Chapter 6
A Hybrid Approach to Content–Based Image Retrieval

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ABSTRACT

Digital image storage and retrieval is gaining more popularity due to the rapidly advancing technology and the large number of vital applications, in addition to flexibility in managing personal collections of images. Traditional approaches employ keyword based indexing which is not very effective. Content based methods are more attractive though challenging and require considerable effort for automated feature extraction. In this chapter, we present a hybrid method for extracting features from images using a combination of already established methods, allowing them to be compared to a given input image as seen in other query-by-example methods. First, the image features are calculated using Edge Orientation Autocorrelograms and Color Correlograms. Then, distances of the images to the original image will be calculated using the L1 distance feature separately for both features. The distance sets will then be merged according to a weight supplied by the user. The reported test results demonstrate the applicability and effectiveness of the proposed approach.

INTRODUCTION

Due to the rapid development of the internet and the world-wide web, multimedia information and visual data has become more common than ever. Moreover, with the ease of access to image databases and the increase in the availability of multimedia information, the need for efficient image retrieval has become a matter of concern. The widespread technologies of today let us browse the visual data related to its text content; that is, its corresponding tag. Although the available text based search engines are in high demand, they are not always sufficient; merely depending on the textual information and indexing is hardly satisfactory in terms of availability, accuracy and effectiveness. Some of the drawbacks with the methods used for indexing can be viewed as: (i) they do not conform to a standard description language; (ii) they are inconsistent; (iii) they are subjective; and (iv) they are time consuming (Idris & Panchanathan, 1997). In order to meet the needs of the users and overcome the drawbacks of the methods based on textual information and indexing, content based image retrieval (CBIR) has been the point of focus in many recent research efforts, especially since the early 90s.

The large number of diversified image resources had bottlenecked efficient image retrieval methods. For instance, if images from last century (black and white) and contemporary news media are mixed together and stored in a database, difficulties arise when multiple criteria are required to retrieve a set of similar images. The hybrid approach for CBIR is therefore advantageous due to the complex nature of images with current technologies. By using hybrid retrieval criteria, images are more accurately retrieved and compared.

The development of automated CBIR systems has been an attractive research area due to its wide range of applications in critical fields like bioinformatics and medical imaging, space images, personal collections, homeland security, etc. There are many CBIR approaches described in the literature, e.g., (Chang & Jay Kuo, 1993; Howarth & Ruger, 2004; Kubo et al. 2003; Smith & Chang, 1996; Sun & Ozawa, 2003); the two papers (Veltkamp & Tanase, 2000; Zachary & Iyengar, 1999) include good surveys of CBIR systems. Moreover, various instances of hybrid methods are present in the literature. For instance, Gebara and Alhajj (2007) introduced a combination method using data mining techniques; feature-based methods are presented in (Howarth & Ruger, 2004; Ziou et al., 2009), where hybridized features can be used to generate CBIR systems; an automated system is covered in (Smith & Chang, 1996) with hybridized methodology.

Some of the known systems could be briefly mentioned as follows. QBIC (Niblack et al., 1993) is one of the most-well known and earliest content-based image retrieval systems. The VIR Image Engine (Bach et al., 1996), developed by Virage Inc., is similar to QBIC in the sense that it supports querying by color, shape, layout and texture. Multimedia Analysis and Retrieval System (MARS) (Huang et al., 1996) project was started at the University of Illinois to develop an effective multimedia database management system. Photobook (Pentland, et al., 1994) project was developed at MIT and uses the features of the images for comparison. In WBIIS (Wang et al., 2001), Wang et al. developed an image retrieval system using Daubechies wavelet transformation. In SIMPLICITY (Wang et al., 2001), Wang et al. developed an image retrieval system in which they developed different image features for different image types. WaveQ (Gebara & Alhajj, 2007) which was developed earlier at the University of Calgary is another CBIR system using Wavelets to narrow down the search to a single cluster. Then, the similar images are retrieved from the closest cluster.

The problem may be roughly defined as follows. Given a query image, the term CBIR represents the process of retrieving related images from a collection of images on the basis of image features such as color, texture and shape. The

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