Retrieval of Images Based on Different Patterns

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Abstract – Nowadays, digital world increase with handheld devices, storage technologies and social networking sites and huge volume of images are stored on web. With significantly huge image database it is difficult to extract that data and retrieve relevant images. The term content-based image retrieval is widely used to describe the process of retrieving desired images from a large collection on the basis of features that can be automatically extracted from the images themselves. Feature Based Image Retrieval is a very important research area in the field of image processing. It is comprises of low level feature extraction such as texture, shape and color and similarity measures for the comparison of images. Recently, the research focus in FBIR has been in reducing the semantic gap, between the low level visual features and the high level image semantics. In this paper, various techniques for image retrieval have been studied. Further, brief discussion has been done on content based image retrieval which is included with feature extraction methods based on texture, shape and color. At the end of this paper, comparative study between various content based image retrieval techniques has been done.

Index Terms – Content based image retrieval (CBIR), Texture Feature, Local Binary pattern.

1. INTRODUCTION

Content-based retrieval uses the contents of images to represent and access the images. A classic content-based retrieval system is alienated into online image retrieval and off-line feature extraction. In on-line image retrieval, a query example of the user can submit to the retrieval system in look for of desired images. The system represents this example with a feature vector. The similarities between the feature vectors of the query example and feature database are then computed and graded. Indexing technique can be used to accomplish the retrieval which provides an efficient way of searching the image database. In off-line image retrieval, each image in the database visual attributes (color, shape, texture, and spatial information) are extracted automatically based on its pixel values and stores them in a different database within the system called a feature database. The feature data also known as image signature for each of the visual attributes of each image is very much smaller in size compared to the image data, thus the feature database contains an abstraction of the images in the image database. The need for human intervention during image indexing and retrieval is to be reduced is the main goal of CBIR.

2. RELATED WORK

A new feature descriptor, named local texton XOR pattern (LTxXORP) is proposed for feature extraction, (b) the proposed LTxXORPs collect the features from the V plane of the HSV color image for image retrieval,(c) further, the performance of the proposed method is improved by integrating it with the HSV color histogram. The evaluation of the proposed method is done on benchmark image database[1]. Novel approaches referred as Local tetra pattern for content based image retrieval encoded the images based on the direction of pixels are calculated by horizontal and vertical derivatives [2]. A novel approach to compute rotation-invariant features from histograms of local non-invariant patterns and this proposed approach to both static and dynamic local binary pattern (LBP) descriptors [3]. For static –texture description, we present LBP histogram Fourier (LBP-HF) features, and for dynamic-texture recognition we present two rotation-invariant descriptors computed from the LBPs from three orthogonal planes (LBP-TOP) features in the spatiotemporal domain. This approach also can be generalized; sign and magnitude components together can improve the description ability, reduces the computational complexity and improve the classification accuracy. A completed modeling of local binary pattern operator is proposed and an associated completed LBP scheme is developed for texture classification and analyzed LBP from a viewpoint of LDSMT [4]. Three operators CLBP_C, CLBP_S and CLBP_M were defined to extract the image local gray level, the sign and magnitude features of local difference, respectively. This method has improved the texture classification accuracy. The computational time for extracting the feature was high in this method.

3. PROPOSED MODELLING

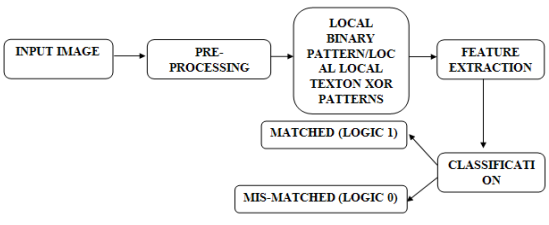

Figure 1 Block diagram of proposed content based image retrieval system

The proposed system consists of image acquisition stage, image pre-processing stage, feature extraction stage and image classification stage.

Texture features are calculated and stored in a database and the features are combined as a Feature Vector. Finally, the system retrieves the similar image to the user on the screen.

A. Feature Extraction

Texture can be described as the repeated patterns of pixels over a spatial domain. Texture properties are the visual patterns in an image that have properties of homogeneity that do not result from the presence of only a single color or intensity. It comprises important information about the structural arrangement of the surface i.e., clouds, leaves, bricks, fabric, etc. The different texture properties as perceived by the human eye are regularity, directionality, smoothness and coarseness. It also depicts the relationship of the surface to the surrounding environment. It is a feature that demonstrates the distinctive physical composition of a surface. Texture measures are classified into first order statistics and second order statistics. First order texture measures are computed from the original image values. They do not consider the relationships with neighborhood pixel. The first order statistics are mean, standard deviation, energy, entropy, skewness and kurtosis. Therefore, the histogram contains the first-order statistical information about the image (or sub image). The gray-level co-occurrence matrix (GLCM) or gray-level spatial dependence matrix based calculations fall under the category of second-order statistics. Haralick et. al. [13] suggested a set of textual features which contain information about image textural characteristics and which can be extracted from the co-occurrence matrix, such as homogeneity, contrast and entropy.

$$\text{Energy (E)} = \sum \sum P(x,y)^2 \quad (1)$$

It is a texture measure of gray-scale image represents homogeneity changing, reflecting the distribution of image gray-scale uniformity of weight and texture.

$$\text{Entropy (S)} = -\sum \sum P(x,y) \log P(x,y) \quad (2)$$

Entropy is a measure of information content. It measures randomness in the image texture. It is minimum when the co-occurrence matrix for all values is equal. On the other hand, if the value of co-occurrence matrix is very uneven, its value is greater. Therefore, the maximum entropy implied by the image gray distribution is random.

