Visual Interest point detection based Rank Order Log filter for Content Based Image Retrieval

K.S Gautam[1],Ms.S.Bhuvana[2],Dr.P.TamijeSelvy[3],and Dr.R.Radhakrishnan[4]
[1]PG Student, [2],Assistant Professor,[3]Associate Professor,[4]Principal.
[1,2,3]Department of Computer Science and Engineering, Sri Krishna College of Technology, Coimbatore, India.
[4]Principal , Sri Shakthi Institute of Engineering and Technology, Coimbatore, India.

Abstract—**With increased digital images in image repositories efficient indexing and searching becomes essential for large image archives. Content based image retrieval system (CBIR) retrieve relevant images using low-level features like color, texture and shape for image representation. In this approach, a scheme of novel color image retrieval based on visual interest point is presented. The existing systems use detectors such as Harris Laplace transform, LOG filter and Harris Detector for the extraction of visual interest points. Such detectors face drawbacks such as the scaling, distortions which affects output image, by the detection of multiple peaks around the corner or blob and leads to the production of multiple false peaks. The proposed approach using Rank Order Log Filter is more robust to abrupt variation of images caused by both illumination and geometric changes, detecting multiple false peaks around the blob and avoids them enabling the extraction of visual interest points.TheFirst step involves conversion of a query image into 8 bitplane images. Higher bit plane reflects the main content of the primitive image and it is the significant bitplane.An improved Rank Order LOG filter is proposed for the extraction of visual interestpoints.The visual interest points can be quantized and color space transformation is done in future for mapping the extracted visual interest points to color histogram for similarity measure thus retrieving the relavant images.**

IndexTerms—Bit plane images, Improved Rank Order Filter, Content based image retrieval.

I. INTRODUCTION

The complexity of image identification in terms of efficient indexing and searching for image retrieval increases with the increased digital images available from the repositories. The necessity leads to the requirement of an efficient image retrieval system.Content-based image retrieval (CBIR) techniques, extract visual features directly from an image content.Content-based image retrieval searchesand analyses the contents of an image rather than the metadatas namely keywords, tags, or descriptions associated with the image. The term “content” refers tofeatures, namely colors, shapes, textures, or any other information that can be derived from the image.The shortcomings in the metadata based system enforced the interest of a CBIR system. The other proposed approach searches the textual information of the images that the user describes database images. The activity toils the users for large image repositories. Hence, a CBIR system is developed to overcome these shortcomings.Feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be then the input data will be transformed into a reduced representation set of features known as feature vectors. The transformation of the input data into the set of features is called feature extraction. The features extracted are carefully chosen and features set will extract the relevant information from the input data for performing the desired task using the reduced representation instead of the full size input.

Many research works have been carried on image retrieval using detectors such asHarris Laplace transform[8], LOG filter [13] Harris Detector [14].Images can be indexed by the feature descriptors that consider spatial relationship, such as Color histogram [16], Color Coherence Vector [15], spatial chromatic histogram (SCH) [3]. The texture feature extraction with spatial frequency domain [5], [6], [7] provides an effective solution for the CBIR system. The texture feature extraction is acquired by Gray Level Co-occurrence Matrix (GLCM) or Color Co-occurrence Matrix (CCM) [17].

The paper focuses on building an effective CBIR system using visual interest point detection based rank order log filter for CBIR. The rest of the paper is organized as follows. A comprehensive survey of CBIR is dealt in Section 2. Section 3 enlights the overview of the proposed framework. Section 4 provides the particulars of the experiment. Section 5 presents the conclusion.

II. RELATED WORKS

Several authors have proposed multiple image retrieval techniques. In this section, conventional image retrieval methods are discussed. Gyuriet al proposed local descriptionfor scale selectionusingSIFT. The paper is based on Performs scale selection based on a region descriptor using SIFT. Characteristic scale is selected based on the stability of the local descriptors. The approach Optimizes key point detection to achieve stable local descriptors, choosing the region for which the descriptor is maximally stable.The scale selection technique is applied to Multi-scale Harris and Laplacian pointsSIFT detects and uses a multiple features of the images,reducing the errors caused by these local variations in the average error of all feature matching errors.SIFT key points of objects areextracted from the set of reference images and stored in the database.Objects are recognized from a new image by individually comparing eachfeature from the new image to the image database. The scale estimation is often unstable on corner structures. SIFT Detector is less robust to noise and is not adapted to texture-like structures.

