JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

IMAGE RETRIEVAL SCHEME USING GRAY LEVEL CO-OCURRANCE MATRIX(GLCM) & LOCAL BINARY PATTERN (LBP)

Suhail Ashraf

Associate Professor Department of CSE,
SSM College of Engineering, J&K India
suhibhat@gmail.com

Abstract

The paper objective is to analyse colour patterns in Hue plane for the improvement of grayscale images for increasing accuracy. The research paper proposes an improvement over an existing content based images retrieval system by introducing Local Binary Pattern (LBP)over the Hue plane. The considered system has added colour parameter which has increased the overall accuracy of the system. A scheme for image retrieval based on residual DCT with GLCM features is proposed. Use of residual Discrete Cosine Transform (DCT) facilities high in increased accuracy. Further the system used Grey Level Co-occurrence Matrix(GLCM) matrix which are generally used to generate high dimensional information of pattern which in DCT image can clearly captures more details and thus have high accuracy. The basic principle is the representation of image as a feature vector and to measure the similarities between the query image and feature vectors of images in the database using image processing techniques. Experimental results have shown that the proposed method produces better results which consumes less computation time.. In this we computed residual image and then applied GLCM, along with Local Binary Pattern(LBP) over Hue planes. We applied Euclidian Distance for Content Based Image Retrieval(CBIR). Experiments were performed by loading dataset1 and applying algorithm to find accuracy, precision, specificity etc. Results indicate that our combined approach is better than other methods.

Keywords:

CBIR(Content Based Image Retrieval), LBP(Local Binary Pattern),GLCM(Grey Level Co-occurrence Matrix),DCT(Discrete Cosine Transform)

Introduction

Image processing

It is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. An image is a two-dimensional function f (x, y), where x and y are the spatial (plane) coordinates, and the amplitude of at any pair of coordinates (x, y) is called the intensity of the image at that level. In image deblurring pixel by pixel or applying kernel on whole image work is done. Image processing is the examination and control of a digitized picture, particularly to enhance its quality.

Purpose of Image processing

The purpose of image processing is divided into 5 groups. They are:

1. Visualization - Observe the objects that are not visible.
2. Image sharpening and restoration - To create a better image.
3. Image retrieval - Seek for the image of interest.
4. Measurement of pattern – Measures various objects in an image.
5. Image Recognition – Distinguish the objects in an image.

Two types of Image Processing:

Analog Image Processing: This process refers to the changes or amendment that is being made to an image by using electrical means like television imagery. Analog image processing is any image processing task conducted on two-dimensional analog signals.

Digital Image Processing: This type of image processing makes use of digital computers to process an image. In digital image processing we require either the full image or the part of image which is to be processed from the user's point of view like the radius of object etc. As digital system is in widely applied in various areas, producing digital images of good contrast and detail is strong in demand especially in areas like vision, remote sensing, model identification and fault detection. There are various advantages of using digital image processing like preservation of original data accuracy, flexibility and repeatability. Digital image processing involves scaling as an important area.

Formats of Digital Images

The configuration utilization to spare the image document will be controlled by its proposed use. A very few formats of digital images are typical for the web others for presentation or for print. Some formats are as following:

PICT: Stands for "Picture" and is utilized for putting away 8-bit, 16-bit or 24-bit shading or dark scale level pictures. PICT records work in all around mannered for the onscreen presentations of illustrations. PICT file format is a meta-format that can be used for two types of images like bitmap images and vector images. PICT records can contain bitmaps which are line-art, gray scale or RGB information. PICT documents containing one and only bitmap are additionally supported under Windows utilizing QuickTime for Window.

TIFF: stands for Tagged Image File Format. TIFF images create very large file sizes. TIFF images are uncompressed and thus contain a lot of detailed image data .TIFFs are also extremely flexible in terms of color (they can be grayscale, or CMYK for print, or RGB for web) and content (layers, image tags). It is the most common file type used in photo software (such as Photoshop), as well as page layout software because it contains a lot of image data.

