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A Review on Region-Based Image Retrieval by the Use of CBIR Technique

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ABSTRACT

Since past few years, content- based image retrieval (CBIR) has attracted considerable attention from many potential practical applications. A variety of relevance feedback i.e. RF schemes has been developed to fulfil the semantic gap between low-level visual features and high-level semantic concepts, this helps to improve the performance of CBIR systems. Among various RF approaches, support-vector-machine i.e.SVM based RF is one of the most popular techniques in this system. Despite the success, directly use of SVM as an RF scheme has two main drawbacks. First drawback is that it treats the positive and negative feedbacks equally, which is not appropriate since the two groups of training feedbacks have distinct properties. Second drawback is that, as the size of image database increases search and retrieval become slow and it affects the performance of the system. To overcome these two drawbacks, CBIR system is implemented using RBIR and which make use of the properties of images.

Key Words:-*CBIR, SVM, RBIR, RF, CSV*

1. INTRODUCTION

Since past few years, content-based image retrieval (CBIR) has gained attractive attention for its potential applications in field of multimedia management. CBIR is a technique which uses visual contents to search images from large scale image databases according to user interests. This is an active research area since the 1990s. Content-based image retrieval is also known as query by image content (QBIC). It is motivated by the tremendous growth of image records and the online accessibility of remotely stored images. An effective search scheme is required urgently to manage the huge image database. Different from the traditional search engine, in CBIR, an image query is explained by using one or more example images and low-level visual features like colour, texture, shape, etc. are extracted automatically to represent the images in the database. However, the low-level features captured from the images may not accurately characterize the high-level semantic concepts. To reduce the inconsistency in the problem, the image retrieval is carried out according to the image contents; such strategy is called content-based image retrieval. In Content-Based Approach, Images can be search based on visual features, such as color, texture, and edge information shown in fig 1 .

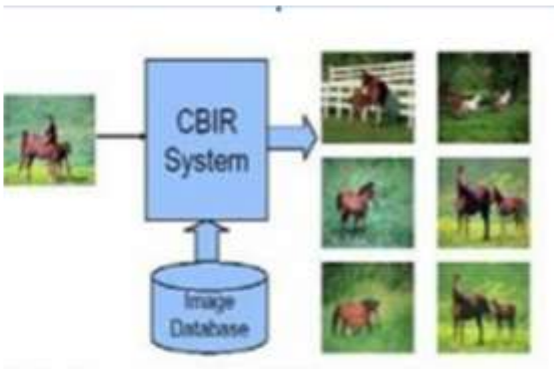

Fig.1- Control Base Image Retrieval

To narrow down the so-called semantic gap, relevance feedback (RF) was introduced as a powerful tool to enhance the performance of CBIR [4]. A self-organizing map was used to construct the RF algorithms. In one-class, SVM estimated the density of positive feedback samples [3]. Derived from one-class SVM, a biased SVM inherited the merits of one-class SVM but incorporated the negative feedback samples. By considering geometry of image low-level visual features and proposed manifold-learning-based approaches for finding out the intrinsic structure of images and improve the retrieval performance. With this observation, “all positive examples are alike; each negative example is negative in its own way,” RF was formulated as a biased subspace learning problem, in which there is an unknown number of classes, but the user is only concerned about the positive class.

Fig.2- Typical set of positive and negative feedbacks samples in RF iteration.

SVM RF approaches ignore the basic difference between two distinct groups of feedbacks, i.e. all positive feedbacks shares a similar concept while each negative feedback usually varies with different. A typical set of feedback samples in RF iteration is shown in above fig 1. Traditional SVMRF techniques treats positive and negative feedbacks equally. Using SVM as an RF scheme directly is potentially damaging to the performance of CBIR systems. One problem arise from the fact that different semantic concepts live in different subspaces and each image can live in many different subspaces and it is the goal of RF schemes to figure out “which one”. However, it will be a burden for traditional SVM-based RF schemes for tunning the internal parameters to adapt to the changes of the subspace. Such difficulties have severely reduces the effectiveness of traditional SVM RF approaches for CBIR. This problem overcomes by implementing CBIR as both offline and online.

Before we get too in-depth, let’s have a look on few important terms.
When building an image search engine ,we will first have to index our dataset. Indexing a dataset is the process of quantifying our dataset by utilization of an image descriptor to extract features from each image.
An image descriptor defines the algorithm that we are utilizing to describe our image.

For example:

- The mean and standard deviation of each Red, Green, and Blue channel, respectively,
- The statistical moments of the image to characterize shape.
- The gradient magnitude and orientation to describe both shape and texture.

The important point here is that the ***image descriptor governs*** how the image is quantified and ***Features*** are the output of an ***image descriptor***. If you put an image into the image descriptor, you will get ***features*** on the other end. In the most basic terms, ***features*** or ***feature vectors*** are just a list of numbers used to abstractly represent and quantify images.

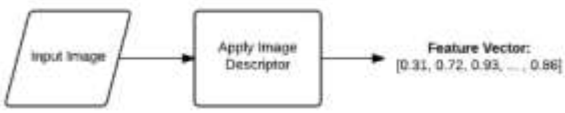

Fig. 3- The pipeline of an image descriptor.

