Chapter 5
Retrieval of Multimedia Information Using Content-Based Image Retrieval (CBIR) Techniques

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ABSTRACT

This chapter will focus on the concept of Content-based image retrieval. Searching of an image or video database based on text based description is a manual labor intensive process. Descriptions of the file are usually typed manually for each image by human operators because the automatic generation of keywords for the images is difficult without incorporation of visual information and feature extraction. This method is impractical in today's multimedia information era. "Content-based" means that the search will analyze the actual contents of the image rather than the metadata such as keywords, tags, and descriptions associated with the 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. Several important sections are highlighted in this chapter, like architectures, query techniques, multidimensional indexing, video retrieval and different application sections of CBIR.

INTRODUCTION

There is something in this world that no word can convey it. It has to be seen. The facial expressions of an actor while playing Charlie Chaplin. Try to imagine a doctor describing the Angiogram report without seeing them. It is beyond words. Interpretation of what we see is hard to characterize. Pictures have to be seen and searched as pictures: by object, style and purpose (Smeulders et al., 2000).

T. Kato (1992) introduced the term *Content-Based Image Retrieval* (CBIR), to explain his research work on automatic retrieval of images from a database by color and shape features. Content-Based Image Retrieval (CBIR), a technique which uses visual contents to search images from large scale image

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databases has been an active research area. Increasing popularity the internet and field of digital imaging have resulted in an exponential raise in the volume of digital images. The need to find a desired image from a collection of databases has wide applications, such as, in crime prevention by automatic face detection, finger print, medical diagnosis, to name a few. Early techniques of image retrieval were based on the manual textual annotation of images, a cumbersome and also often a subjective task. Texts alone are not sufficient because of the fact that interpretation of what we see is hard to characterize by them. Hence, contents in an image, color, shape, and texture, started gaining prominence (Wang, et al., 1998).

In content-based image retrieval we are focusing on *content* of the image not the total part of the image. *Content-based* means that the search will analyze the actual contents of the image rather than the metadata such as keywords, tags, and descriptions associated with the 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. During the retrieval procedure features and the descriptors of the query are compared to those of the image in the database in order to rank of the each index image according to its distance to the query.

Content-Based Image Retrieval (CBIR) is the application of computer vision to the image retrieval problem. Some of the major areas of application are Art collections, Medical diagnosis, Crime prevention, Military, Intellectual property, Architectural and engineering design and Geographical information and Remote sensing systems (Eakins et al., 1999).

CBIR involves the subsequent four parts in system designing, collection of data, feature extraction and build up feature database, searching in the database, process index wise and generate the result.

1. **Data Collection:** In case of Content-based image retrieval images are treated as data, and data collection is processed using Internet spider program that can collect webs automatically to interview Internet and do the gathering of the images on the web site, then it will go over all the other webs through the URL, repeating this process and collecting all the images it has reviewed into the server. In an Internet web resources are treated as a node and hyperlink of that web resources are treated as edges and the overall concept is called web graph.
2. **Feature Extraction and Build up Feature Database:** The query image can be analyzed to extract the visual features and can be compared to find matches with the index of the images stored in the database. The extracted image features are stored as meta-data, and images are indexed based on these meta-data information.
3. **Searching in the Database:** This meta-data information comprises some measures of the extracted image features. Then the extracted features of the example image are compared with the features of the images stored in the metadata database. Then the difference will be calculated and the values which are less than some defined threshold produced as output.
4. **Index Wise Processing and Result Generation:** Index the image obtained from searching due to the similarity of features, and then returns the retrieval images to the user and allows the user select those images. If the user is not pleased with the searching result, he/she can regenerate the retrieval query and searches the database again.

In the past decade, several image retrieval systems have been successfully developed, such as the IBM QBIC System (Flickner et al., 1995), developed at the IBM Almaden Research Center, the VIRAGE System (Gupta & Jain, 1997), developed by the Virage Incorporation, the Photobook System (Pentland