GIF: stands for 'Graphical Interchange Format'. The compression is lossless (no detail is lost in the compression, but the file can't be made as small as a JPEG. GIFs have the limited number of colors suitable for the web but not for printing. This format is never used for photography. The GIF supports up to 8 bits per pixel for each image and every image. It can also be used for animations.

JPEG: Stands for 'Joint Photographic Experts Group'. JPEG is the most widely used and accepted image format. JPEG files are very 'lossy', because so much information is lost from the original image when you save it. This is because JPEG discards most of the information to keep the image file size small. JPEG files are bad for line drawings or logos or graphics.

PNG: stands for' Portable Network Graphics'. It is an image format specifically designed for the web. PNG is the superior version of the GIF. Just like the GIF format, the PNG is saved with 256 colors maximum. It saves the color information more efficiently. It also supports an 8 bit transparency. The compression is Lossless.

BMP: Stands for "Bitmap". BMP files are made of millions and millions of dots called 'pixels', with different colors and arrangements to come up with an image or pattern. It might be an 8-bit, 16-bit or 24-bit image.The BMP arrangement stores color information for every pixel in the image without any compression. For example, 10x10 pixel BMP picture will incorporate shading information for 100 pixels. Consequently, JPEG and GIF pictures are use on the Web, while BMP pictures are frequently utilized for printable pictures.

Digital Image Processing:

Digital image processing permits the utilization of substantially more intricate calculations, and thus, can offer both more modern execution at basic assignments, and the usage of techniques which would be unimaginable by simple means.

Specifically, advanced picture preparing is the main handy innovation for:

- Classification
- Feature extraction
- Pattern acknowledgment
- Projection
- Multi-scale flag investigation

A few systems which are utilized as a part of advanced picture handling include:

- Pixilation
- Linear sifting
- Principal segments examination
- Independent segment examination
- Hidden Markov models
- Anisotropic dissemination
- Partial differential conditions
- Self-arranging maps.
- Neural systems.
- Wavelets.

Image Restoration

Picture Restoration is the operation of taking a degenerate/loud picture and evaluating the spotless, unique picture. Defilement may come in numerous structures, for example, movement obscure, commotion and camera miss-centre. Picture rebuilding is performed by turning around the procedure that obscured the picture and such is performed by imaging a point source and utilize the point source picture, which is known as the Point Spread Function (PSF) to re-establish the picture data lost to the obscuring procedure.

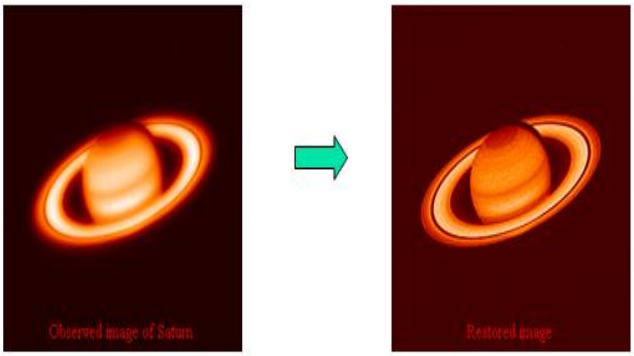


Fig. a Image Restoration

Classification of Image Restoration

Image restoration techniques are methods which attempt the inversion of some degrading process. Image restoration technique can be broadly classified into two types depending upon the knowledge of degradation. If the prior knowledge about degradation is known then the deterministic method of image restoration can be applied. If it is not known then the stochastic method of image restoration has to be employed.

Content Based Image Retrieval: CBIR

Content-based" implies that the inquiry examines the substance of the picture as opposed to the metadata, for example, watch words, labels, or portrayals related with the picture. The expression "content" in this setting may allude to hues, shapes, surfaces, or whatever other data that can be gotten from the picture itself. CBIR is attractive on the grounds that inquiries that depend simply on metadata are subject to comment quality and fulfilment. Having people physically comment on pictures by entering watchwords or metadata in a substantial database can be tedious and may not catch the catchphrases wanted to depict the picture. The assessment of the adequacy of watchword picture seek is subjective and has not been all around characterized. In a similar respect, CBIR frameworks have comparable difficulties in characterizing achievement.

