E-ISSN: 2321–9637
Volume 1, Issue 5, December 2013
International Journal of Research in Advent Technology
Available Online at: http://www.ijrat.org

CHARACTERIZATION OF COLOR AND TEXTURE FEATURES FROM RETRIEVED IMAGES USING CBIR

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ABSTRACT:

The field of digital image processing refers to processing of digital images by means of a digital computer. A digital image is framed of a finite list of components, each of which has a specific position and value. These components are called picture components. Image Retrieval techniques integrate both low level visual features and high level semantic features. Image content descriptors may be visual features such as color, texture, shape etc. The storage of images is done in the database that is created by the user. The images stored in the database are segmented using K-Means algorithm. The color and the texture features are extracted using Histogram and Tree structure wavelet transform respectively. The features of the query image are also extracted from the database. The similarity of the color, texture features and the query image features are computed using Distance Formula. It reduces the semantic gap between the images. Finally the query image is retrieved from the database. All the features of the images that are extracted are stored in the Content Based Image Retrieval (CBIR).

Keywords: *Digital Image Processing, Image Retrieval, K-Means algorithm, Histogram, Wavelet transform, Semantic gap, CBIR.*

1 INTRODUCTION

An image is defined as two-dimensional function, f(m, n) where m and n are spatial coordinates and the amplitude of f at any pair of coordinates(m, n), is called the strength or gray level of the image at that point. When m, n and the amplitude of values of f are all finite, discrete quantities, the images are digital images.

Image retrieval is based on availability of a representation scheme of image content. Conventional information retrieval is based solely on text and these approaches textual information retrieval have been transplanted into image retrieval in a variety of ways, including the representation of image as a vector of feature values. Image contents are much more versatile compared with text, and the amount of visual data and is already enormous and still expanding very rapidly.

The various types of information that are associated with images are:

a Content Independent Metadata

The data that is not directly concerned with the image content but related to it.

b Content-based Metadata

b.1 Non-Information-bearing Metadata:

The data referring to low-level features such as color, texture etc. This information can easily computed from the metadata.

b.2 Information-bearing Metadata:

The data referring to the content semantics concerned with relationships of image entities to real world entities.

1.1 Content Based Image Retrieval (CBIR)

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CBIR [5] is the retrieval of images based on visual features such as color, texture [3], [4], [6], [7], shape etc. In CBIR [5] each image that is stored in the database has its features are extracted in compared to the features of the query image.

In the existing system, the Adaptive wavelet transform is used to characterize the query image. The performance is low and the computation time is high when this type of transform is used. In order to improve the performance and to reduce the computation time another type of transform called highly adaptive wavelet transform is used. But the performance and computation time is not up to the consideration what we expected. Also the semantic gap cannot be reduced.

In the proposed system, the Pyramid structure [1] and the Tree structure wavelet transform [4] is used to improve the performance and to reduce the computation time. The images in the database are segmented and the features of the images are extracted by using K-Means algorithm and Wavelet Transform respectively. The similarities between the images that are extracted based on the features are computed and the query image is retrieved from the database. Therefore, the semantic gap between the images is reduced. At last the extracted features of all images are stored in Content Based Image Retrieval (CBIR) [5].

2 EXISTING SYSTEM

The image is characterized by Adaptive wavelet transform in existing work. They used content based image retrieval application for wavelet adaptation. This wavelet transform is tuned to maximize the retrieval performance and also the computation time is high. So they used different wavelet transform for image characterization based on color and texture [4], [6]. It is used for separable or non-separable images which are tuned to maximize the retrieval performance. It is used to estimate the wavelet filter. In this usage of wavelet transform, again the performance is low and the computation time is high that is expected. Also the semantic gap cannot be reduced.