B. Local Binary Pattern

The original LBP operator, introduced by Ojala et al. [5], is a powerful means of texture description. The operator labels the pixels of an image by thresholding the 3x3 -neighborhood of each pixel with the center value and converts the result into a binary number by using (1)

$$LBP_{p,r} = \sum S(x_{r,n} - x_{0,0}),\ S(x) = 1,\ x >= 0$$
$$0,\ x < 0 \quad (3)$$

The first defined LBPs for neighborhoods of different sizes, thus making it possible to handle textures at different scales. Using circular neighborhoods and bilinear interpolating the pixel values allow any radius and number of pixels in the neighborhood. In this extension, P sampling points on a circle of radius of R, are shown to form a (P, R). The second defined the so - called uniform patterns: an LBP is uniform if it contains at most one 0 - 1 and one 1 - 0 transition when viewed as a circular bit string.

C. Local Tetra Pattern

The LTrP describes the spatial structure of the local texture using the direction of the center gray pixel .Given image , the first-order derivatives along 0 and 90 directions are denoted as $I'\theta(g_p)$ I_θ = 00, 900 . Let denote the center pixel in , and let and denote the horizontal and vertical neighborhoods of , respectively. Then, the first-order derivatives at the center pixel gc can be written as

$$I'_0{}^0(g_c) = I(g_h) - I(g_c)$$
$$I'_{90}{}^0(g_c) = I(g_y) - I(g_c) \quad (4)$$

D. Local Texton XOR patterns (LTxXORPs)

Let the image be divided into overlapping 2 × 2 subblocks named as I1. For easy analysis, we consider the positions of gray values as “A, B, C, D”. The subblocks are coded based on the texton shape. After calculating the texton image, we collect the center and its surrounding neighbors for each pixel on the texton image and perform the XOR operation between the center texton and its surrounding neighbor textons. The local texton XOR patterns are coded as follows.

$$LTxXORP_{P,R} = \sum 2(i-1) * f3(Tx(gi) \otimes Tx(gi)) \quad (5)$$

$$F3(x \otimes y) = 1 \quad x \neq y$$
$$= 0 \quad \text{else} \quad (6)$$

where Tx(gi) represents the shape of texton for the neighbor pixel gi , Tx(gc) represents the shape of texton for the center pixel gc , represents the XOR operation between the variables.

E. Classification Methods

Classification and clustering are important part of image mining. This machine learning technique is used to reduce semantic gap between low level image feature and high level semantic. Data classification is a two step process, consisting of a learning step and a classification step. Classification algorithm is applied to image database in which image is best described to classify it in classes. Classification is challenging task in various application domains, including biomedical

imaging, biometry, video surveillance, vehicle navigation, industrial visual inspection, remote sensing and handwritten letter reorganization. Image Classification has mainly three stages:

1. Feature extraction – In this stage features are extracted from sample images that are alreadylabeled and establish feature description for each image.
2. Training –The samples of each class are trained and model description for each class is established in this stage.
3. Classification – Use the model to classify and index images that are not labeled.

4.RESULTS AND DISCUSSIONS

Performance Analysis

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

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

Figure 2 Sample images from COREL data base

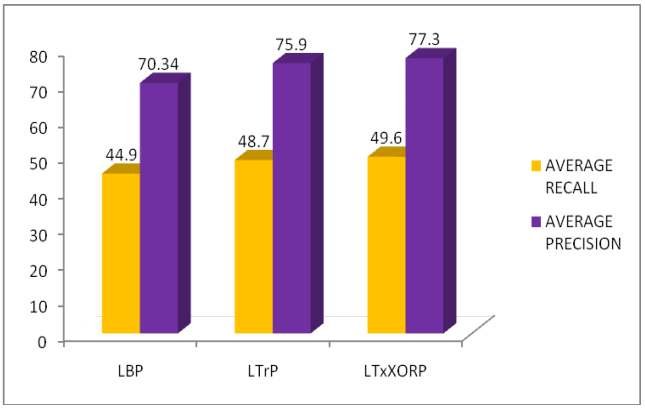

Figure 3 Performance comparisons between LBP, LTrP and LTxXORP Patterns Average Precision and Average Recall.

From the Figure 3 the average precision and average recall for the proposed method has increased compare with the existing systems.

5 CONCLUSION

After comparing various techniques of content-based image retrieval, it is concluded that Local Texton XOR patterns, technique has been achieved the highest average precision and highest average recall for image retrieval system. So, in future including some advance techniques, which will achieve the high accuracy of image retrieval, can extend this comparative study.

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