Content-based picture retrieval (CBIR) is regarded as one of the most effective ways of accessing visual data. It deals with the image content itself such as color, shape and image structure instead of annotated text. Huge amounts of data retrieval

challenge the traditional database technology, but the traditional text-object database cannot satisfy the requirements of an image database. The traditional way of an annotated image using text, lacks the automatic and effective description of the image. In order to implement CBIR, the system need to understand and interpret the content of managed images. The retrieval index should be produced automatically, which provides more a visual retrieval interface to users.

CBIR refers to image content that is retrieved directly, by which the images with certain features or containing certain content will be searched in an image database. The main idea of CBIR is to analyze image information by low level features of an image, which include color , texture, shape and space relationship of objects etc., and to set up feature vectors of an image as its index. Retrieval methods focus on similar retrieval and are mainly carried out according to the multi-dimensional features of an image.

HOW CBIR WORKS

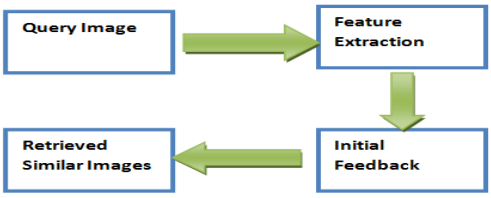


Fig. b CBIR

Image Segmentation:

It is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

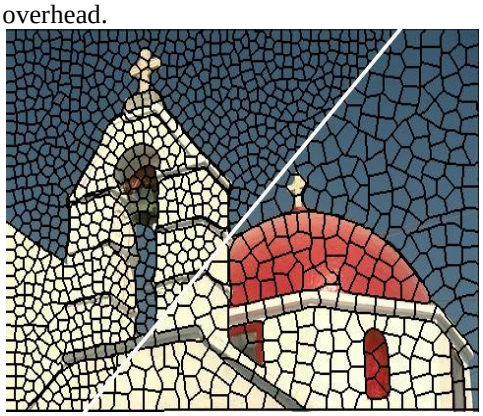
The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture.

Simple Linear Iterative Clustering (SLIC): A Super-pixeling algorithm

Super pixels are winding up progressively well known for use in PC vision applications. Nonetheless, there are couples of calculations that yield a coveted number of customary, reduced super pixels with a low computational overhead. A novel calculation called SLIC (Simple Linear Iterative Clustering) that groups pixels in the joined five-dimensional shading and picture plane space to productively create reduced, almost uniform super pixels was presented in [11]. The effortlessness of their approach makes it amazingly simple to utilize - a solitary parameter determines the quantity of super pixels - and the effectiveness of the calculation makes it extremely down to earth. Analyses demonstrate that SLIC creates super pixels at a lower computational cost while accomplishing a division quality equivalent to or more prominent than four best in class strategies, as estimated by limit review and under-division blunder.

What is a superpixel?

A superpixel can be defined as a group of pixels which have similar characteristics. It is generally color based segmentation. Superpixels can be very helpful for image segmentation. There are many algorithms available to segment superpixels but the one that I am using is state of the art with a low computational overhead.



Superpixel

Desirable Properties of Superpixels

- Good adherence to object boundaries
- Regular shape and similar size
- Compute fast and simple to use

Advantage of Superpixels

- Regional information
- High computational efficiency

Grey Level Co-Occurrence Matrix: (GLCM)

A co-occurrence occurrence matrix, also referred to as a co-occurrence distribution, is defined over an image to be the distribution of co-occurring values at a given offset.

Or

Represents the distance and angular spatial relationship over an image sub-region of specific region of specific size.

What are Co-occurring Values?

The GLCM is created from a grey-scale image.

