A PERFORMANCE ANALYSIS OF IMAGE RETRIEVAL METHODS

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Abstract

In this paper, the overview of the Image Retrieval Methods are surveyed. Feature selection and extraction is the pre-processing step of Image Image Retrieval. Obviously this is a critical step in the entire scenario of Image Mining. Our approach to mine from Images –is to extract patterns and derive knowledge from large collection of images, deals mainly with identification and extraction of unique features for a particular domain. Though there are various features available, the aim is to identify the best features and thereby extract relevant information from the images using different image retrieval methods. Various methods for extraction are used in this paper. Content Based Image Retrieval is the popular image retrieval method by which the target image is to be retrieved based on the useful features of the given image. In this paper, the concepts of Content Based Image Retrieval and Image mining have been combined and a new clustering technique has been introduced in order to increase the speed of the image retrieval method. Experimental results show that the features here used are sufficient to identify the patterns from the Images. The extracted features are evaluated for goodness and are tested on the images. This paper presents a survey on various image retrieval methods that were proposed earlier in literature.

Index Terms: Image Mining, Image Retrieval Methods, Image Features, CBIR.

1. INTRODUCTION

The World Wide Web is regarded as the largest global image repository. An extremely large number of image data such as satellite images, medical images, and digital photographs are generated every day. These images, if analyzed, can reveal useful information to the human users. Unfortunately, there is a lack of effective tools for searching and finding useful patterns from these images. Image mining systems that can automatically extract semantically meaningful information (knowledge) from image data are increasingly in demand. The fundamental challenge in image mining is to determine how low-level, pixel representation contained in a raw image or image sequence can be efficiently and effectively processed to identify high level spatial objects and relationships. The popular amongst them are Features based on color, Features based on texture and Features based on shape. In Image retrieval system for searching, browsing, and retrieving images from a large database of image, most conventional and common methods of image retrieval utilizes some methods of adding metadata such as tokens, captioning, keywords, or descriptions to the images. So that retrieval can be performed over the words of annotation. Some systems are working with lower level features. Manual image annotation is time-consuming, laborious and expensive. To address this, many researchers are proposed on automatic user friendly image retrievals using different methods. Content-based means that the search analyzes the actual contents of the image. The term content in this

context might refer to colors, shapes, textures, or any other information that can be derived from the image itself. Without the ability to examine image content, searches must rely on metadata such as captions or keywords, which may be laborious or expensive to produce. In this paper, proposed methods are providing the best solution in large image set.

1. IMAGE MINING PROCESS

Image Mining is an extended branch of data mining that is concerned with the process of knowledge discovery concerning images**.** Image retrieval is the fast growing and challenging research area with regard to both still and moving images. Many Content Based Image Retrieval (CBIR) system prototypes have been proposed and few are used as commercial systems. CBIR aims at searching image databases for specific images that are similar to a given query image. It also focuses at developing new techniques that support effective searching and browsing of large digital image libraries based on automatically derived image features. The features further can be classified as low-level and high-level features. Users can retrieve images based on these features such as texture, color, shape, region and others. By similarity comparison the target image from the image repository is retrieved. This paper aims at reviewing the steps of image mining, the most often utilized techniques for the individual sub processes of IM and at identifying the major current issues and challenges in image mining.

1.1 Preprocessing

Image pre-processing is the name for an operation on images at the lowest level of abstraction whose aim is an improvement of the image data that suppress undesired distortions or enhances some image features important for further processing. It does not increase image information content. Its methods use the considerable redundancy in images. Image pre-processing tool, created in Mat Lab, realizes many brightness transformations and local pre-processing methods.

1.2 Feature Extraction

Feature Extraction involves reducing the amount of resources required to describe a large set of data. When performing analysis of a complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power or a classification algorithm which over fits the training sample and generalizes poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy. Feature transformation is a group of methods that create new features (predictor variables). The methods are useful for dimension reduction when the transformed features have a descriptive power that is more easily ordered than the original features. In this case, less descriptive features can be dropped when building models.

