A 3D CAD Tool for Body Fat Identification

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Abstract

In recent years non-invasive medical diagnostic techniques have been used widely in medical investigations. Among the various imaging modalities available, Magnetic Resonance Imaging is very attractive as it produces multi-slice images where the contrast between various types of body tissues such as muscle, ligaments and fat is well defined. The distribution of fat tissue in the body is an important measure of health and overall fitness and is not well quantified by the body mass index (BMI) which is currently the measure most widely used to quantify body fat content. The aim of this work is to present the development of a fully automatic CAD tool that can be applied to identify the actual fat mass in MR data. The MR acquisition protocol currently in use involves imaging the patient in a number of successive coronal sections in order to achieve a full body scan. As the greyscale in-homogeneities between adjacent sections are quite significant, to make this data suitable for automated CAD we have been forced to devise a procedure to alleviate as much as possible the discontinuities in the unprocessed data. The devised unsupervised segmentation algorithm that is applied to segment the fatty tissues has three main steps. The first step pre-processes the data using a feature preserving diffusion-based technique to improve the local homogeneity and reduce the level of image noise. The second step extracts the image areas representing fat tissues by using an unsupervised clustering algorithm. Finally, image refinements are applied to reclassify the pixels adjacent to the initial fat estimate and to eliminate outliers. The devised CAD tool has been tested on a database of 42 patients and the experimental data indicates that the proposed tool returns accurate results.