INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

CONTENT BASED IMAGE RETRIEVAL USING LINE EDGE SINGULAR VALUE PATTERN (LESVP): IMPLEMENTATION PAPER

Swati Thakur*, Megha Singh[1]
*, [1]Computer Science Engineering Department, Central India Institute of Technology, Indore (M.P.) -India

ABSTRACT

Content Based Image Retrieval Technique is highly used technique in this world of large image database. Content Based Image Retrieval is actively used in field of Data Mining, Education, Medical, Crime Prevention, Remote Sensing, Management of Earth Resource, Whether Forecasting etc. It is very effective and efficient method for indexing and retrieving the images based on the content features like color, shape and texture. With increasing popular technologies content based image retrieval is very accurate and fast method to retrieve the image. In this paper Content Based Image Retrieval technique is observed and new approach is proposed by the integration of Line Edge and Singular Value Decomposition which is called Line Edge Singular Value Pattern.

Keywords: Content Based Image Retrieval (CBIR), Color Histogram, Singular Value Decomposition, Local binary Pattern.

Introduction: Content Based Image Retrieval is the method which is commonly used to retrieve the images from huge image database. Research on CBIR started on early 1990's and originated by T. Kato. It is progressively used in the field of Digital Image Processing. Today many research institutes and companies are working and researching on the CBIR. There are two most common approaches used for image retrieval. (i) Text Based (ii) Content Based

Text based method is based on textual description and categorization of images but it is time consuming when we deal with large image database. So the Content Based method is the solution to overcome this problem or limitation of Text Based method.

Content Based Image Retrieval is also called Query by Image Content (QBIC) and Content Based Visual Information Retrieval (CBVIR) [4]. The Visual Content denotes to the colors, shapes, textures [1, 2, 3] and other information which can be used to retrieve the images from large database. It supports Query based on the images, colors and texture of images.

Texture is very important content feature of CBIR. Texture is one of the important characteristics which is usually present in the image. In image processing, texture content shows the information about the spatial arrangement of the colors or intensities in an image. There are two basic methods which can be used to analysis the texture: (1) Structural approach (2) Statistical approach

Histograms used to show image statistics in a proper visual format. Histogram is mainly helpful to improve the visual appearance if an image in digital image processing. Histogram shows frequency of the intensity value of an image. Color content of an image can be represented by color histogram. Color histogram is very important technique which can be used in CBIR. It is use mainly for color images to show statistical nature of color image. Color histogram is beneficial because of its effectiveness and accuracy.

Local Binary Pattern are the descriptor which is used to describe the local structure of an image. LBP defines the local structure of an image by comparing each pixel of an image with its neighboring pixels of image. LBP is a powerful method which is used to classification of texture.

Singular Value Decomposition generally applied in many restoration problems of images. SVD is very significant topic which is used in linear algebra by mathematicians. SVD is very reliable orthogonal matrix decomposition method. Some of the SVD properties are normally used in digital image processing.

In this paper new approach LINE EDGE SINGULAR VALUE PATTERN (LSVP) is proposed by the integration of Line Edge and Singular Value Decomposition.

Related work: CBIR is very highly used technique in Digital Image Processing. Query by pictorial example [QBPE] is very common process in CBIR [5].Color, Shape and Texture are important visual features which is used in image retrieval [8,9]. Shape and Texture using elastic energy based approach to measure image similarity [6] . Smith and Chang represented an automated extraction of color and texture information by using binary set representation [7].

Color is the powerful descriptor for identification and retrieval of object from an image [10]. Color histogram counts the number of color contents and occurrence of intensities of each color in an image [11]. Effectiveness and efficiency is very desire characteristics of color histogram [12].

LBP is a standard method to analysis the 2D images [13]. LBP is successfully applied in texture analysis [14],[15]. Pepton [16] used local binary pattern in face recognition. Ojala introduced Rotation-invariant texture classification using feature distributions [17] which is based on pattern recognition with local binary pattern. Facial expression analysis and recognition is proposed by Ahonen et al. [18] and Zhao and Pietikainen [19] by using Local Binary Pattern Operator. Yao and Chen [20] have proposed two types of local edge patterns (LEP) histograms. The center-symmetric local binary pattern (CS-LBP) which is a modified version of the well-known LBP feature is combined with scale invariant feature transform (SIFT) [21]. . Subrahmanyam et al. [27] have proposed the DLEP which collects the directional edge information for image retrieval.

