14—1 Machine Vision for Medicine of 21st Century

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Abstract

Medical Image Analysis, Surgery Simulation, and Medical Robotics are young scientific fields with huge potential applications and many challenging research problems. I will present a list of such problems including rigid and deformable registration of multimodal brain images, motion analysis from dynamic sequences of cardiac images, and soft-tissue modeling for liver surgery. I will also discuss some recent advances and perspectives, and illustrate my presentation with current projects involving our research group Epidaure at INRIA. Interested readers can find a recent bibliography on the subject in the following surveys [1, 2, 3], in the proceedings of the MICCAI conference [4], or in the recent issues of the MedIA, TMI or CAS journals [5, 6, 7].

Acknowledgments

The author wants to acknowledge David Rey and the Epidaure group at INRIA for the preparation of this talk, and also Gilles Kahn for his permanent advices and support.

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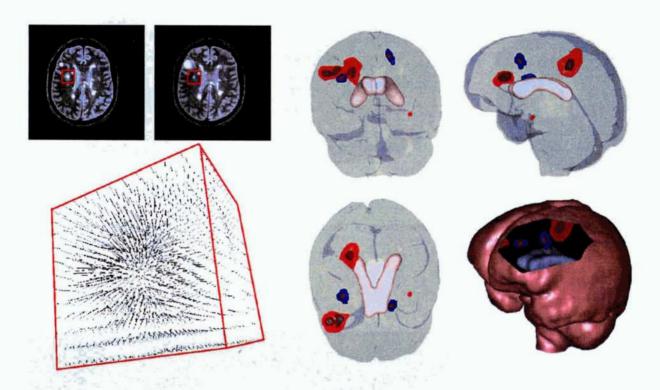


Figure 1: Automatic detection and quantification of evolving lesions from 2 successive Magnetic Resonance Images of a patient with multiple sclerosis (there is an interval of 2 weeks between the 2 images) [8].

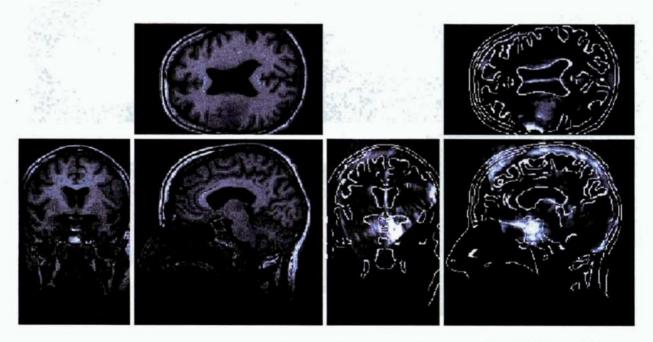


Figure 2: Automatic registration of per-operative 3-D ultrasounds with pre-operative 3-D Magnetic Resonance Image for neuroendoscopic surgery [9].



Figure 3: Automatic analysis of the deformations of the left ventricule from a dynamic sequence of tagged magnetic resonance images. [10]

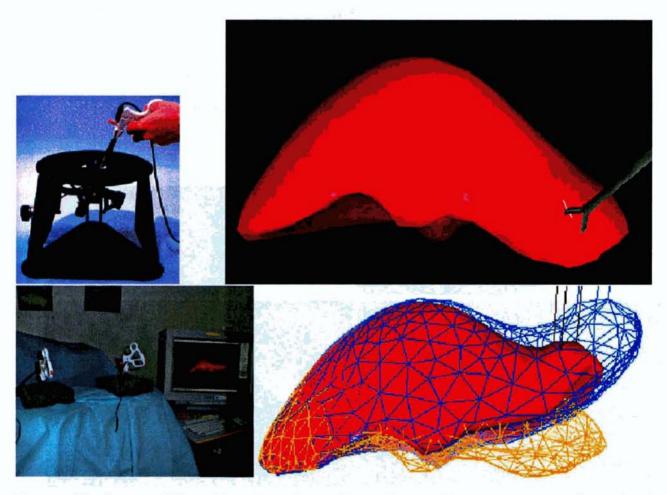


Figure 4: Non linear modelling of liver tissues for simulation of minimally invasive surgery with visual and haptic feedback [11].