1.3 Mining

Image Mining is focused on extracting patterns, implicit knowledge and image data relationship or patterns which are explicitly found in the images from databases or collections of images. Some of the methods used to gather knowledge are: image retrieval, data mining, image processing and artificial intelligence. These methods allow Image mining to have two different approaches. First, is to extract only from databases or collections of images, and second, dig or mine a combination of associated alphanumeric data and collection of images.

1.4 Interpretation and Evaluation and Knowledge discovery

After mining, patterns are obtained and these patterns finally evaluate and interpret the knowledge that is required. The knowledge retrieved can be used by individual or organization for various purposes to make predictions and profitable output further.

2. IMAGE RETRIEVAL METHODS

2.1 FILTERING

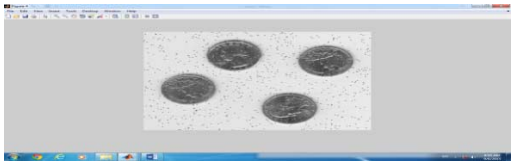
Filtering is a technique for modifying or enhancing an image. The image is filtered to emphasize certain features or remove other features. The noise in the images is filtered using linear and non-linear filtering techniques. Median filtering is used here to reduce the noise. Images are corrupted by noise such as salt and pepper noise, impulse noise and Gaussian noise. As there is a trade-off between edge strength and noise reduction, filtering is done. Various types of noise have their own characteristics and are inherent in images in different ways.

The noises are removed using the following filters.

2.1.1 Salt and Pepper Noise Reduction

This type of noise is represented as random existence of white and black pixels. Such type of noise is to be reduced by using median filter. Whenever faulty switching takes place, Salt and pepper noise creeps into images.

a) Before Add Noise



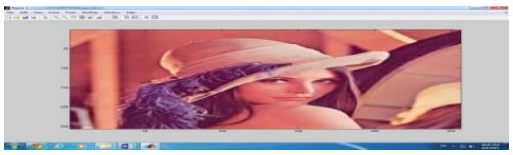
b) After Add Salt and Pepper Noise

c) After Salt and Pepper Noise Removal

Fig.3 Result for Salt and Pepper Noise Removal Image

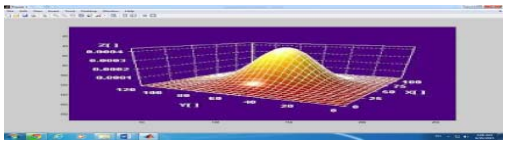
2.1.2 Gaussian Noise Reduction

This noise is also called as statistical noise which has a probability density function of the normal distribution .The values that the noise can take on are Gaussian distributed. It is most commonly used as white noise as addition to yield additive white Gaussian noise. This is an idealized form of white noise, which is caused by random fluctuations in the signal.Gaussian filters are a class of low-pass filters, all based on the Gaussian probability distribution function.



a) Original Image

b) Gaussian Filtering



a) Original Image

b) Gaussian Filtering

Fig.4 Filtering Types

2.2 RGB Components Processing

An RGB image can be viewed as the stack of three gray scale images that, when fed into the red, green, blue inputs of a color monitor, produce the color image on the screen. By convention the three images form an RGB images are called as red, green and blue components.

The average values for the RGB components are calculated for all images

Red average = R(P)/P

Green average = G(P)/P

Blue average = B(P)/P

Where R (P) = RED component pixels,

G (P) = GREEN component pixels,

B (P) = BLUE component pixels,

P =No. of pixels in the image.

