Abstract

This work presents a complete and automated process of multimodal registration between X-ray and magnetic resonance mammograms to aid radiologists in breast cancer diagnosis. This process allows radiologists, for the first time, to mark points in the magnetic resonance images of the breast and without any manual intervention provides their corresponding points in both breast X-ray images, craniocaudal and mediolateral, and vice versa.

In the developed methodology magnetic resonance images and X-ray images are automatically segmented using the Otsu method and the C-Means method, respectively. The magnetic resonance images are compressed in both directions (craniocaudal and mediolateral) using a biomechanical model of the breast. Finally, a projection of both compressions are performed and registered with the original X-ray images using affine transformations and non-rigid registration methods.

The process has qualitatively and quantitatively been validated by two expert radiologists from two different hospitals. The qualitative validation had been carried out using random points and showed very good results as well as a good agreement between both radiologists. The quantitative study showed a medium error of less than 5 mm between points marked by radiologists and the corresponding points obtained by the application.

The main contribution of this thesis is the development of a complete methodology to automatically register X-ray and magnetic resonance images of the breast, which objective is to locate suspicious lessions in one image modality using a determined position from the other image modality. Results show that this process can accelerate the mammographic screening processes since it permits radiologists to estimate the position of lessions with a clinically acceptable error.