The GLCM is calculates how often a pixel with grey-level (grayscale intensity or level) value i occurs either horizontally, vertically, or diagonally to adjacent pixels with the value j.

GLCM directions of Analysis:

1. Horizontal
2. Vertical
3. Diagonal:
   a.) Bottom left to top right.
   b.) Top left to bottom right.

RESEARCH METHODOLOGY

In paper, a novel scheme for image retrieval based on residual DCT with GLCM features is proposed. Use of residual DCT facilitates in increased accuracy. Further, the system used GLCM matrix which are generally used to generate high dimensional information of pattern which, in DCT image can clearly captures more details and thus have high accuracy. Experimental results have shown that the proposed method produces better results

while consuming less computation time.

The work can be extended further to enhance the proposed method by using more effective feature set to represent various regions in the images. We propose the usage of GLCM features along with the local binary pattern (LBP) over Hue plane. This will help us in capturing colour details as well which in our scenario will produce higher accuracy.

Proposed Algorithm

- Computing DCT of Grayscale Image
- Reducing the image by taking only first 'n' coefficient of DCT and applying Inverse DCT (IDCT) on rest of DCT coefficient matrix. 'n' is be 10 in our case.
- Computing Residual Image
- Applying GLCM and generate the vector
- Compute Hue from original color image by transforming it to HSV plane
- Compute Local Binary Pattern (LBP) over Hue plane only
- Concatenate the LBP vector with previously computed GLCM vector to generate final vector.

Algorithm:

1. Input Images are taken. We are using Corel-1K dataset for it and taken only Dogs and Cats images for experiment.
2. By convolution process a8*8 size DCT Matrix convolute with original image to compute DCT. This is a block level DCT. Used in image compression.
3. Applying GLCM over 8x8 block to generate GLCM vector.
4. Transforming the original image to HSV image and applying LBP over Hue plane.
5. Finally concatenate the original GLCM vector with LBP vector to generate our feature vector set.
6. Apply Euclidean Distance model to compute the distance for CIBR.

Results

In the proposed System, we calculated the below listed parameters to analyze the accuracy of the system. In experiment dataset of cats and dogs are used. Firstly we have loaded the image dataset and the experiments are performed in MATLAB. The parameter which are calculated are :

True Positive Rate or Recall Rate

False Positive Rate or Fall out Rate

True Negative Rate or Specificity

False Negative Rate or Precision

Results and Analysis

Visual Representation of implemented algorithm: GUI based proposed system as given below in Fig. 5, Fig. 6, Fig. 7, Fig.8, Fig.9, Fig. 10, Fig11 and Fig 12.