Singular Value Decomposition is very important linear algebra method which is used in image compression [22][23].Improved SVD techniques used in watermarking, image compression and quality measure in digital image processing[24][25][26]. Many watermarking schemes based on SVD decomposition [27][28].

Proposed Methodology: On the basis of previous experiments on CBIR we are trying to implement new algorithm Line Edge Singular Value Pattern (LESVP) which is based on Line edge by multiplication of windows function with gray value pattern. As the name suggest Singular Value Pattern and Line Edge both are most important keywords of our new algorithm. In this approach we will perform our method on Coral1000 database which contains 10 groups of images and each group having 100 images.

We will load original image (I) with gray value (gc) as query image. On the basis of input image we will calculate Line Edge by multiplying windows function with gray value pattern. After that we will take absolute value of Line Edge Matrix (LE) and Centre pixel value will be mean of absolute of Line edge LE(θ). With the help of Line Edge value we will calculate Singular Value Decomposition. Centre pixel value is replaced by maximum value of singular value matrix that is called LESVP. After identifying the LESVP pattern of image whole image represent by Histogram.

Algorithm: There are some basic steps to implement LESVP (Line Edge Singular Value Pattern)

Step 1:- Load Original Image=I (Table -1),

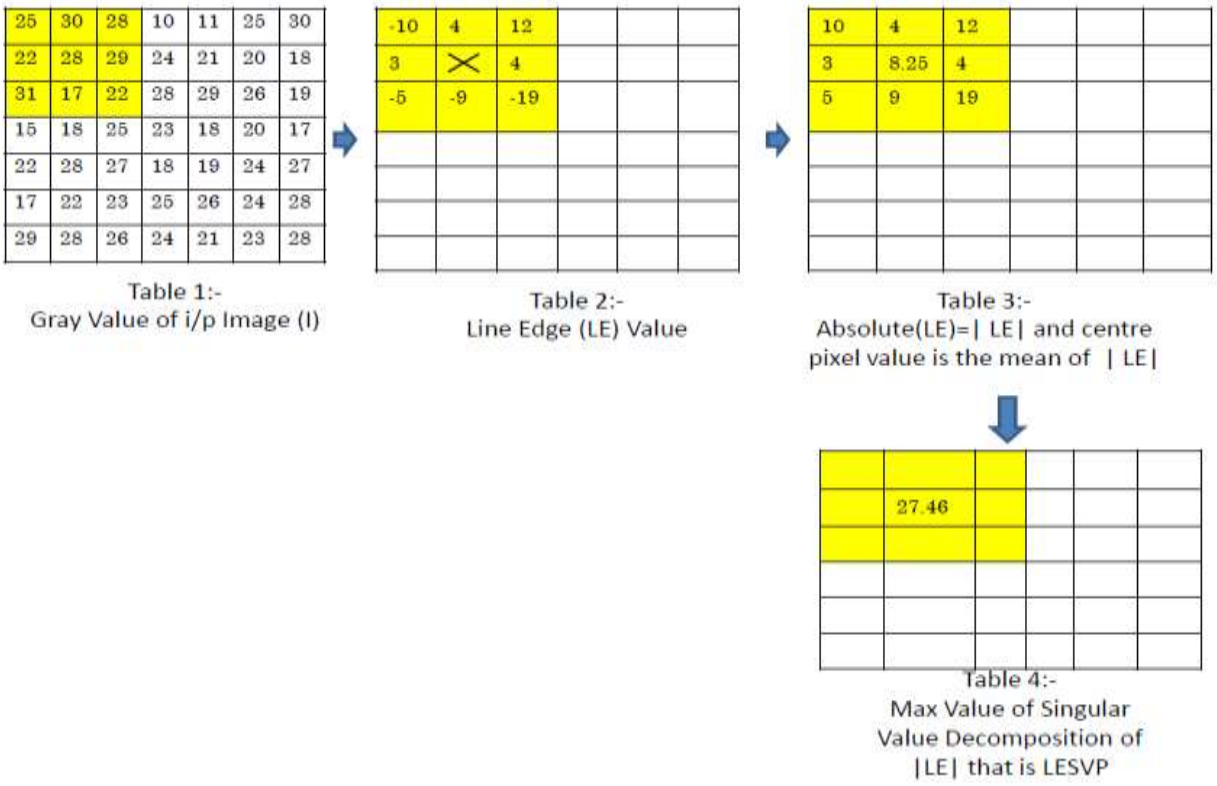
PTN(gc)= the 3×3 pattern value of an image (I) with central pixel gc.