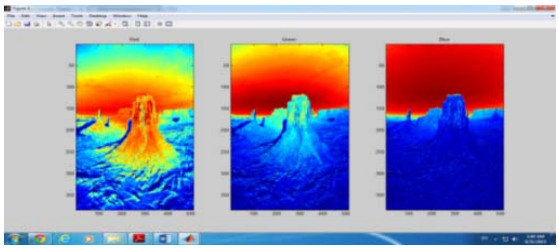


Fig.5 Results of RGB Components Clustering Images

2.3 Entropy Categorization Using Histogram Count

Entropy is a statistical measure of Randomness that can be used to characterize the texture of the input image. Entropy is defined as

Entropy = $\sum_{i=0}^{n} -\ln(P_{ij})\, Pij$

-sum (hc.*log2 (hc)) -------F (1)

Where hc is the histogram counts obtained from the histogram calculation. The image is

Pre- processed and the entropy value is calculated based on the given formula (F (1)).

The formula (F (2)) is used to convert the RGB values to grayscale values by

forming a weighted sum of the *R*, *G*, and *B* components.

0.2989 * R + 0.5870 * G + 0.1140 * B -------F (2)

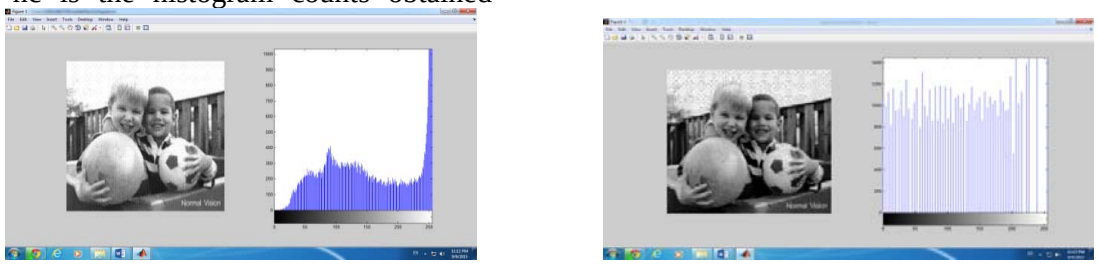


Fig.6 Processes for High and Average Texture Analysis

2.4 Edge Detection

Segmentation refers to the process in which an image is subdivided into constituent regions or objects. These objects can be further processed or analyzed for the extraction of quantitative information. Shape of an image describes more or less each and every object presented in an image. Edge extracted from an image tells us about the full content of an image. The Prewitt filter and the Sobel filter belong to a class of filters called 'first-derivative' filters, which essentially calculate the slope of grayscale intensities in an image in a given direction. They give a maximum value (or minimum value) at regions with discontinuities in grayscale values and are frequently used in edge detection. There are various techniques of edge detection available i.e. Prewitt method (Fig a), Sobel method (Fig b) and Robert method (Fig c).One way to find boundaries of objects is to detect discontinuities in intensity values at the edge of a region. These discontinuities can be found by calculating the first and/or second order derivatives of an image.

The first derivative of choice in image processing is the gradient, defined as the vector:

$$gradf = [G_x\ G_y]$$

Where $G_x = df/dx$ and $G_y = df/dy$ are the partial derivatives in the horizontal and vertical directions of the image. The magnitude of this vector is

$$|grad\ f| = (G_x^2 + G_y^2)^{1/2}$$

The gradient vector points in the direction of steepest ascent. The angle of steepest ascent is given by:

