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Extended abstract

Cardiac image processing techniques

Nihad Mešanović[1]*, Elnur Smajić[1]

[1] University Clinical Center Tuzla, Tuzla, Bosnia and Herzegovina

* Corresponding author phone: +387 (35) 303-500, e-mail: Nihad.Mesanovic@ukctuzla.ba

Abstract

Heart disease is the leading cause of death in the modern world. Cardiac image processing is now routinely applied for detecting, classification and diagnosis of heart diseases. One of the most common uses of processing methods that are now widely applied are cardiac segmentation [1] and registration methods [2], that are used in order to extract the detailed anatomy and function of the heart.

Automatic segmentation plays a central role when inspecting reconstructed 3D cardiac images from CT or MR scanners. An accurate classification of the different cardiac regions is usually the first step of tasks like: cardiac visualization, coronary artery inspection, measurement of the ejection fraction for the left and right ventricles and wall motion analysis.

In a clinical context, physicians often mentally integrate image information from different modalities. Automatic registration, based on computer programs, might, however, offer better accuracy and repeatability and save time [3]. Cardiac image registration remains a challenge because of the numerous specific problems mainly related to the different motion sources (patient, respiration, heart) and to the specificity of each imaging modality. Up to now, no general method could automatically register any modality with any other modality so far.

This paper presents a survey of shape modeling applications to cardiac image analysis from MRI, CT, echocardiography, PET, and SPECT and aims to introduce new methodologies in this field, classify major contributions in image-based cardiac modeling, provide a tutorial to beginners to initiate their own studies, and introduce the major challenges of registration and segmentation and provide practical examples.

Image-driven processing methods, such as thresholding, region-based or edge-based techniques, or else pixel classification [4-6], provide a limited framework for further medical image analysis. They can include geometrical information, as well as high level information, in the so-called shape prior based segmentation framework, or through active shape models and active appearance models. At last, atlas guided segmentation also make use of a set of manually segmented images.

By using different analysis software of cardiac images, CAD prototypes can be used in clinical routines in order to provide a computer output as a second reader to assist physicians in the detection of abnormalities, quantification of disease progression and differential diagnosis of lesions [7]. Computerized analysis of cardiac images in combination with artificial intelligence can be used in clinical practice and may contribute to more efficient diagnosis.

Keywords

Cardiac image processing • Analysis • Artificial intelligence

Literature

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