N.SEBE et alproposedsalient point extraction for content based retrieval a wavelet based approach. Thefeature vector for the image properties are computed and stored in a feature database for each image in the image database. Feature vector is computed from the query image compared to the stored feature vectors. Most similar images to the query image are returned to the user. Extract the maximum coefficient and trace it recursively in the finer levels. For each image pixel, compute the saliency value as the sum of the coefficients along the trace ended at this point. Feature selection techniques are used incaseof multiple features and few samples. The global features cannot capture all parts of the picture with different features.Demand for local computation for the image data is higher.

JulianStottinger et al proposed color interest points for image retrieval.Thecorners measure of image data is calculated based on a second moment matrix M describing the gradient distribution in the local neighborhoodpoint. The scale space of the Harris function is built by iteratively calculating the corners measurement. The image is globally analyzed and principal component analysis (PCA) is done to reduce the three color, dimensions of the input image to a one dimensional dataset. Laplacian-of-Gaussian (LoG) function is used for building the scale space which requires noiseless pixels in the image sample. The localization of the features may not be very accurate.

George paschos et al proposed image content-based retrieval using chromaticity moments**.**Extraction of sets of two dimensional moments from chromacity diagram to characterize the shape and distribution of chromaticities of the given image. Chromaticity moments capture the essence of the spectral content of the specific image. A small number of features of the image are extracted which captures the spectral content of the image.Only chrominance of special content of the image can be captured.The user is expected to have his own set of images that have to be presented to the system for retrieval of similar images from the image database.

III PROPOSED WORK

The proposed system implements image retrieval based on the analysis of visual interest pointsusing ROLG filter. The process involves conversion of a query image to bitplane image and the most significant bit plane is opted for theextraction of visual interest points as shown in figure 1. ROLG filter detects peaks at the centre of the blob eliminating the false peaks surrounding the corner/blob. The ROLG filter is robust to the strong and abrupt variations of images. Since a single peak is produced at the centre of the blob and no ring is produced around the blob. ROLG filter avoids detecting falsepoints around the blob. It suppresses the response of edges, hence no point is detected on edges.

A. Bit plane extraction:

The bit value contributing the same weight of real value is known as bit plane. The bit plane image is encapsulated with more informations than the greyscale image.This bit plane in the image will be extracted from