The line edges (LE) (shown in Table -2) are calculated by multiple of window functions (Wθ) with the gray values pattern.

$$LE(\theta) = sum\ (PTN(g_c) * W_\theta); \quad \theta = 0°, 45°, ..., 315° \qquad (5)$$

Step 2:- Take the absolute of Line Edge matrix (LE) and Centre pixel value will be mean of absolute of LE(θ). That is shown in Table-3.

ISSN: 2277-5528
Impact Factor: 3.145



25	30	28	10	11	25	30
22	28	29	24	21	20	18
31	17	22	28	29	26	19
15	18	25	23	18	20	17
22	28	27	18	19	24	27
17	22	23	25	26	24	28
29	28	26	24	21	23	28

Table 1:-
Gray Value of i/p Image (I)

-10	4	12			
3		4			
-5	-9	-19			

Table 2:-
Line Edge (LE) Value

10	4	12			
3	8.25	4			
5	9	19			

Table 3:-
Absolute(LE)=| LE| and centre pixel value is the mean of | LE|

	27.46				

Table 4:-
Max Value of Singular Value Decomposition of |LE| that is LESVP

Step 3:- Find out the Singular Value Decomposition (SVD) of Table-3:

$$[U\ S\ V] = SVD(|\ LE\ |) \qquad (6)$$

Where, U=left singular Vectors, V= Right singular Vectors, S= Singular Value of the corresponding matrix (|LE|)

Step 4:- Centre pixel replaced by maximum value of Singular Value Matrix (S) (In Table-4) that is the LESVP of the 3×3 pattern- image .

Step 5:- After identifying the LESVP pattern of each pixel *(j, k)*, the whole image is represented by building a histogram:

$$H(l) = \sum_{j=1}^{N_1} \sum_{k=1}^{N_2} f_2(LESVP_{P,R}^{u2}(j,k), l);\ \ l \in [0, 255] \qquad (7)$$

$$f_2(x, y) = \begin{cases} 1 & x = y \\ 0 & else \end{cases}$$

where the size of input image is *N1×N2*

Experiment Result: To check the retrieval performance of the proposed method, we have performed experiment using Coral1000 database which contains 10 groups of images and each group having 100 images, total number of images 1000.

Our experiment shows when we give query image as input, our method is successfully retrieve corresponding matching image as output image. For example, when we give flower as input, 12 flower images are retrieved**.**

We also calculated precision of result using our method (LESVP) against other method like LEBP, LBP.

The graph shows our method gives better result:

ISSN: 2277-5528
Impact Factor: 3.145

No of Top Images	10	20	30	40	50	60	70	80	90	100
LESVP	79.43077	70.76923	66.06154	62.50769	59.94154	57.71026	55.67473	54.00577	52.28889	50.69231
LEBP	74.552	68.997	64.124	61.001	58.471	56.743	54.764	53.217	51.233	49.798
LBP	71.511	65.001	60.752	58.0124	55.213	53.184	51.129	49.326	47.816	45.721

