

Content Based Image Retrieval: Concept and Methodologies

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Abstract

Due to increase in digital trend the number of images to be stored in digital format has also increase. so text based image retrieval was facing many problems to overcome these challenges content based image retrieval came under consideration, searching and retrieving of images from large database can be done using content based image retrieval system.

Image retrieval based on low level features like color, texture and shape is a wide area of research scope, In this paper we focus on the whole concept of content based image retrieval system and discussed about some of the methodologies used by content based image retrieval system.

Keywords

Content based image retrieval, Wavelet Transform, Saliency model, BoF

I. INTRODUCTION

Due to the explosive growth of digital technologies Image retrieval has become key factor in various applications like digital libraries, historic research, finger print identification, medicine etc. Searching, Browsing and Retrieving images from huge image databases are done by Image Retrieval Systems or we can say Image retrieval is technique concerned with searching and browsing digital images from database collection. To search images, a user provides query terms of keyword and the system will return images similar to the query.

Image retrieval systems are classified as concept-based or text-based and content-based image retrieval systems. In Text-Based Image Retrieval, images are indexed using Keywords, which means keywords are used as retrieval keys during search and retrieval. In Content Based Image Retrieval image content is used to search and retrieve digital images from huge collection of Dataset.

II. CONTENT BASED IMAGE RETRIEVAL

A Content Based Image Retrieval (CBIR) act as an interface between a high level system (the human brain) and a low level System (a computer). In a content based image retrieval, image content are used to search and retrieve digital images from the Huge set of database based on the automatically derived features or visual content such as color, texture, shape and edge.

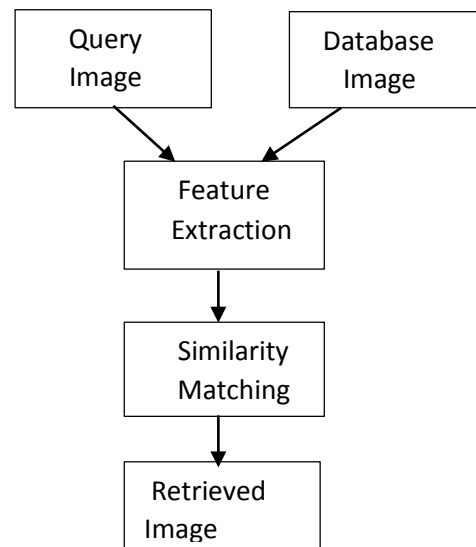


Fig 1. Basic Block Diagram of Content Based Image Retrieval System

Figure 1 show the basic block diagram of content based image retrieval. Image features are extracted for both query image and images in the database. The distance (i.e., similarities) between the features vectors of the query image and database are then computed and ranked. The database images that have highest similarity to the

query image are retrieved. Then the performance analysis is carried out using precision and recall.

The image features like colour, texture, shape etc. uniquely describe an image and these features can be extracted by Content based image retrieval system. Transforming the input data into the set of features is called feature extraction

Feature extraction includes colour, texture and shape

A. Colour

Colour is one of the most used visual feature in CBIR systems because humans recognize images mostly by means of colour features. Colour features are defined by a particular colour space or model. Once the colour space is specified, colour feature is extracted from images or regions. Many colour features have been proposed in the literatures, including colour histogram, colour moments (CM), colour coherence vector (CVV), colour correlogram etc.

B. Texture

Texture is another important visual feature. It is the natural property of all surfaces, which describes the structural arrangement of colour each having the properties of homogeneity and also it contains important information about the structural arrangement of surfaces. Several methods have been introduced by researchers to extract texture feature including discrete wavelet transform, Gaussian pyramid, Fourier transform etc.

C. Shape

Shapes are used to recognize all the natural object thus the shape is the external form, contour or outline of an object irrespective of its color, texture or the material composition. Many methods have been described by the researchers to extract shape feature including Fourier Descriptors, CSS Descriptors etc.

III. METHODOLOGIES

Image in Content based image retrieval is represented by the visual contents of the image such as colour, shape, texture and spatial layout. These visual contents are extracted from the database and described by the multidimensional feature vectors. Feature database is formed by the feature vectors of the images. To retrieve images, Users provide the retrieval system with images or sketched figures. The system then changes these images into feature vectors and then the retrieval is performed.

Some of the methods used by content based image retrieval system are discussed in this paper.

