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Sketch Based Image Retrieval System Using Wavelet Transform

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Abstract:
Content Based Image Retrieval (CBIR) is an automatic process to search relevant images based on user input. The input could be parameters, sketches or example images. A typical CBIR process first extracts the image features and store them efficiently. Then it compares with images from the database and returns the results. Most of the available image search tools, such as Google Images and Yahoo! Image search, are based on textual annotation of images. In these tools, images are manually annotated with keywords and then retrieved using text-based search methods. The performances of these systems are not satisfactory. This paper aims to introduce the problems and challenges concerned with the design and the creation of CBIR systems, which is based on a free hand sketch i.e. Sketch Based Image Retrieval – SBIR using Wavelet Transform.

Key words: *Content Based image retrieval, Sketch based image retrieval, Wavelet transform, Lucene Indexing, Fuzzy C-Means algorithm.*

1.Introduction

1.1.Content Based Image Retrieval

Content-based image retrieval also known as query by image content and content-based visual information retrieval problem of searching for digital images in large database. Content-based means the search will analyze the actual contents of 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.

The ideal approach of querying an image database is using content semantics, which applies the human understanding about image. Until semantic extraction can be done automatically and accurately, image retrieval systems cannot be expected to find all correct images. They should select the most similar images to let the user choose the desired images. The number of images of retrieved set can be reduced by applying similarity measure that measures the perceptual similarity.

In this paper sketch or image is given as a input to a system and accordingly processing is done on these images by applying appropriate algorithms such as wavelet transform for image processing, Lucene algorithm for indexing, Fuzzy C-means algorithm for clustering. The most matching images are retrieved from database.

2.Our Project

2.1.Literature Review Of CBIR

CBIR usually deals with large image collection of low level and high level features, which directly influence indexing, and retrieval complexity, memory and disk space requirement. Due to high memory and processing power requirement, CBIR has not widely been applied on platform shaving limited resources, such as mobile devices.

Content Based Image Retrieval (CBIR) is an automatic process to search relevant images based on user input. The input could be parameters, sketches or example images. A typical CBIR process first extracts the image features and store them efficiently. Then it compares with images from the database and returns the results. Feature extraction and similarity measure are very dependent on the features used. In each feature, there would be more than one representation. Among these representations, histogram is the most commonly used technique to describe features.

2.2.SBIR System

The goal of SBIR is to extract visual content of an image automatically, like color or shape. This paper introduces the solution to the problems and challenges concerned with the design and the creation of CBIR systems, which is based on a free hand sketch (Sketch based image retrieval).

The SBIR as a process can be divided into two main phases. The first is the database construction phase. In which the data of preprocessed images is stored in the form of feature vectors. This is the offline part of the program. This part carries out the computation intensive tasks, which has to be done before the program actual use. The other phase is the retrieval process, which is the on-line unit of the program.

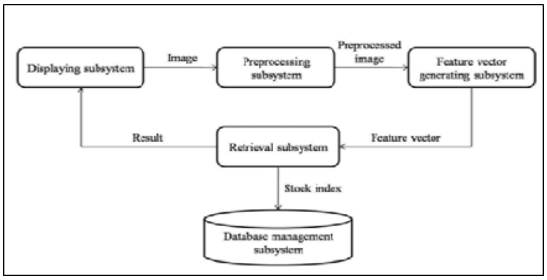

Figure 1: Construction of Database in the form of feature vectors

Using the feature vector generating subsystem our image or sketch can be represented by numbers considering a given property. The database management subsystem provides an interface between the database and the program. Based on the feature vectors and the sample image the retrieval subsystem provides the response list for the user using the displaying subsystem.

Typical CBIR system uses Fourier transform for Image processing, and K-means algorithm for clustering.

2.3.HAAR Wavelet Transform

Fourier transforms decomposed the original signal into a linear combination as a sin and cosine function whereas by wavelet transform the signal is decomposed as a sum of a more flexible function called wavelet that is localized in both time and frequency. The wavelet transforms were used to adopt a wavelet prototype function (mother wavelet).

Wavelet analysis is a mathematical model that transforms the original signal into a different domain for analysis and processing. This model is very suitable with the non-

stationary data, i.e. mean and auto correlation of the signal are not constant over time, that is well known, most of the financial time series data is non- stationary.

Although, wavelet transforms is the transformation process from time domain to time scale domain, these processes are known as signal decomposition because a given signal is decomposed into several other signals with deferent levels of resolution. These processes allow recovering the original time domain signal without losing any information.

2.4.Fuzzy C-means Algorithm

One of the most widely used fuzzy clustering algorithms is the Fuzzy C-Means (FCM) Algorithm. The FCM algorithm attempts to partition a finite collection of n elements$X = \{x_1, .., x_n\}$ into a collection of c fuzzy clusters with respect to some given criterion. Given a finite set of data, the algorithm returns a list of c cluster centers. $C = \{c_1, .., c_n\}$ And a partition matrix $U = u_{i,j} \in [0,1],\ i = 1, .., n\ j = 1, .., c,$ where each element u_{ij} tells the degree to which element x_i belongs to clusterc_j. Like the k-means algorithm, the FCM aims to minimize an objective function. The standard function is:

$$u_k(x) = \frac{1}{\sum_j (\frac{d(center_k, x)}{d(center_k, x)})^{2/(m-1)}}$$

This differs from the k-means objective function by the addition of the membership values u_{ij} and the fuzzifier m. The fuzzifier m determines the level of cluster fuzziness. A large m results in smaller memberships u_{ij} hence fuzzier clusters. This algorithm will be used for clustering of images for retrieval after calculating feature vectors. Then indexing will be done using Lucene algorithm.

2.5.Lucene Algorithm For Indexing

Lucene is able to achieve fast search responses because, instead of searching the text directly, it searches an index instead. This would be the equivalent of retrieving pages in a book related to a keyword by searching the index at the back of a book, as opposed to searching the words in each page of the book. This type of index is called an inverted index, because it inverts a page-centric data structure (page->words) to a keyword-centric data structure (word->pages).

3.Conclusion

As in the existing system "CBIR" we were using K-means algorithm for clustering, flourier transform for image processing. But Denoising and indexing was not possible using these algorithms. So, we will be trying to overcome these disadvantages by proposing a new system i.e. "Sketch Based Image Retrieval (SBIR) System Using Wavelet-Transform" in which we will be using wavelet transform for image processing, Fuzzy C-means for clustering. With the help of which we will try to get the better result i.e. we will be using Wavelet Transform for De noising and Lucene Algorithm for indexing purpose. Using Fuzzy C means algorithm and above algorithms we will get better results than CBIR system.

4.Reference

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