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COMPARATIVE STUDY OF VARIOUS TEXTURE BASED APPROACHES AND SIMILARITY MEASUREMENT APPROACHES IN CBIR

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ABSTRACT

Texture features are important factor in content based image retrieval. Texture descriptors are important factor in grey scale images, but due to advancements in colour image processing textures descriptors are developed a major factor for colour space images. In this paper various colour and grey scale based texture features have been discussed that can be used for extraction of texture histogram based features from the dataset images. Similarity measurement is also an important factor for recognition of query images to relevant images in the dataset. Probability based and features based similarity distance measurement approaches have been discussed in this paper.

Keywords: CBIR, LBP, LTP,QBIR and Gabor Wavelet.

I. INTRODUCTION

1.1 CBIR: “Content-based" means that the search analyses the contents of the image rather than the metadata such as keywords, tags, or descriptions associated with the image. The term "content" in this context might refer to colours, shapes, textures, or any other information that can be derived from the image itself. CBIR is desirable because searches that rely purely on metadata are dependent on annotation quality and completeness. Having humans manually annotate images by entering keywords or metadata in a large database can be time consuming and may not capture the keywords desired to describe the image. The evaluation of the effectiveness of keyword image search is subjective and has not been well-defined. In the same regard, CBIR systems have similar challenges in defining success.

Content-based image retrieval uses the visual contents of an image such as color, shape, texture, and spatial layout to represent and index the image. In typical content-based image retrieval systems, the visual contents of the images in the database are extracted and described by multi-dimensional feature vectors. The feature vectors of the images in the database form a feature database. To retrieve images, users provide the retrieval system with example images or sketched figures. The system then changes these examples into its internal representation of feature vectors. The similarities /distances between the feature vectors of the query example or sketch and those of the images in the database are then calculated and retrieval is performed with the aid of an indexing scheme. The indexing scheme provides an efficient way to search for the image database. Recent retrieval systems have incorporated users' relevance feedback to modify the retrieval process in order to generate perceptually and semantically more meaningful retrieval results.

1.2 Image Content Descriptors

Generally speaking, image content may include both visual and semantic content.

Visual content can be very general or domain specific. General visual content include color, texture, shape, spatial relationship, etc. Domain specific visual content, like human faces, is application dependent and may involve domain knowledge. Semantic content is obtained either by textual annotation or by complex inference procedures based on visual content. This chapter concentrates on general visual contents descriptions. Later chapters discuss domain specific and semantic contents. A good visual content descriptor should be invariant to the accidental variance introduced by the imaging process (e.g., the variation of the illuminant of the scene). However, there is a tradeoff between the invariance and the discriminative power of visual features, since a very wide class of invariance loses the ability to discriminate between essential differences. Invariant description has been largely investigated in computer vision (like object recognition), but is relatively new in image retrieval.

- **Color Histogram**

The color histogram serves as an effective representation of the color content of an image if the color pattern is unique compared with the rest of the data set. The color histogram is easy to compute and effective in characterizing both the global and local distribution of colors in an image. In addition, it is robust to translation and rotation about the view axis and changes only slowly with the scale, occlusion and viewing angle. Since any pixel in the image can be described by three components in a certain color space. A histogram, i.e., the distribution of the number of pixels for each quantized bin, can be defined for each component. Clearly, the more bins a color histogram contains, the more discrimination power it has. However, a histogram with a large number of bins will not only increase the computational cost, but will also be inappropriate for building efficient indexes for image databases. Furthermore, a very fine bin quantization does not necessarily improve the retrieval performance in many applications. One way to reduce the number of bins is to use the opponent color space which enables the brightness of the histogram to be down sampled.

- **Texture**

Texture is another important property of images. Various texture representations have been investigated in pattern recognition and computer vision. Basically, texture representation methods can be classified into two categories: Structuraland statistical. Structural methods, including morphological operator and adjacency graph, describe texture by identifying structural primitives and their placement rules. They tend to be most effective when applied to textures that are very regular. Statistical methods, including Fourier power spectra, co-occurrence matrices, shift-invariant principal component analysis (SPCA), Tamura feature, World decomposition, Markov random field, fractal model, and multi-resolution filtering techniques such as Gabor and wavelet transform, characterize texture by the statistical distribution of the image intensity.

