

Virtual Reality and Robotics for Detection and Treatment of Abdominal Cancer in animal preclinical studies and clinical use.

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Abstract : In the fight against cancer, early tumour detection, treatment and follow-up enable to improve the survival rate of patients. However, current imaging techniques do not allow to perform these operations for tumours smaller than one centimetre. The aim of our work is to set up new techniques for the detection, 3D delineation and 4D time follow-up of small abdominal lesions from standard medical images (CT scan, MRI). It also aims at developing innovative systems making tumour resection or treatment easier with the use of pre-operative planning, simulation, augmented reality and robotized systems, increasing gesture accuracy. It also permits a real-time long distant connection between practitioners allowing them to share a same 3D reconstructed patient as well as to interact on a same patient, virtually before the intervention and really during the surgical procedure thanks to a telesurgical robot. In preclinical studies, our first results obtained from a micro-CT scanner show that these technologies allow to obtain an efficient and precise 3D modelling of anatomical and pathological structures of rats and mice. In clinical studies, our first results show the possibility to improve the therapeutic choice thanks to an improved detection and representation of the patient before carrying out the surgical gesture. Moreover, preoperative simulators including the 3D model of the operated patient offer a new way of preparing the surgical procedure. These results also show the efficiency of augmented reality that provides a virtual transparency of the patient in real-time during the operative procedure. It represents thus a new form of fight against cancer, the usefulness and pertinence of which have been proved.

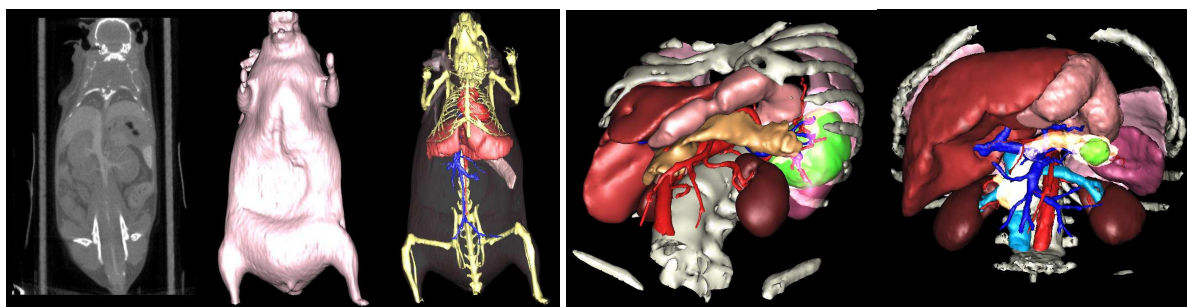


Figure 1: Automated 3D modelling of a mouse from an *in vivo* micro-CT scanner (left) and of human abdomens from CT-scans (right).

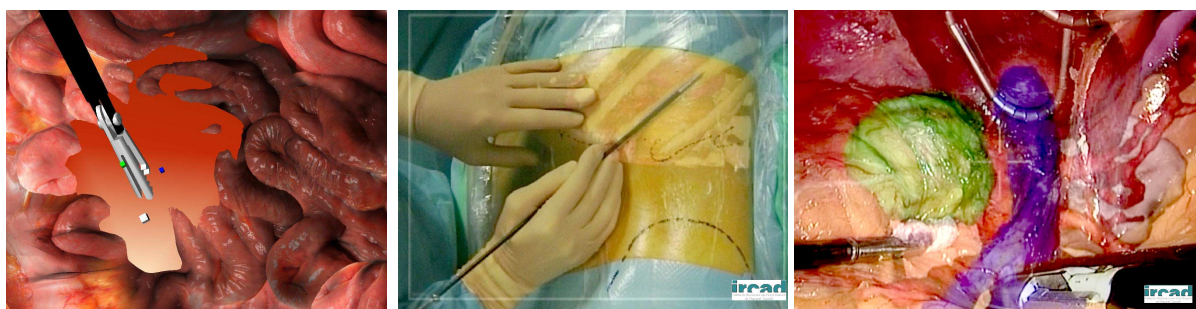


Figure 2 : Preoperative simulator from 3D modelled patient, and intra-operative augmented reality views providing a virtual transparency of the patient.

Mini CV : Luc Soler was born on 6th October 1969. In 1994, he was valedictorian at the magister at the Computer Science High School of Paris. He obtained his PhD degree in computer sciences in 1998. Since 1999, he is research project manager in computer sciences and robotics at the Research Institute against Digestive Cancer (IRCAD Strasbourg). In October 2000, he joined the surgical team of Professor Marescaux as associated Professor at the Medical University of Strasbourg. His main areas of interest are computerized medical image analysis, 3D modelling, Virtual and Augmented Reality, surgical robotics and abdominal anatomy. With IRCAD, he obtained in 1999 a Computer World Smithsonian Award for his work on virtual reality applied to surgery, and in 2003 the first World Summit Award for his work in telemedicine and virtual reality.