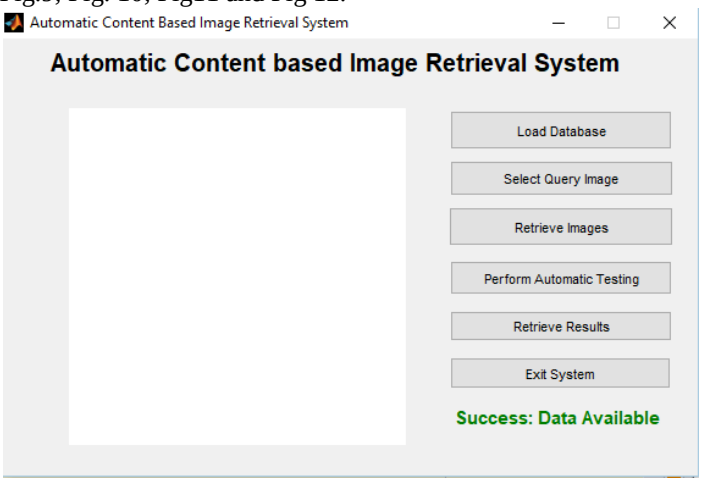


Fig. 1 ***The GUI of the Experiment***

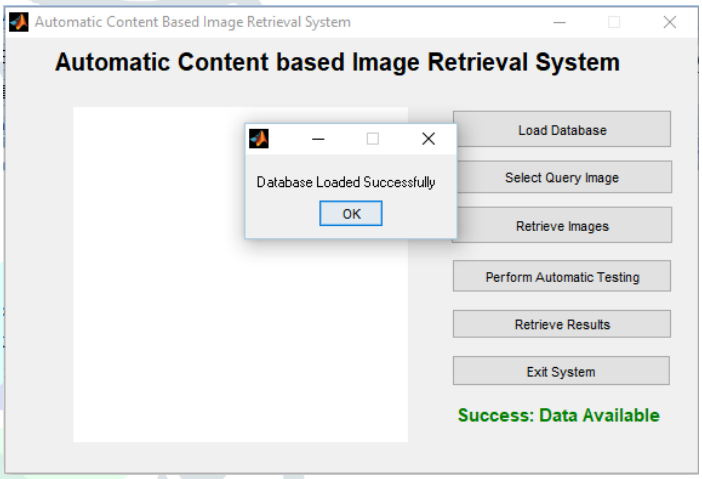


Fig. 2 Database loaded successfully

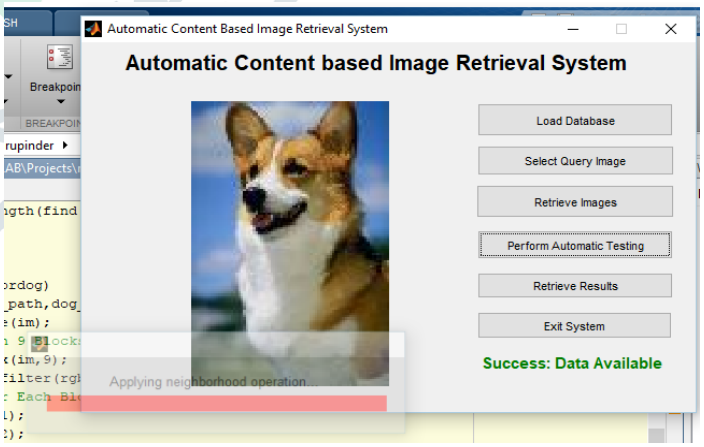


Fig.3 Automatic Testing is being performed

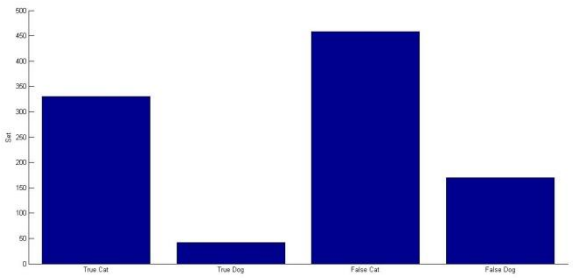


Fig. 4 True Positive, True Negative, False Positive and False Negative

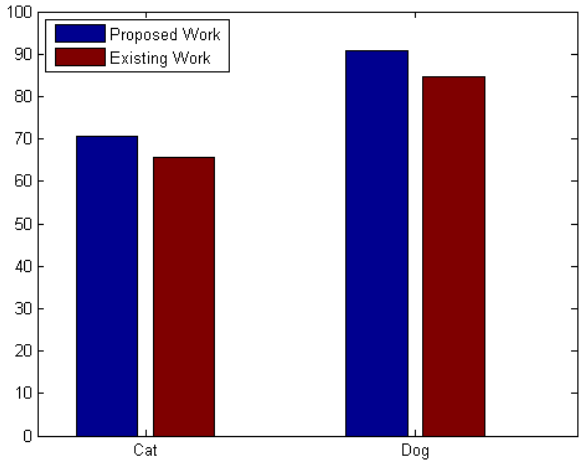


Fig. 5 Comparative Accuracy

Conclusion and future scope

In this experiment we've proposed an improvement over an existing Content based image retrieval system by introducing LBP pattern over Hue plane. The considered system has added colour parameter which has increased the overall accuracy of the system. In this study we have seen how the use of Discrete Cosine Transform(DCT) has resulted in giving image over hue planes compressed image which has eventually resulted in faster search within the database and also with applying the image over hue planes has resulted in focussing the object thus image retrieval is made easy.

