability of decomposition of image into sub images for better result and gives exact match. The methods of wavelet transform gives decomposition of the image into 2x2 sub bands. It is observed that proposed method outperforms the other conventional histograms and standard wavelet decomposition techniques. Local binary pattern works on Variations of texture caused by changing illumination and imaging conditions and gives the desired result that can't be obtained by discrete cosine and wavelet transform Discrete Curvelet transform has a powerful capability of representing the edge curves in an image. As compared to the other methods the wrapping based discrete curvelet transform has been found to be the most effective and efficient. Therefore, we choose it to represent the image textures in this project. Result images displayed using GUI which gives exact images or similar images. And retrieval accuracy is improved using Euclidean distance than the man hat tan distance of texture feature for CBIR. Speed is calculated using time required to execute the program it also gives less time. Retrieval accuracy is improved using curvelet transform. During the implementation, we also proved that by considering object uniqueness during similarity distance computation improve the accuracy during retrieval.

7. References

[1] "A generic approach to content based image retrieval using DCT and classification technique" Ramesh Babu Duraic Research Scholar, Anna University Coimbatore. Dr.V.Duraisamy Principal, Hindustan College of Engineering & Technology,Coimbatore Tamil Nadu, India.

[2] "Local Binary Patterns as Texture Descriptors for User Attitude Recognition" Mohamed Eisa, A. ElGamal, R. Ghoneim and A. Bahey Department of computer science Mansoura University, 35516 Egypt.

[3] "Color and Texture Features for Content Based Image Retrieval" Lenina Birgale, Manesh Kokare and Dharmpal Doye Department of Electronics and Telecommunication Engineering, Shri Guru Gobind Singhij Institute of Engineering and Technology,Vishnupuri, Nanded 431606,INDIA

[4] "Wavelet Transform Based Texture Features For Content Based Image Retrieval" Manesh Kokare, B.N. Chatterji and P.K. Biswas Electronics and Electrical Communication Engineering Department, Indian Institute of Technology, Kharagpur PIN 721302, India

[5] "Graph Based Segmentation in Content Based Image Retrieval"1P.S.Suhasini, 2K. Sri Rama Krishna and 3I.V. Murali Krishna 1Asst. Professor in ECE , Daita Madhusudana Sastry Sri Venkateswara Hindu College of

Engineering , Machilipatnam, A.P., India - 521001

[6] "Multiresolution Gray-Scale and Rotation Invariant Texture Classification with Local Binary Patterns" by Timo Ojala, Matti PietikaÈinen, Senior Member, IEEE, and Topi MaÈenpaÈa Ieee Transactions On Pattern Analysis And Machine Intelligence, Vol. 24, No. 7, July 2002

[7] "Image Retrieval using Color-Texture Features from DCT on VQ Codevectors obtained by Kekre's Fast Codebook Generation" H.B.Kekre, Tanuja K. Sarode, Sudeep D. Thepade.Management and Engineering, SVKM's NMIMS University, Mumbai, INDIA

[8] "The Curvelet Transform for Image Denoising" Jean-Luc Starck, Emmanuel J. Candès, and David L. Donoho

[9] "Parallel Approach for Content Based Medical Image Retrieval System"1M. Emmanuel, 2D.R. Ramesh Babu, 3Jayashree Jagdale, 3Pravin Game and 3G.P. Potdar 1Dr. MGR Research Institute Chennai, India 2Department of Computer Engineering, Dayanand Sagar Engineering College, Bangalore, India 3Department of Information Technology, PICT Pune, India

[10] "Model-Driven Development of Content-Based Image Retrieval Systems" Temenushka IgnatovaUniversity of Rostock Database Research Group A.-Einstein-Str. 21, 18051 Rostock, Germany

[11] "A Universal Model for Content-Based Image Retrieval"S.Nandagopalan, Dr. B. S. Adiga, and N. Deepak

[12] "Content Based Image Retrieval Using Curvelet Transform" Ishrat Jahan Sumana, Md. Monirul Islam, Dengsheng Zhang and Guojun Lu Gippsland School of Information Technology, Monash University Churchill, Victoria 3842, Australia

[13] "The curvelet transform A review of recent applications"

[14] "Texture Classification using Curvelet Transform Liran Shen1, and Qingbo Yin2 1 College of Information and Communication" Engineering, Harbin Engineering University, Harbin 150001,P.R.China shenliran@hrbeu.edu.cn2 College of Computer Science
and Technology, Harbin Engineering University, Harbin 150001,P.R.China

[15] "Content Based Image Retrieval based on Color, Texture and Shape features using Image and its complement"by p.s. hiremath and jagdish pujari.

"Image Retrieval Based On Hierarchical Gabor Filters Tomasz Andrysiak, Michał Chora´S"Institute Of Telecommunications, University Of Technology And Agriculture Ul. Kaliskiego 7, 85–796 Bydgoszcz, Poland

[16] 3D Discrete Curvelet Transform Lexing Ying, Laurent Demanet and Emmanuel Cand`es Applied and Computational Mathematics,MC 217-50, Caltech, Pasadena, CA