Chapter 3
Biomedical Image Processing Overview

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ABSTRACT

Over the years, there are different sorts of medical imaging have been developed. Where the most known are: X-ray, computed tomography (CT), nuclear medicine imaging (PET, SPECT), ultrasound and magnetic resonance imaging (MRI), each one has its different utilities. Various studies in biomedical informatics present a process to analyze images for extracting the hidden information which can be used after that. Image analysis combines several fields that are classified into two categories; the process of low-level, that requires very little information about the content image and the process of high-level, which may need information about the image content. The topic of this chapter is to introduce the different techniques for medical image processing and to present many research studies in this domain. It includes four stages, firstly, we introduce the most important medical imaging modalities and secondly, we outline the main process of biomedical image.

1. INTRODUCTION

The large amount of medical images generated in exponential manner demands a serious need to use technology to treat patients by analyzing medical images. Medical imaging has an efficient role in the health care process. It is useful for specialists to diagnose, and to treat diseases. Several imaging techniques are available and showing, in detail, the structure and the functionalities of the body. Over the years, advances in medical technology have greatly increased information density for imaging studies. There are different sorts of medical imaging that have been developed. The most known are: X-ray, computed tomography (CT), nuclear medicine imaging (PET, SPECT), ultrasound and magnetic resonance imaging (MRI), each one has its different utilities. Various studies in biomedical informatics present a process to analyze images for extracting the hidden information which can be used after that. However, they share

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the common methodology of transforming raw imaging data, through knowledge-based data mining algorithms, into clinically relevant information. The analysis of biomedical image data is a complex procedure involving several processing phases, such as data Biomedical image mining combines several techniques; data mining, artificial intelligence and algorithms, because they may need advanced image processing and classification knowledge and skills from the side of the biomedical expert.

The topic of this chapter is to introduce the different techniques of mining medical images and to present some techniques for medical image processing. It includes seven sections. Section 2 will introduce the most important medical imaging modalities. Section 3 gives an overview of the mining medical images. In section 4, the most important medical image mining techniques are cited. In section 5, biomedical Image Processing is introduced. Finally, section 6 concludes the chapter.

2. MEDICAL IMAGING MODALITIES

Thanks to modern medicine technology, medical imaging has known major achievements. So we can know more about the human body. Over the years, there are different sorts of medical imaging that have been developed using different technologies and provide different types of images. In the following the most known types are presented.

- **X-ray:** Is a form of radiation, similar to light and microwaves. It traverses the body to record two-dimensional medical images for use in patient diagnosis and treatment. In the past, X-ray images were recorded on hard film copy. Currently, medical images are a set of digital files stored electronically, showing a certain part of the human body (Goldstein et al., 2012). This digital data facilitates the images processing.
- **Computed Tomography (CT):** Is a highly specialized x-ray used to produce cross-sectional layers that show detailed images inside the body. Computer tomography is more detailed than ordinary x-rays (Hsieh, 2009).
- **Nuclear Medicine Imaging (PET, SPECT):** Consists of injecting, breathing or swallowing a radioactive 'tracer' to produce an image that exams body function. The rays emitted by this material are used to detect the location of the tracer in the body and create images. It looks at how a specific organ is working (Mettler & Guiberteau, 2011).
- **Ultrasound:** Produces moving images of the inside of the body using high-frequency sound waves involves the use of a small transducer, which collects the sounds that bounce back and a computer uses those sound waves to create an image (Lynn, Zwemer, Chick, & Miller, 1942).
- **Magnetic Resonance Imaging (MRI):** Is a type of scan that using strong magnetic fields and radio waves to get detailed images of the body. These images can be stored and handled by a computer. One exam can produce dozens or hundreds of images (Liang & Lauterbur, 2000).

3. MINING MEDICAL IMAGE

The accumulation of the biomedical data available on the web, especially imagery data, needs some specific treatment. This increase is due to technological and scientific progress, that makes searching for pertinent information through large collections of images very difficult, hence the need of an adequate