$$d = \sum_{i=0}^{7} 2^i b_i \qquad (1)$$

i=Number of bit plane, bi= image pixel information

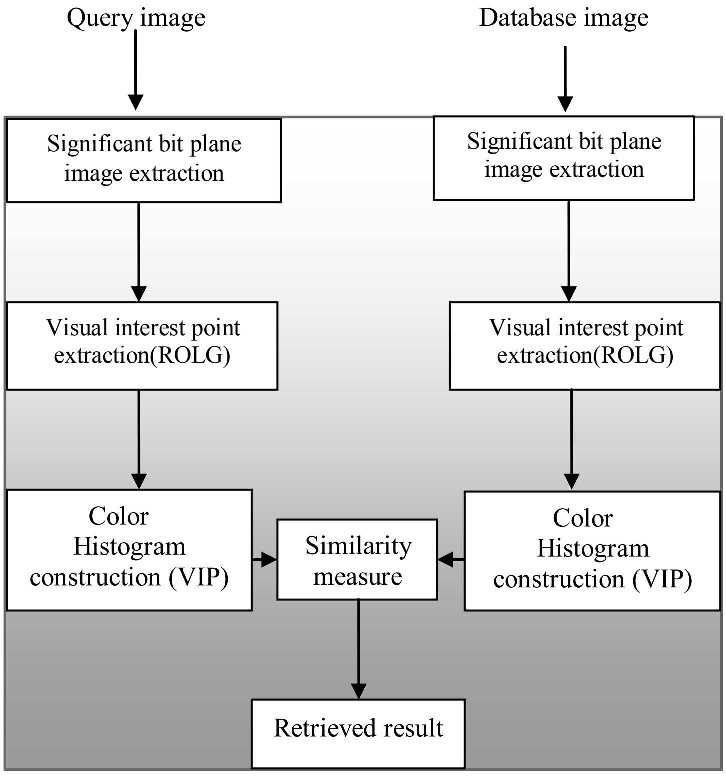

Fig 1. Overview of the proposed system

Given an X-bit per pixel image, slicing the image at different planes (bit-planes) is an important role in image processing. In general, 8-bit per pixel images are processed. An image can be sliced into the following bit-planes using eqation (1) in figure (4). Zero is the least significant bit (LSB) and 7 is the most significant bit (MSB).The pixel values were decomposed into a series of binary values, the plane constituted by bit with the same weight is called a bitplane. Each pixel occupies one byte to 256-level grey image. Eight binary bits are arranged asb7b6b5b4b3b2b1b0 from higher to lower bit. The pixels at b0 bit constitute the 0th bit-plane, the b1 bit constitute the 1st bit-plane. The bit plane images will be complex from higher to lower value of bit planes (i.e. 7 to 0). Similarly the noise content also increases. The texture of least importance covers the entire part of the image in the 0^{th}plane. The higher bit planeholds similar data about the original image in comparision with other bit planes.

B.Significant bit plane:

The image can be represented by I(i,j), where i and j values are the row and column pixel values of an image

$$D_{pt}\,(i,j) = B_{p,t}(i,j) = if \begin{Bmatrix} 1\ int\ \dfrac{if(i,j)}{2p} mod(2) \\ 0\ \text{otherwise} \end{Bmatrix}$$

ISSN: 2278 – 7798

(2)

Where p = 0 to 7 which represent bit planes.
The p values are considered p=(8-H,9H………..7, t=1,2,3) Here the H values are taken as 5 from [8].t=1 to 3 for R,G,B color space in an image. The (i,j) denotes the t value component in an image.$B_{p,t}$ I(i,j) gives the significant bit plane decomposition

C. Improved Rank Order Filter Based Visual Interest Point Detector:

Interest point detection plays a vital role in image retrieval.One of the applications of interest points is to signal points or region in the image that are likely candidates to be useful for image matching and view-based object recognition. The Laplace detector is used to detect the visual interest point of an image. The key drawback of using Laplace detector is that the image undergoes a noise attack, translation and rotation problems. TheImproved Rank Order Filter Based Visual Interest Point Detector is robust to abrupt variations. Edge response is suppressed by the ROLG filter. The ROLG filter does not produce spurious peaks around the blobs.
The resulting interest point detector outperforms the existing approach.

The LOG filter based Harris Laplace filter detector was used to detect the interest point [8].The system takes only scant information about image local features to extract the visual interest points. To overcome this drawback a new method has been proposed known as an Improved Rank Order Log Filter. RLOG filter provides the exact information on the pixel intensity in bright and dark part in the image.
The Laplacian function can be denoted by the following formula

$$L(x, y, \delta D) = G(x, y, \delta D) * Dp,t\,(i,j) \qquad (3)$$

Dp,t (i,j) denotes 5th plane significant bit image
δD is standard deviation .
G(x, y, δD) represents the Gaussian function from [8]

$$G(x, y, \delta D) = \frac{1}{\sqrt{2\pi}.\delta_D}.\exp\left(\frac{x^2+y^2}{2.\delta_D{}^2.}\right) \quad \delta D$$

This resultant value filter the image by generating the blob /corner map. The scale parameter can be defined initially. The rank order filter can be applied to the Laplacian result represented as

rwr(x,y,λ)=∑ λ (m,n)£s((L+(m, n,)*I(x-m ,y-n)) (4)