II. LITERATURE SURVEY

Shiv Ram Dubey “Multichannel Decoded Local Binary Patterns for Content-Based Image Retrieval”, Local binary pattern (LBP) is widely adopted for efficient image feature description and simplicity. To describe the colour images, it is required to combine the LBPs from each channel of the image. The traditional way of binary combination is to simply concatenate the LBPs from each channel, but it increases the dimensionality of the pattern. In order to cope with this problem, this paper proposes a novel method for image description with multichannel decoded LBPs. We introduce adder- and decoder-based two schemas for the combination of the LBPs from more than one channel. Image retrieval experiments are performed to observe the effectiveness of the proposed approaches and compared with the existing ways of multichannel techniques. The experiments are performed over 12 benchmark natural scene and colour texture image databases, such as Corel-1k, MIT-VisTex, USPTex, Colored Brodatz, and so on. It is observed that the introduced multichannel adder- and decoder-based LBPs significantly improve the retrieval performance over each database and outperform the other multichannel-based approaches in terms of the average retrieval precision and average retrieval rate.

Navneet Kaur "Relevance Feedback Based CBIR System Using SVM and Bayes Classifier "In this paper, Relevance Feedback is used to deal with this issue which based on Support Vector machine has been extensively used in the CBIR system to bridge the semantic gap between low level features and high level human perception features. The learning techniques are predominantly used for the classification of images in labelled and unlabelled datasets. In our proposed work we have to work on KNN, SVM and Bayes Classifier to classify the images. The implementation of our proposed work is done in OpenCV and experiments conducted on the Corel Dataset having 10,000 images. After attempting the experiments on various images we have to calculate the Precision and Recall which represent in the form of graphs. After analysing the results we have concluded that our method is effective to reduce the semantic gap.

Tatiana Jaworska "CBIR search engine for user designed query (UDQ)" At present, most Content-Based Image Retrieval (CBIR) systems use query by example (QBE), but its drawback is the fact that the user first has to find an image which he wants to use as a query. In some situations the most difficult task is to find this one proper image which the user keeps in mind to feed it to the system as a query by example. For our CBIR, we prepared the dedicated GUI to construct a user designed query (UDQ). We describe the new search engine which matches images using both local and global image features for a query composed by the user. In our case, the spatial object location is the global feature. Our matching results take into account the kind and number of objects, their spatial layout and object feature vectors. Finally, we compare our matching result with those obtained by other search engines.

Kamlesh Kumar "Complementary feature extraction approach in CBIR" Content Base Image Retrieval (CBIR) system has got more attention from its generic to specific use. CBIR depends upon visual low-level feature extraction i.e.colour, texture, shape and spatial layout. In this paper, a Local Binary Patterns (LBP) has been employed for texture analysis of image and also it is compared with average RGB colour image descriptor method. And then a complementary feature extraction approach using average RGB colour and LBP texture method has been proposed for CBIR. Euclidean distance is used as similarity measure for finding similar images in the database. The experimental results are generated using MATLAB. The obtained results proved that the accuracy and efficiency of proposed method in terms of overall precision, recall and f-measure and retrieval time are quite higher than single colour and texture feature extraction approach.

Vinayak A. Bharadi "Novel architecture for CBIR SAAS on Azure cloud" Multimedia messages like images or videos are used in large scale for effective way of communication in today time. Content Based Image Retrieval (CBIR) is an efficient and effective way for retrieval of relevant/similar images from large database based on features extraction principal. In this paper we have proposed a system which extracts images, already uploaded in database through worker role, after analysing property or message associated with images. The main purpose of this paper is to purpose a system which facilitates quick retrieval of data (images) from cloud. It can be used easily for retrieving images, based on the query image, from a large set of distinct images. We are proposing one architecture in which feature extraction technique is used to extract image by feature vectors based on colour, shape, texture features etc. Mentioned features retrieved from the images can be stored in vectors called feature vectors of images and therefore these are compared to the feature vectors of query image and the image information is sorted in decreasing or ascending order. The Proposed system is an application built on Windows Azure platform for the uploading and retrieval of images.

Dounia Awad "A CBIR-based evaluation framework for visual attention models" The computational models of visual attention, originally proposed as cognitive models of human attention, nowadays are being used as front-ends to numerous vision systems like automatic object recognition. These systems are generally evaluated against eye tracking data or manually segmented salient objects in images. We previously showed that this comparison can lead to different rankings depending on which of the two ground truths is used. These findings suggest that the saliency models ranking might be different for each application and the use of eye-tracking rankings to choose a model for a given application is not optimal. Therefore, in this paper, we propose a new saliency evaluation framework optimized for object recognition. This paper aims to answer the question: 1) Is the application-driven saliency models rankings consistent with classical ground truth like eye-tracking? 2) If not, which saliency models one should use for the precise CBIR applications.

III. APPROACHES USED

3.1 Texture: This is a first property which is use for the recognition of image. Basically texture is a continual pattern of pixel over a spatial domain. It has the extension of noise. Its pattern is the visually of an image which have property of homogeneity that do not response from the existence of only single color. Texture is a natural property of surfaces and it gives visual patterns of the image. It contains critical details regarding the structural arrangement of the surface. It also gives the relationship between the side and external environment.