It is pertinent to mention here that the results of proposed work has better efficiency. we can conclude from results that True Positive is improved by 9.9% and True negative was improved by 15.4% also False Positive was reduced by 15.4% and False Negative reduced by 9.9%.

The overall accuracy of the system is improved by 6.7% as by addition of colour parameter.

Scope of Future Work

In future work we can enhance the system by introducing region based segmentation using SLIC or similar algorithms to improve the accuracy to a much higher level.

References

[1] Naushad , Arup, "A novel image retrieval scheme using gray level co-occurrence matrix descriptors of discrete cosine transform based residual image",Springer,Jan 2018.

[2] Murala, Niranjana G," A Survey on Privacy Preserving Content based image retrieval". International journal of pure mathematics, Volume 118 No. 20 2019

[3] Liu Y, Zhang D, Lu G, Ma W-Y, " A survey of content-based image retrieval with high-level semantics Pattern Recognition 40(1):262–282 2021

[4] Shrivastava, Wan-Lei Zhao, K-means based histogram using multiresolution feature vectors for color texture database retrieval, Multimedia Tools and Applications, v.74 n.4, p.1469-1488, February 2022

[5] Boomilingam, Lv Rui, "Performance Comparison between Color and Spatial Segmentation for Image Retrieval and Its Parallel System Implementation", *Computer Science and Computational Technology 2008. ISCSCT '08. International Symposium on*, vol. 1, pp. 539-543, 2008.

[6] R. Achanta, A. Shaji, K. Smith, A. Lucchi, ," SLIC SuperPixel compared to the state of art super Pixel", IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI), Volume 34, No. 11, Pages 2274-2281, 2019

[7] Ray I Chang, Shu-Yu Lin, Jan-Ming Ho, —"A Novel Content Based Image Retrieval System using K-means/KNN with Feature Extraction", ComSIS Vol. 9,

[8] P. S. Hiremath and Jagadeesh Pujari, "Content Based Image Retrieval using Color, Texture and Shape features", in 15th International Conference on Advanced Computing and Communications, pp.780-784 , 2020

[9] Kavitha and P .Jeyanthi, "Exemplary Content Based Image Retrieval Using Visual Contents & Genetic Approach" in IEEE ICCSP conference, pp. 1378-1384, 2015.

[10] Kang, Jiayin, and Wenjuan Zhang, "A framework for image retrieval with hybrid features", Control and Decision Conference (CCDC), 24th IEEE, pp. 1326-1330,2012

[11] Deepti Jadhav, Gargi Phadke, Satish Dewane, **"**Novel weight allocation technique for image retrieval based on higher order colour moments and CCM texture features" ,2012 International conference of (IEEE).

[12] Apurva .N. Ganar ,C.S. Gode, Sachin, "Enhancement of Image Retrieval by Using Colour, Texture and Shape Features", 2014 International conference.

[13] Jun Yue Zhenbo, Li Lu Liu Zetian Fu. "Content based image retrieval using color and texture fused features" 1121-1127 2011 Elsevier.

[14] Kwang-Kim, Dongni Zhang, Mun-Cheon Kang, Sung-jeo,"Improved simple linear iterative clustering superpixels ", IEEE Intenational Symposium an consumer electronics 2013, pp 159-160.

[15] C.S. Gode , Ms. A. N. Ganar , "Image Retrieval by using Texture, Colour, and Shape Features", International Journal Of Advance Research In Electrical, Electronics and Instrumentation Engineering, Vol 3.

[16] Hasan Farsi, Sajad Mohamadzadeh," Colour and Texture feature based image retrieval by using Hadamard matrix in discrete wavelet transform", IET Image Processing 7(3) 212-218.