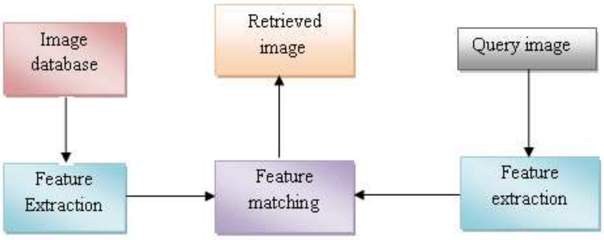

Fig 1: Block Diagram of the existing system

The image database is created by the user in which different types of images are stored. The features of the images are extracted i.e. color, texture etc. The query image features is also extracted from the image database. The features are then compared with each other and at last the query images are retrieved from the database.

3 PROPOSED SYSTEM

In order to overcome the above mentioned drawback of existing system, segmentation is highly reduces the semantic gap problem. Segmentation [2], [8] has the ability to preserve the detail in low variability image regions while ignoring detail in high variability regions. The performance efficiency of CBIR [5] increases when implementing the intermediate segmentation process. From the segmentation results it is possible to identify regions of interest and objects in the scene, which is very much beneficial to the subsequent image analysis.

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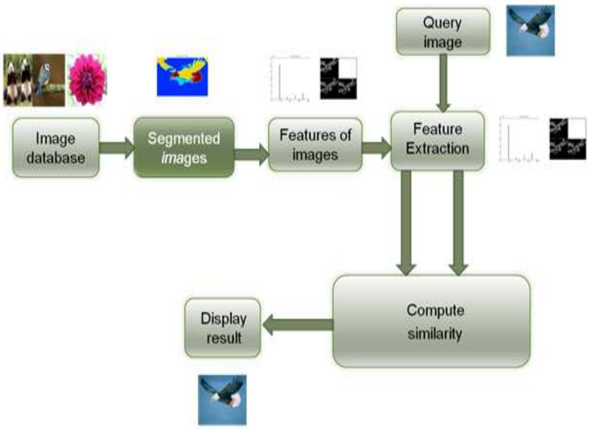

Fig 2: Block Diagram of CBIR with segmentation

Image database consists of collection of images which is going to undergo segmentation. The segmentation is implemented by using K-Means algorithm. After segmentation, the associated features of extracted images that undergo feature extraction and at the same time query image features is also extracted. Then the similarity measures for the extracted images are found. All the images should be stored in the database. Finally the query image is retrieved from the image database.

3.1 Segmentation

Color based image segmentation is the type of pixel based image segmentation. In this method, colors in the images are basically quantized without significantly degrading the color quality. The quantization reduces the number of colors used in an image. The purpose is to extract a few representing colors that can be used to differentiate neighboring regions in the image. In color based image segmentation, K-Means Clustering algorithm is used to cluster the coarse image data.

K-Means Clustering Algorithm

- The dataset is zoned into K clusters and the data points are arbitrarily allotted to the clusters resulting in clusters that have roughly the similar number of data points.
- For each data point estimate the distance from the data point to each cluster.
- If the data point is closest to its own cluster, leave it where the cluster is. If the data point is not closest to its own cluster, proceed it into the closest cluster.
- Repeat the above step until a complete pass through all the data points results in no data point moving from one cluster to another. At this point the clusters are static and the clustering process ends.
- The choice of initial segment can greatly affect the final clusters that result, in terms of inter-cluster and intra-cluster distances and cohesion.

3.2 Color Feature Extraction

Color based feature extraction is done by color histogram. Compute the histogram of image. The image can be a 2D or 3D image. The number of bins is computed automatically depending on the image type for integer images, and the min/max values of the image for floating point images. If the image is a color image, the result is a N-by-3 array, containing histograms for the RGB bands in each column. It specifies the number of histogram bins. It specifies the gray level extents. This can be especially useful for images stored in float, or for images with 256 gray levels to a greater extent. It forces the function to compute the histogram limits from values of image gray levels. It specifies the bin centres. When bin centres are called without an output argument, it displays the histogram on the current axis.

3.3 Texture Feature Extraction

Pyramid-Structured Wavelet Transform

Pyramid-Structured Wavelet Transform [1] for texture sorting [7] is used to disintegrate sub signals in the low frequency channels. It is mostly important for textures with prevalent frequency channels. For this reason, it is mostly desirable for signals consisting of elements with information focused in lower frequency

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channels. Due to the natural image properties that allows for most information to exist in lower sub-bands, the pyramid-structured is highly adequate.