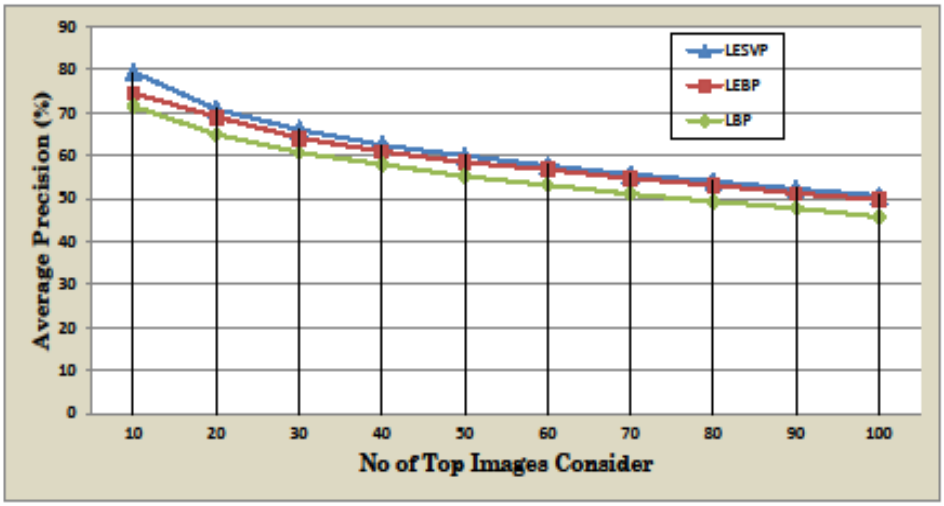
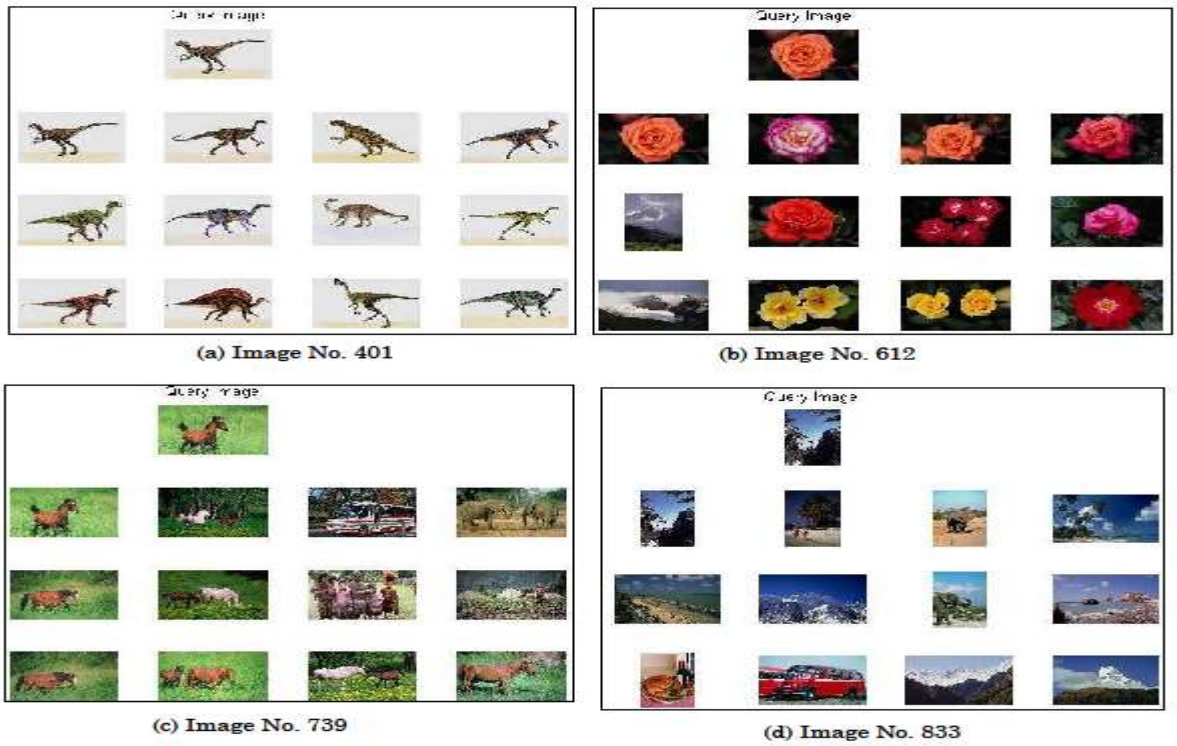


Fig 1. Average Precision Graph



(a) Image No. 401 (b) Image No. 612

(c) Image No. 739 (d) Image No. 833

Fig 2. Query results of our proposed method on Coral Database

Conclusion: In this paper, Line Edge Singular Value Pattern (LESVP) is presented for texture image retrieval application. The performance of proposed method is experimented on Coral1000 Database. From our experiment and result shows that proposed method gives efficient and accurate result in terms of precision against other methods like LBP , LEBP. Our proposed method gives better result.

References:

[1] Kokare M, Chatterji BN, Biswas PK. A survey on current content based image retrieval methods. IETE J Res 2002;48(3/4):261–71.

[2] Liu Y, Zhang D, Lu G, Ma W-Y. A survey of content-based image retrieval with high-level semantics. Pattern Recognition 2007;40:262–82.

[3] Smith JR, Chang SF. Automated binary texture feature sets for image retrieval. In: Proc. IEEE int. conf. acoustics, speech and signal processing. New York: Columbia Univ.; 1996. p. 2239–42.

[4] A.Ramesh Kumar et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 4 (2) , 2013, 242 - 245

[5] N.-S. Chang and K.-S. Fu. Query by pictorial example. IEEE Transactions on Software Engineering, 6(6):519–524, November 1980.