Where s is the region of the filter.λ is the rank orders.
I(x-m ,y-n) is the input image.Rank values are fixed minimum value to compensate the median filter output [8]. The scale parameter will change and initiates the above process again until it reaches the peak scale value. This result provides the information about the visual points in animage. The proposed algorithm for the ROLG detector is summarized below:

1.ROLG filter is initialized the by setting the offset parameter δ and the scale parameter s.
2.Generate the corner/blob map by filtering the input image with the ROLG filter [18].
3.Detect thepeakspresent oncorner/blobmap,andremovepeaksonridges.Remainingpeaksaretheinterestpointsin this scale.
4. ROLG filter is updated by a larger scale s, and go back to second step to detect interest points in new scale until the maximal scale is reached.

IV EXPERIMENTAL RESULTS

The Experiments can be done with the image of COREL 1,000 database .This database consists of the images of buses, Beaches, Buildings, Tribals, dinosaurs, etc. Among these images four kinds of images are taken for this experiment such as Beach, buses, Buildings and Tribal.

Figure 2. Sample database images

The database holds 1000 color images of JPEG format which are divided into ten classes such as: Africans, beach, buildings, bus, dinosaur, elephant, flower, horse, mountain and food. Each class is encapsulated with 100 images of size 384*256 or 256*384.

The experiments for various bit planes can be done among the number of bit planes 5th bit plane of the image provides the effective precision.Due to that, this plane can be taken as a significant bit plane for this proposed method. This can be proved by the following chart. This chat has the result of precision values for 1 to 8 bit planes.

$$\text{Precision} = \frac{\text{Number of relevant images retrieved}}{\text{Number of retrieved images}}$$

$$\text{Recall} = \frac{\text{Number of relevant images retrieved}}{\text{Total number of relevant images in the database}}$$

Precision is defined as the ratio of the number relevant images retrieved to the total number of retrieved images and Recall is defined as the number of retrieved relevant images to the total number of relevant images available in the database.