A. Wavelet Transform

Wavelet Transform is one of the most popular method recently applied to many image processing applications. It is a signal processing technique that is used to decompose an image or signal at multiple resolutions or levels into different frequency sub bands. On every level of decomposition the details of the signal or images are captured by the high frequency subbands such as edge

information of an image and low frequency subbands are the subsampled version of the original image. As a result the low frequency subbands can be further decomposed in high frequency subbands, this process may carry on further.

The basic idea is to separate the higher half and lower half of an image by using a low filter to subsample the image of lower half of the spectrum and to repeat the process.

Wavelets can be used in image retrieval for extracting features based on the description of the particular object. (See fig 2)

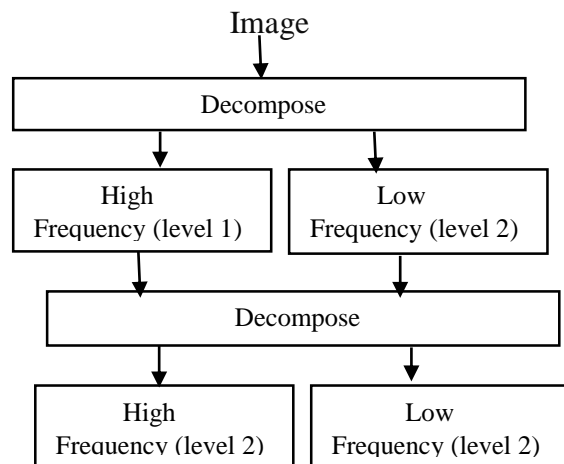


Fig 2: Wavelet Decomposition

B. Saliency Model

The perceptual quality which draws the attention of viewer by making the object differ from its neighbour is said to be Visual saliency. In CBIR, images are indexed by their visual content, such as color, texture, shapes. A color volume with edge information together is used to detect saliency regions. Using the saliency detection model less number of regions are detected in an image which may increase the efficiency of retrieving the image as false region of the image will not be included.

Saliency model produces regions in the ROI as the output

C. Bag of Features

Bag of feature method is analogous to bag of words which is used in text mining or text retrieval .Bag of words method is also suitable for large databases as in this approach visual codebook is formed by clustering extracted features of the images. A bag of feature method is one that represents an image as a set of orderless local features,it has two main concepts : Local feature and Codebook.

1). Local Features :The essential aspect of BoF concept is to construct a visual vocabulary which represents dictionary by extracting clustering features from a set of images.as the words represents the local features of the document similarly the image feature represent the local area of the image. Clustering is done for the generation of distinct vocabulary from millions of local features. Each clustered feature is a visual word. If given a query image

feature are detected and assigned to their closest matching points from the visual vocabulary.

2).Codebook Representation: Codebook is a way to represent an image by a set of local features. The concept is to cluster the feature descriptor of all the sub images called patches based on the given cluster number and each cluster represents a visual word that will be used to form the codebook. Once the code book is obtained each image can be represented by BoF frequency histograms of visual vocabulary of the code book. (See fig 3).

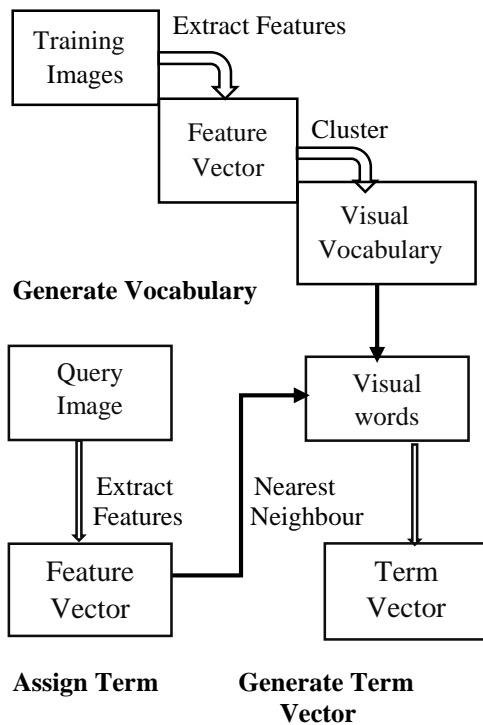


Fig3: Bag of Features Image Representation

IV. CONCLUSION

The purpose of this study is to provide an overview about the concept of content based image retrieval, functionality of content based image retrieval system. After analysing the methodologies of content based image retrieval, we concluded that only wavelet transform or Saliency model or Bag of Features cannot search and retrieve the image exactly so the researcher should find the best method of wavelet transform feature extraction, best method of Saliency model and the best method of Bag of features for extracting features, so we can get the very good results.

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