Chapter 3

Intelligent Information Description and Recognition in Biomedical Image Databases

Khalifa Djemal
University of Evry Val d’Essonne, France

Hichem Maaref
University of Evry Val d’Essonne, France

ABSTRACT

There is a significant increase in the use of biomedical images in clinical medicine, disease research, and education. While the literature lists several successful methods that were developed and implemented for content-based image retrieval and recognition, they have been unable to make significant inroads in biomedical image recognition domain. The use of computer-aided diagnosis has been increasing. It is based on descriptors extraction and classification approaches. This interest is due to the need for specialized methods, which are specific to each biomedical image type, and also due to the lack of advances in image recognition systems. In this chapter, the authors present intelligent information description techniques and the most used classification methods in an image retrieval and recognition system. A multicriteria classification method applied for sickle cells disease image databases is given. The recognition performance system is illustrated and discussed.

INTRODUCTION

To understand the influence of the images database on the description method and the appropriate classification tool, it is more convenient to subdivide the image databases into two categories. The first category consists of image databases usually heterogeneous. In this context, the objective of images
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Recognition system is to assist the user to intelligently search in images database a particular subject adapting to the subjective needs of each user. The system seeks to be as flexible as possible, for example, offering the user to refine his request for a more precise result. The second category concerns specific image databases. In this context, the images are most often a uniform semantic content. The concerned applications are generally professional. To index these image databases, the user must integrate more information defined by the expert to develop a specific algorithm. The objective is to optimize system efficiency and its ability to respond as well as the expert. Image retrieval in such databases is a specific problem of image recognition in biomedical image database. This categorization is taken into account when developing any content image retrieval system. Indeed, to obtain satisfactory results, the choice or development of new description methods must be appropriate for the considered type of images database. This is due simply to the great difficulty in obtaining a universal description algorithm.

Biomedical images also play a growing role, often central in many aspects of biomedical research, particularly in the field of genomics and biotechnology for health, but also in pharmaceutical research. These biomedical images provide anatomical information, functional, and even physical tissues and organs with spatial and temporal resolutions on the increase. Quantitative analysis of these data provides an unparalleled source of information for the development and testing of new drugs and new therapeutic approaches. Finally, better use of biomedical images absolutely requires the development of new methods for analyzing such images. Joint approaches to description, analysis, and classification algorithms appear to be perfectly suited to address this problem description and content image retrieval in large image databases.

Image recognition systems require two essential steps: the images description and their classification. The choice of descriptors is mainly due to their capacity to describe images and the combination made by the fusion of this set allows to achieving a better description. On the classification, the kernel based classifiers such as RBF and SVM, and multicriteria approach are often chosen. This choice is justified by the qualities they offer in terms of speed, precision and response time.

The study of content based image recognition has led us to experiment different description techniques and methods of classification. The objective is to evaluate these techniques while studying the influence of selected descriptors and their contribution in terms of image recognition efficiency. To this end, several tests were performed by using several samples of images. In this chapter, the results are presented and discussed in relation with the used images database, the selected descriptors and classification techniques. The different sections of this chapter recall and present the importance and the influence of the description and classification in image content recognition system. Indeed, in section 3 different description methods and two classification approaches are presented and discussed. We illustrate the principle and obtained results of these methods on sickle cells disease application in sections 4 and 5.

RELATED WORKS

The image recognition system consists of extracting from a database all the similar images to a request image chosen by the user. Indeed, the system has attracted research interest in recent years. Principal difficulties consist on the capacity to extract from the image the visual characteristics, the robustness to geometrical deformations and the quantification of similarity concept between images. Indexation and recognition are given from classification methods accomplished on image descriptors.
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