- **Grey level Co-Occurrence Matrices:** The co-occurring of values at a given offset is distributed. The GLCM is created from a grey scale image. The GLCM is computed how frequently a pixel with grey level value occurs either vertically, horizontally or diagonally to adjacent pixels.
- **Gabor Transform:** This wavelet proved very important texture analysisGabor wavelet proved very useful texture analysis and is mostly adopted in the literature. Present an image retrieval method based on Gabor filter. In present days texture features are found by calculating mean and variation of the Gabor filtered image. Rotation normalization is accomplished by a circular shift of feature elements therefore all images have the same dominant direction. Mostly the image indexing and retrieval are organized on textured images and natural images.
- **Tamura Feature:** Coarseness, directionality, contrast, line likeness, regularity and roughness are the six Tamura features. In this features coarseness, contrast and directionality correspond strongly with human perception and therefore they are very important.
- **Local Binary Pattern**: LBP Pattern labels the pixel of an image with decimal number called LBP or LBP Codes. It is used to encode the local structure around each pixel. Every pixel is compare with its eight neighbors in a 3*3 neighborhood by subtracting the center pixel value. The resulting strictly negative values are encoded with 0 and the others with 1; A binary number is obtained by concatenating all these binary codes in a clockwise direction starting from the top-left one and its corresponding decimal value is used for labeling. The derived binary numbers are referred to as Local Binary Patterns or LBP codes.

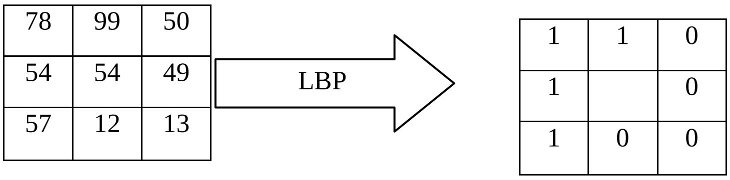

Fig 3.1 LBP codes Extraction

- **Local Ternary Pattern:** Local ternary operator works over a 3X 3 window over the selected region of interest. Local ternary pattern uses a threshold constant to threshold pixels into three values whereas Local Binary Pattern uses only two values to threshold the pixels either 0 or 1. The neighboring pixels are combined after thresh-holding into ternary pattern. The histogram is computed for these ternary patterns. Each ternary pattern selected will comprise two binary patterns. LBP neglects importance of center pixel value that has been modified in LTP.

  Ternary codes have been extracted from the image on the basis of different mask moving on image different regions. Uniform patterns have been extracted from the image.

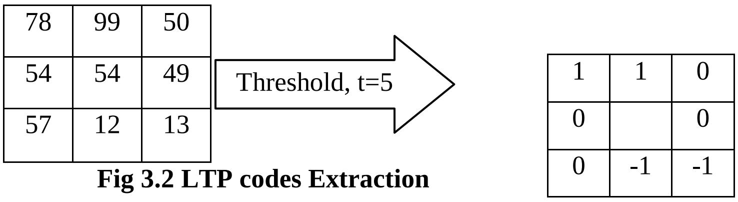

Fig 3.2 LTP codes Extraction

This figure represents ternary codes that have been extracted from a single patch of the image using t=5 as user defined threshold value. These codes have been divided into two different codes that are upper binary code and lower binary code. These two different codes have been extracted foe all the patches of the image. These codes have been concatenated to develop a feature vector.

3.2 Distance Measures

Distance measures are used for analyzing the similarity of two images. There are different kinds of similarity measurements like Euclidean distance, histogram intersection, Bhattacharya distance and Mahalanobis distance for CBIR applications.

- **Euclidean Distance:** To calculate the Euclidian distance between images or image features, our matrices should have same dimensions.

Distance=SQRT(sum((h-h1)^2))

h= Feature value of first image

h1= Feature value of second image

In Euclidean distance, the least value of distance measure indicates the similarity.

- **Bhattacharya Distance**

The Bhattacharya Distance measures the similarity between two discrete or consecutive probability distributions. A popular distance of similarity between two Gaussian distributions is the Bhattacharya distance. This is one of the most used methods for finding out the distance.

- **Mahalanobis Distance**

The Mahalanobis Distance is based on the correlations between variables, and is used to analyze various patterns. It is useful in determining the similarity between an unknown sample set and a known one. The unknown sample set is the query image, and the known set is the images in the database.

VI. CONCLUSIONS

CBIR is field of digital imaging for extraction of relevant images on the basis of content available in the images. Content in the image is similar to things that have been represented in the images. Textures are also contents that have been available in the images on the basis of various features that contain information of background of the image. In this paper various approaches of texture based featureextraction. On the basis of study of various approaches of texture features we can say that local ternary pattern approach provides much better results in terms of texture features of the images in CBIR.

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