Abstract

Now a days ultrasound is widely used for medical and biological therapies and diagnostics. This image modality is responsible for one of 5 medical images for the diagnosis of different pathologies; however, the use of 2D ultrasound have some disadvantages that can be eliminated by using 3D ultrasound. In this work we present the available technics for real time tracking of a clinical ultrasound probe, and two methods for volume reconstruction from a set of dimensional tracked ultrasound images in mode B (one voxel based method and one pixel based method). The calibration problem of the ultrasound probe is also presented here, along with the details for the implementation of the two cross-wire calibration method, which presented an accuracy error of 0.56mm and a precision of 0.249mm. As case study, we present the reconstruction of ultrasound volumes of breast phantoms with tumors. Both reconstruction methods showed similar results, however the voxel based method presented more advantages than the pixel based method.

Since breast cancer has become the number one cause of death among women around the world, it is very important to have fast and accurate diagnostic methods to improve the prognosis of a patient. Several diagnostic methods using ultrasound images have been proposed for the diagnosis and classification of breast tumors, but the visualization of lesions in ultrasound images is a difficult task due to some intrinsic characteristics of the images. Accurate automatic segmentation methods of breast tumors can help the experts to achieve faster diagnoses, and it is a key stage of fully automatic systems for breast cancer diagnosis using ultrasound. In this work we present the implementation of an automatic segmentation method of breast tumors that uses intensity and texture information. Also, we present a comprehensive evaluation of the ability of different texture descriptors to enhance the contrast between the tumor and the surrounding tissue, and how they affect the outcome of the segmentation method; the evaluated texture descriptors in this work are extracted from histogram, co-occurrence and run-length statistics, and the results showed that the short run emphasis of the run-length matrix is the texture descriptors with better results in contras enhancement and the automatic segmentation of breast tumors. Two methods are proposed in this work for the segmentation of the skin and adjacent tissue in breast tumor ultrasound images, in order to construct a constitutive mesh that represents the patient anatomy that can be used in several applications.

In this work two applications are presented, which can benefit from the methods proposed here: Breast tumor biopsies with needles and breast tumor instrumented palpation.