Tree-Structured Wavelet Transform

The energy function is chosen due to its simplicity. The tree-structured wavelet transform [4] generates a multi- resolution or multichannel texture representation with complete basis functions which have a reasonably well controlled spatial or frequency localization property.

Algorithm for Tree-Structured Wavelet Transform:

- Decompose a given textured image into four sub- images using a 2-D wavelet transform. This can be viewed as the parent and children nodes in a tree.
- Calculate the energy of each disintegrated image. That is, if the disintegrated image is x(m, n), with $1 \leq m \leq M$ and $1 \leq n \leq$ ***N***, the energy is

$$e = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left|X(i, j)\right|$$

Where,

M and N = dimensions of the image.

X= The intensity of the pixel situated at row i and column j in the image map.

- If the energy of a sub-band is significantly smaller than that of any other stop the decomposition in that band since it contains less information. This step can be accomplished by equating the energy with the largest energy value in the same scale. That is if $e < Ce_{\max}$ stop decomposing this region. C is a constant less-than 1.
- If the energy of a sub-band is significantly larger than that of others, the above decomposition procedure is applied to that sub-band.

3.4 Similarity Measures

The Quadratic Distance and Euclidean Distance is used for measuring similarity of color histogram [2] and texture features. The Quadratic Distance and Euclidean distance is calculated between the query image and every image in the database. These processes are repeated until all the images in the database have been compared with the query image. All the images are stored in the CBIR. Finally the images are retrieved from the database.