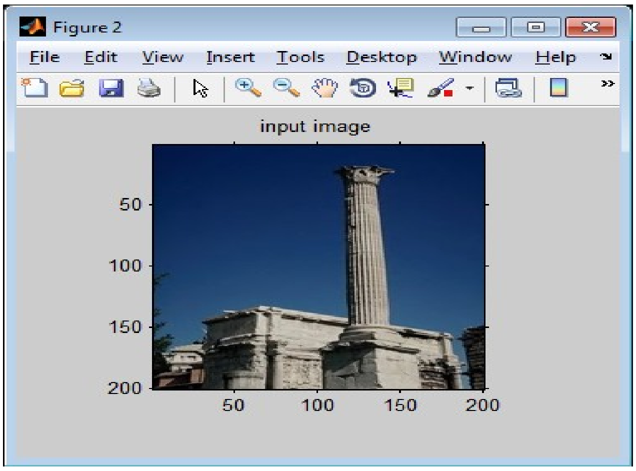

Fig 3. Query image

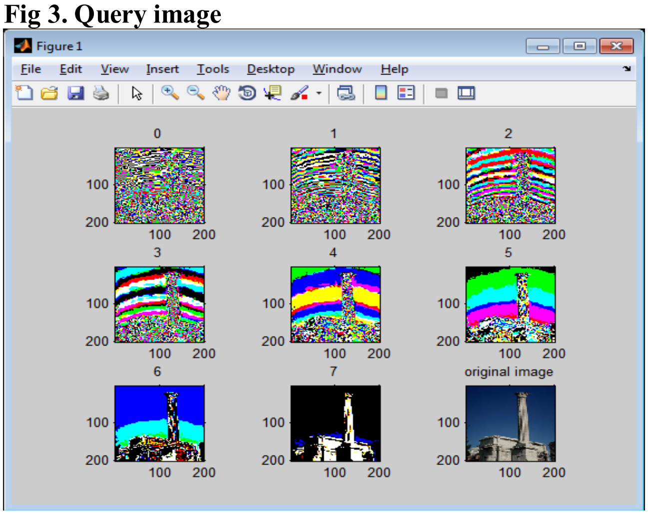

Fig:4 The resultant value of bit planes from 0 to 7

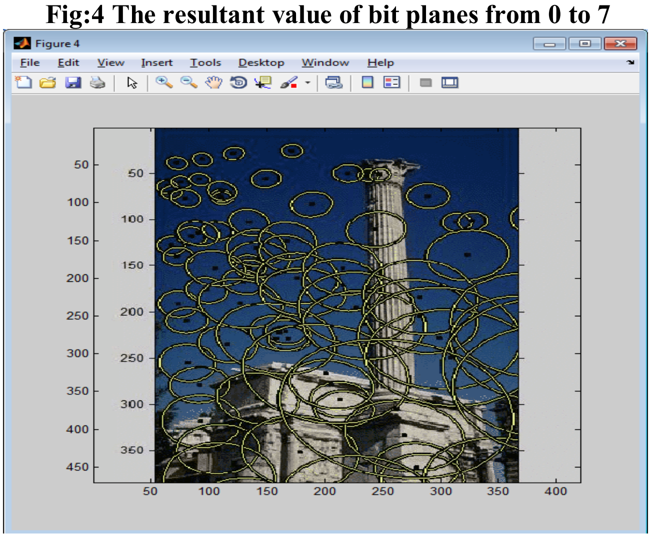

Fig:5 Visual interest point detection

V CONCLUSION

This work proposed an improved Rank Order LOG based visual interest point detector for color image feature extraction.The visual interest points are extracted from the bit plane image by the Improved Rank Order Log Filter based visual interest point detector.The ROLG filter detects less false and unstable points, and is more robust to abrupt variations of images caused by illumination and geometric changes. Thus compared to Harris Laplace detector, LOG filter and Harris detector, ROLG filter detects the false peaks and extracts interest points.Color images can be retrieved in future based on the construction of color histogram of visual interest points.Thisapproachwill provide an efficient solution for noise affected images and provide a lower schematic gap for image retrieval with higher rate of precision and recall. The application of interest point detectors in face recognition using interest point detecors is one of the major applications for the superiority of the proposed ROLG detector.

REFERENCES

[1]PetteriKerminen, MoncefGabbouj,'Image Retrieval Based OnColorMatching',Pori School of Technology and Economics, TUT Tampere University of Technology Information Technology.

[2]P.S.HiremathandJagadeeshPujari,'ContenBased Image Retrieval based on Color, Texture and Shape features using Image and its complement,Dept. of P.G. Studies and Research in Computer Science, GulbargaUniversity, Gulbarga, Karnataka, India',International Journal of Computer Science and Security, Volume (1) : Issue (4).

[3]L.cinque,G.Giocca,S.levialdi,A.pellicano,R.schettini,'Color based image retrieval using spatial-chromatic histograms',Image and vision computing 19(2001)979-986.

[4]ShamikSural, Gang Qian and SaktiPramanik,'A Histogram with Perceptually Smooth Color Transition for Image Retrieval',Dept. of Computer Science and Engineering, 3115 Engineering Building, Michigan State University, East Lansing, MI 48824, USA.

[5]Nadia Baaziz, Omar Abahmane and RokiaMissaoui,'Texture feature extraction in the spatial-frequency domain for content-based image retrieval',Department of Computer Science and Engineering,Université du Québec en Outaouais 101 rue Saint Jean Bosco, C.P. 1250, Gatineau, Québec, J8X 3X7 Canada.

[6]Rui Hu, Stefan R¨uger, Dawei Song, HaimingLiu and ZiHuang,'Dissimilarity Measures For Content-Based ImageRetrieval',The Open University, Knowledge Media Institute ,Milton Keynes, MK7 6AA, UK.

[7]Swati V. Sakhare&Vrushali G. Nasre,Design of Feature Extraction in Content Based Image Retrieval (CBIR) using Color and Texture,Dept. of Electronics Engg., BapuraoDeshmukh College of Engg., Sevagram, Wardha (India).International Journal of Computer Science & Informatics, Volume-I, Issue-II, 2011.