Here, after presenting image to the descriptor and after applying image descriptor, a feature vector (i.e a list of numbers) is returned which is used to quantify the contents of the image. Content-based image retrieval (CBIR) emerged as a novel approach to efficiently retrieve relevant images. CBIR techniques tends to retrieve the images that are visually similar to a given query image. For typical CBIR system, the user provides the system with an image as a query, and seeks relevant images.

2. METHODOLOGY

1] Defining your image descriptor: At this level you need to decide what aspect of the image you want to describe. Are you interested in the color of the image? Or The shape of an object in the image? or do you want to characterize texture?

2]Indexing your dataset: Now that you have your image descriptor defined, your job is to apply this image descriptor to each image in your dataset, extract features from these images, and write the features to storage (ex. CSV file, RDBMS, Redis, etc.) so that they can be later compared for similarity.

3] Defining your similarity metric: Cool, now you have a bunch of feature vectors. But how are you going to compare them? Popular choices include the Euclidean distance, Cosine distance, and chi-squared distance, but the actual choice is highly dependent on your dataset and the types of features you extracted.

4]Searching: The final step is to perform an actual search. A user will submit a query image to your system (from an upload form or via a mobile app, for instance) and your job will be to (1) extract features from this query image and then (2) apply your similarity function to compare the query features to the features already indexed. From there, you simply return the most relevant results according to your similarity function.

Again, these are the most basic 4 steps of any CBIR system. As they become more complex and utilize different feature representations, the numbers of steps grow and you'll add a substantial number of sub-steps to each step mentioned above. But for the time being, let's keep things simple and utilize just these 4 steps.

Let's take a look at a few graphics to make these high-level steps a little more concrete. The figure below details Steps 1 and 2:

Fig.4-flowchart representing the process of extracting features from each image in the dataset.
We start by taking our dataset of images, extracting features from each image, and then storing these features in a database.
We can then move on to performing a search (Steps 3 and 4):

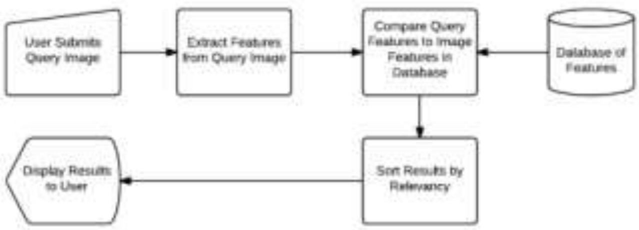

Fig.5- Performing a search on a CBIR system.

A user submits a query, the query image is described, and the query features are compared to existing features in the database, and results are sorted by relevancy and then presented to the user.First, a user must submit a query image to our image search engine. We then take the query image and extract features from it. These "query features" are then compared to the features of the images we already indexed in our dataset. Finally, the results are then sorted by relevancy and presented to the user. Typically, CBIR systems rely on image content to search and retrieve similar images. CBIR system consists of two main components. The first one represents the offline phase. It is also called data insertion component. It includes the preprocessing task to enhance the image quality for specific retrieval purposes. The extracted features are then used to represent the database image. The second component of CBIR system is the online phase that is also called query-processing phase. In this step, the user submits his query image through a user interface. Then, the system extracts the visual feature from the query image, and computes the similarity between the query visual features and the database images in the considered feature space. Finally, the system displays the retrieved images.

3. THE GOAL

Our goal here is to build a personal image search engine. Given our dataset of vacation photos, we want to make this dataset "search-able" by creating a "more like this" functionality — this will be a "search by example" image search engine. For instance, if I submit a photo of sail boats gliding across a river, our image search engine should be able to find and retrieve our vacation photos of when we toured the marina and docks.

Take a look at the example below where I have submitted an photo of the boats on the water and have found relevant images in our vacation photo collection:

Fig.6-Color histogram.

By utilizing a color histogram as our image descriptor, we'll be we'll be relying on the *color distribution* of the image. Because of this, we have to make an important assumption regarding our image search engine:
Assumption: Images that have similar color distributions will be considered relevant to each other. Even if images have dramatically different contents, they will still be considered "similar" provided that their color distributions are similar as well.
This is a really important assumption, but is normally a fair and reasonable assumption to make when using color histograms as image descriptors.

4. CONCLUSIONS

In this paper we explored how to build an image retrieval engine to make our vacation photos search-able.
We utilized a color histogram to characterize the color distribution of our photos. Then, we indexed our dataset using our color descriptor, extracting color histograms from each of the images in the dataset.
To compare images we utilized the chi-squared distance, a popular choice when comparing discrete probability distributions.
From there, we implemented the necessary logic to accept a query image and then return relevant results.
The proposed system tries to fulfil the following objectives:

1] To narrow down the searching space in the similarity computation step and to enhance the retrieval speed, we add classification procedure into our method.

2] Considering the tough work of the representative samples selection, we adopt SSL to decrease the workload of choosing train set.

3] Due to the inevitable misclassification, a classification error recovery scheme is presented here to reduce the influence to the retrieval behavior.

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