$$a(x, y) = tan^{-1}(G_y/G_x)$$

Roberts $Gx = X_8 - X_6$

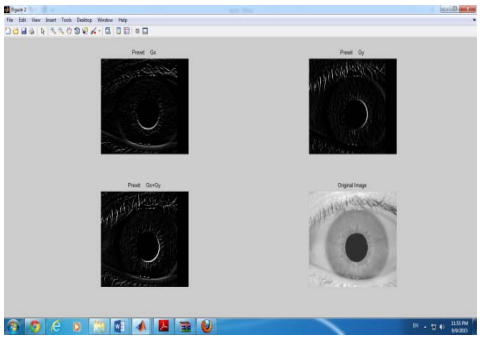


Fig. a) Prewitt Method

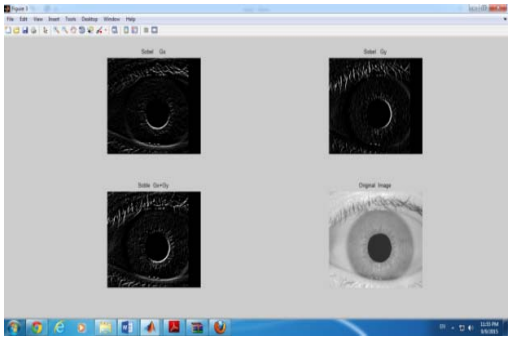


Fig. b) Sobel Method

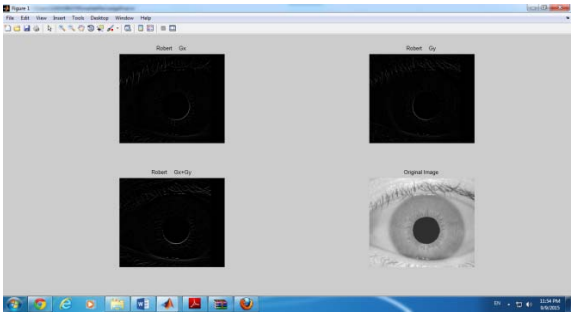


Fig. c) Robert Method

2.5 Shape Retrieval

The ability to retrieve by shape is perhaps the most obvious requirement at the primitive level.

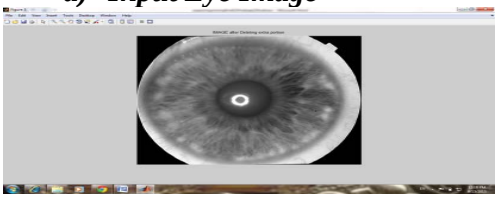
Unlike texture, shape is a fairly well-defined concept – and there is considerable evidence that natural objects are primarily recognized by their shape. A number of features characteristic of object shape (but independent of size or orientation) are computed for every object identified within each stored image.

Object recognition has been an active research focus in field of image processing.

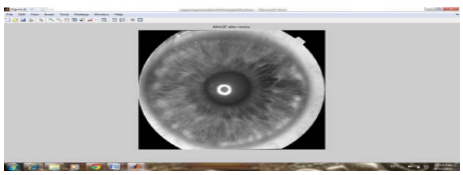
Object recognition system finds objects in the real world from an image. This is a major task in image mining. Machine learning and meaningful information extraction can only be realized when some objects have been identified and recognized by machine. In this paper, the objects of eye images are extracted using canny edge detection method. The Canny Edge Detection block finds edges by looking for the local maxima of the gradient of the input image. It calculates the gradient using the derivative of the Gaussian filter. The canny method uses two thresholds to detect strong and weak edges. It includes the weak edges in the output only if they are connected to strong edges. The following diagram shows the data types used in the Edge Detection block for fixed-point signals.

a) Input Eye Image

b) Gray Conversion

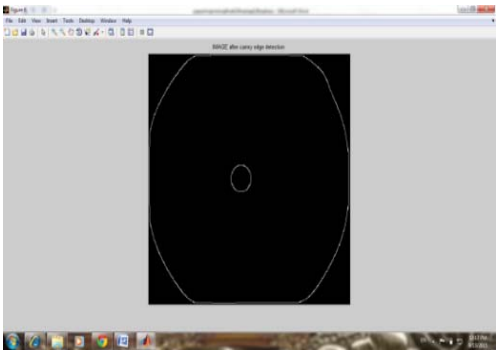


c)Deleting Extra Portiions



d) Image after resize

e) Image After Histogram Equalization



f) Object Detection using Canny Method

Conclusion

This paper presents a survey on various image retrieval methods that was proposed earlier by researcher. This overview of image retrieval focuses on image retrieval implementations, usability and challenges. It also delivers conceptual overview of methodology. Image retrieval is an expansion of Image mining in the field of image processing. Future investigations that are discussed may be implemented in the area of image mining.

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