[8]Xiang-Yang Wang, Hong-Ying Yang, Yong-Wei Li, Fang-Yu Yang,'Robustcolor image retrieval using visual interest point feature of significant bit-planes',Digital Signal Processing 23 (2013) 1136–1153.

[9] Niblack, W., R.Barber, et al, “The QBIC Project: Querying images by content using color texture and shape”, Proc. SPIE Int. Soc. Opt. Eng., in Storage and Retrieval for Image and Video Databases, Vol. 1908, pp. 173-187, San Jose, 1993.

[10]K. Mikolajczyk, C. Schmid,'A performance evaluation of local descriptors',INRIA Rhone-Alpes, GRAVIR-CNRS 655, av. de l'Europe, 38330 Montbonnot, France.

[11]KrystianMikolajczyk andCordeliaSchmid,'Scale& Affine Invariant Interest Point Detectors',International Journal of Computer Vision 60(1), 63–86, 2004 .

[12]Ju Han and Kai-Kuang Ma, Senior Member, IEEE,FuzzyColor Histogram and Its Use in Color Image

Retrieval,IEEEtransactions on image processing, vol. 11, no. 8, august 2002.
[13]ZhenweiMiao,Xudong Jiang, Interest point detection using rank order LoG filter , Pattern Recognition Volume 46, Issue 11, November 2013.
[14]Julian Stottinger, NicuSebe, Theo Gevers, and Allan Hanbury,ColourInterest Points for Image Retrieval,Computer Vision Winter Workshop 2007.
[15] Greg P, Ramin Z, Justin M (1996) Comparing images using color coherence vectors. ProcACM Multimed 96:65–73.
[16]Jing H, Kumar SR, Mandar M, Wei-Jing Z, Ramin Z (1997) Image indexing using color correlogram.ProcConf Comp Vision Pattern Recog 97:762–768.
[17]Prabhu, J. and J.S. Kumar, 2014. Wavelet based content based image retrieval using color and texture feature extraction by gray level coocurence matrix and color coocurence matrix. J. Comput. Sci., 10: 15-22.
[18]F.Rothganger, S.Lazebnik, C.Schmid, J.Ponce, 3D object modeling and recognition using affine-invariant patches and multi-view spatial constraints, in: IEEE Conference on Computer Vision and Pattern Recognition,vol.2,2003, pp. II-272–277.

Short Biodata of all The Authors

Gautam K S was born in Tamilnadu, India, in 1989. He received his Bachelor of Engineering degree in Computer Science and Engineering from Anna University, Chennai, India in 2012. He is currently pursuing M.E in Computer Science and Engineering under Anna University, Chennai, India.

Prof. S. Bhuvana received her Bachelor of Engineering degree in Computer Science and Engineering from Sri Ramakrishna Engineering College, India, in 1999 and her Master of Engineering degree in Computer Science and Engineering from Kumaraguru College of Technology, India in 2007. At Present, she is working as Assistant Professor in the department of Computer Science &Engg., Sri Krishna College of Technology, Coimbatore. Currently she is pursuing her research work in Image Retrieval. Her research interests include Image Processing and Machine Learning.

Dr. P.TamijeSelvy received B.Tech (CSE), M.Tech (CSE) in 1996 and 1998 respectively from Pondicherry University. Since 1999, she has been working as faculty in reputed Engineering Colleges. At Present, she is working as Associate Professor in the department of Computer Science &Engg, Sri Krishna College of Technology, Coimbatore. She has published more than 40 papers in reputed journals and conferences. Her Research interests include Image Processing, Data Mining, Pattern Recognition and Artificial Intelligence.

Dr.R.Radhakrishnan is the principal of Sri Sakthi Institute of Engineering And Technology.He obtained his Bachelor's degree in Engineering in Electronics and Communication Engineering from Bharathidasan University, received his Masters Degree from P.S.G.College of Technology, Coimbatore, in the year 1997 and the Ph.D from Anna University Chennai in the year 2008. His research interest includes Wireless Communication, Signal Processing, Networking and Mobile Communication. He has published more than 20 Journal papers in the field of CDMA systems, Mobile communication, Wireless Networking and Signal Processing.

