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# Left ventricle Hermite-based segmentation

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## Abstract

In recent years, computed tomography (CT) has become a standard technique in cardiac imaging because it provides detailed information that may facilitate the diagnosis of the conditions that interfere with correct heart function. However, CT-based cardiac diagnosis requires manual segmentation of heart cavities, which is a difficult and time-consuming task. Thus, in this paper, we propose a novel technique to segment endocardium and epicardium boundaries based on a 2D approach. The proposal computes relevant information of the left ventricle and its adjacent structures using the Hermite transform. The novelty of the work is that the information is combined with active shape models and level sets to improve the segmentation. Our database consists of mid-third slices selected from 28 volumes manually segmented by expert physicians. The segmentation is assessed using Dice coefficient and Hausdorff distance. In addition, we introduce a novel metric called Ray Feature error to evaluate our method. The results show that the proposal accurately discriminates cardiac tissue. Thus, it may be a useful tool for supporting heart disease diagnosis and tailoring treatments.

*Keywords:* Active shape models, level sets, steered Hermite transform, left ventricle segmentation, local binary patterns, Ray Feature error

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## 1. Introduction

According to the World Health Organization, cardiovascular diseases rank number one as cause of death worldwide and were responsible for 31% of all deaths in 2012 [1]. Regarding heart failure, although it is a serious condition, it does not necessarily mean cardiac arrest. Tobacco, unhealthy diet, and obesity represent major risk factors for heart failure [2]. About 5.7 million adults in the United States have suffered from heart failure and about half of the people who develop heart failure die within 5 years of diagnosis [3]. Every year, approximately

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