[6] Pala, S.: Image retrieval by shape and texture. PATREC: Pattern Recognition. Pergamon Press 32 (1999)

[7] Smith, J.R., Chang, S.F.: Automated image retrieval using color and texture. Technical Report 414-95-20, Columbia University,Department of Electrical Engineering and Center for Telecommunications Research (1995)

[8] Arnold. W. M. Smeulders, M. Worring, S. Satini, A. Gupta, R. Jain, (2000) "Content - Based Image Retrieval at the end of the early years", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 22, No. 12, pp. 1349-1380.

[9] M. Kokare, B. N. Chatterji and P. K. Biswas, (2002) "A Survey on Current Content Based Image Retrieval Methods," IETE Journal of Research, Vol. 48, no. 3&4, pp. 261-271.

[10] Broek, E. L. van den (2005). Human-Centered Content-Based Image Retrieval. PhD-thesis Nijmegen Institute for Cognition and Information (NICI), Radboud University Nijmegen, The Netherlands - Nijmegen.

[11] M. Worring and Th. Gevers. Interactive retrieval of color images. International Journal of Image and Graphics, 1(3):387.414, 2001.

[12] M. J. Swain and D. H. Ballard. Color indexing. International Journal of Computer Vision, 7(1):11–32, 1991.

[13] T. Ma¨enpa¨a¨ and M. Pietika¨inen. In C. Chen and P. Wang, editors, Handbook of Pattern Recognition and Computer Vision, chapter Texture analysis with local binary patterns., pages 197–216. World Scientific, 2005.

[14] T. Ma¨enpa¨a¨ and M. Pietika¨inen. In C. Chen and P. Wang, editors, Handbook of Pattern Recognition and Computer Vision, chapter Texture analysis with local binary patterns., pages 197–216. World Scientific, 2005

[15] H. Yang and Y. Wang. A lbp-based face recognition method with hamming distance constraint. In ICIG '07: Proceedings of the Fourth International Conference on Image and Graphics, pages 645–649, Washington, DC, USA, 2007. IEEE Computer Society.

[16] Petpon, A., Srisuk, S.: Face recognition with local line binary pattern. In: Proc. International Conference on Image and Graphics, pp. 533–539 (2009)

[17] Pietikäinen, M., Ojala, T., Xu, Z.: Rotation-invariant texture classification using feature distributions. Pattern Recognit. 33, 43–52 (2000)

[18] Ahonen T, Hadid A, Pietikainen M. Face description with local binary pat-terns: applications to face recognition. IEEE Trans Pattern Anal Mach Intell2006;28(12):2037–41.

[19] Zhao G, Pietikainen M. Dynamic texture recognition using local binary patternswith an application to facial expressions. IEEE Trans Pattern Anal Mach Intell2007;29(6):915–28.

[20] Yao C-H, Chen S-Y. Retrieval of translated, rotated and scaled color textures.Pattern Recogn 2003;36:913–29.

[21] Heikkil M, Pietikainen M, Schmid C. Description of interest regions with localbinary patterns. Pattern Recogn 2009;4EE2:425–36.

[22] Linear Algebra And Its Applications, 3rd ed, David C Lay, Addison-Wesley Publishing Company, 2002.

[23] Linear Algebra And Its Applications, 3rd ed, Gilbert Strang, Thomson Learning, Inc, 1988.

[24] Singh, S.K., Kumar, S. A Framework to Design Novel SVD Based Color Image Compression, Computer Modeling and Simulation, 2009. EMS '09. Third UKSim European Symposium, Athens 2010

[25] A. Shnayderman, A. Gusev and A. M. Eskicioglu, " A Multidimensional Image Quality Measure Using Singular Value Decomposition," IS&T/SPIE Symposium on Electronic Imaging 2004, Image Quality and System Performance, San Jose, CA, January 18-22, 2004.

[26] Ganic, N. Zubair, and A.M. Eskicioglu, "An Optimal Watermarking Scheme based on Singular Value Decomposition," Proceedings of the IASTED International Conference on Communication, Network, and Information Security (CNIS 2003), pp. 85-90, Uniondale, NY, December 10-12, 2003

[27] Subrahmanyam M, Maheshwari RP, Balasubramanian R. Directional localextrema patterns: a new descriptor for content based image retrieval. Int JMultimedia Inform Retrieval 2012;1(3):191–203.

[28]R. Liu and T. Tan, "A svd-based watermarking scheme for protecting right-ful ownership", IEEE Transactions on Multimedia, vol. 4, pp. 121-128, 2002.

[29] C. Bergman, J. Davidson, "Unitary Embedding for Data Hiding with the SVD", Security, Steganography, and Watermarking of Multimedia Contents VII, SPIE vol. 5681, 2005.