4 RESULT ANALYSIS

Segmentation Results

Fig 3: Input Image

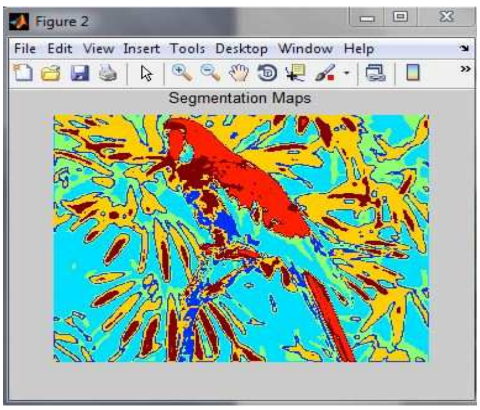

Fig 4: Segmented Output

Histogram Results

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Fig 5: Input Image

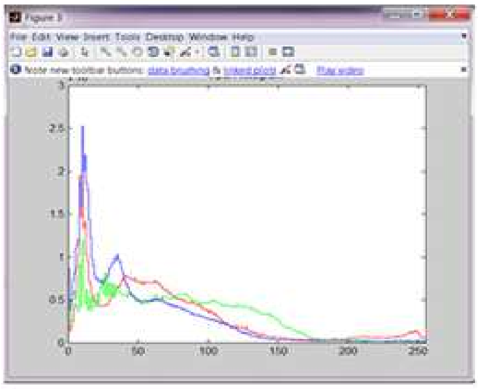

Fig 6: Histogram

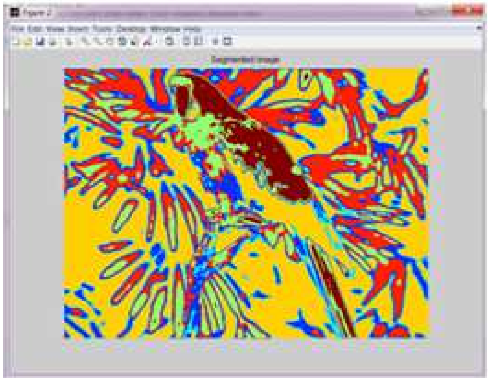

Fig 7: Segmented Input Image

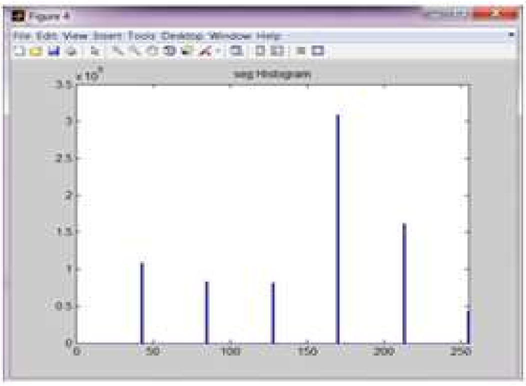

Fig 8: Histogram

Texture Results

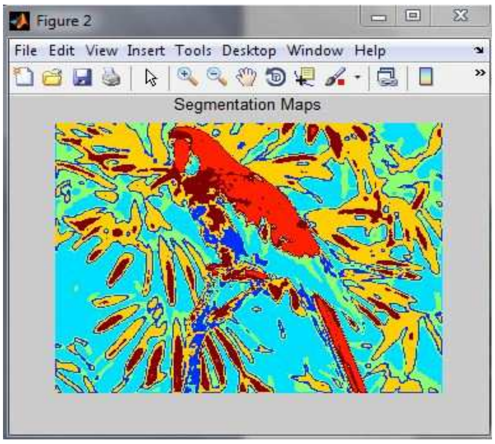

Fig 9: Segmentation Input

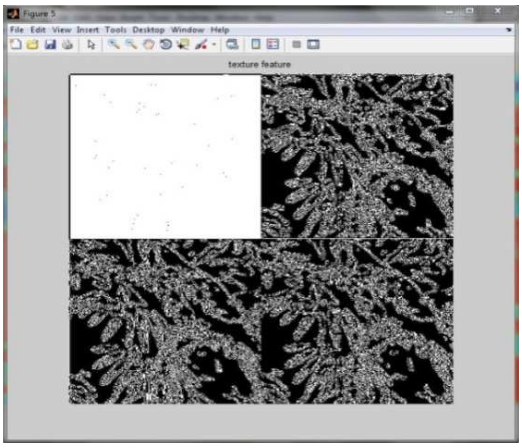

Fig 10: Texture Output

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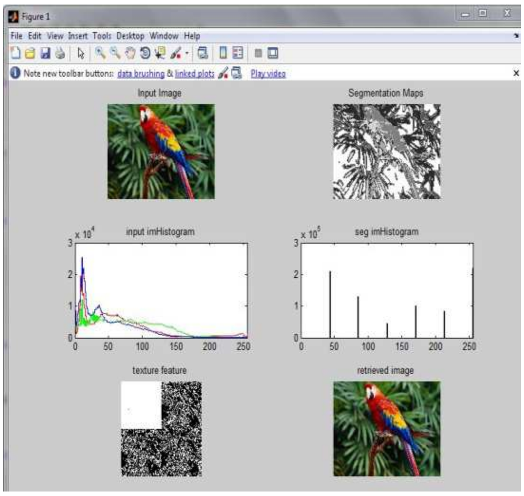

Fig 11: Final Result

The image is retrieved from the database. The input image is segmented and the color features are extracted using Color Histogram. The color features are separately extracted for the input image and the segmented image. The texture feature for the image is extracted using Tree Structure Histogram. Finally the query image is retrieved from the database.

5 CONCLUSION AND DISCUSSION

Segmentation is used as a pre-processing step in CBIR and then color and texture features are extracted. Color, texture, shape, spatial relationship and other single low-level features can only describe the parts of image content. Sometimes the retrieval solutions are not satisfied. Combining the low-level features in retrieval has lot of advantages because different features can complement each other and enhance the retrieval precision and make CBIR system more agile. With segmentation the performance is found to be increased as it reduces the semantic gap problem in CBIR systems to some extent. In conventional CBIR systems, similarities among the target images are usually ignored.

As a future work, clustering using Neural networks after segmentation for fully exploiting similarity information. Semantic Gap is a challenging task in CBIR since the features from image data are low level visual characteristics which have very limited ability in representing and analyzing the high level semantic content of the image. Neural network learning can be embedded in this system to reduce the semantic gap.

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