Computer Assisted Medical Interventions (CAMI) in France

P. Cinquin, P. Haigron, G. Morel, P. Poignet, P. Renaud, Ch. Roux, Fellow, IEEE

Abstract—We present here the domain of Computer Assisted Medical Interventions (CAMI) and the major scientific challenges it has to address. We discuss the potential interest of wider scale cooperation in CAMI, based on our experience in a French excellence network.

I. CAMI (COMPUTER ASSISTED MEDICAL INTERVENTIONS)

Medical Interventions (surgery, interventional radiology, radiotherapy) can provide a significant boost for progress in terms of patient-specific optimal planning and performance. To fulfill patient’s demand for Quality, Senior Operators demand to see beyond the immediately visible, to be assisted in their real-time vital decisions and to accede to enhanced dexterity, while junior operators request to “learn to fly” before being left alone, and Public Health Authorities and companies require demonstration of the Medical Benefit of innovations.

Computer Assisted Medical Interventions (CAMI) technology successfully brought Information Technology into the Operating Room to answer these demands but, with some exceptions, was yet unable to penetrate significantly into clinical routine practice. The objective of the mini-symposium will be to discuss the major scientific challenges in this area and to contribute to the elaboration of an international collaboration about the way to take up this challenge by an integrated approach that combines medical drive and scientific & technological push, ranging from fundamental research to industrial exploitation. This integrated approach should take into account educational issues and demonstration of a clear medical benefit in terms of Public Health.

CAMI solutions should offer the operator the possibility to see beyond the immediately visible by innovative fusion of multimodal data obtained by novel or classical sensors.

High-level planning and monitoring of the intervention should offer assistance to real-time decision-making. Miniaturized robots and solutions for augmented dexterity should offer the operator a new dimension in intervention performance.

User-centered learning strategies should exploit the educational potentialities of these technologies in order to reduce the learning curve. An adapted methodology for demonstration of the Medical Benefit of our techniques should be developed and used.

II. MAJOR SCIENTIFIC CHALLENGES

Five major challenges have to be taken up: Augmented Perception (invent new sensors, bring sensors developed in other contexts to the operating field, bring pre-operative data into inter-operative surgical views through augmented reality, combine multimodal data in an innovative way), Augmented Decision (invent new methods to model the consequences of the intervention and to analyze in real-time the performance of the intervention), Augmented Action (develop novel navigation and robotic solutions), Augmented Learning (develop novel user-centered learning strategies, involving learning models and simulators), and Demonstration of Medical Benefit (propose novel observational and interventional medical research methods, involving models of Medical Benefit and a “CAMI Observatory”). In France, these challenges are taken-up by CAMI-Labex, an excellence network that brings together the 6 French research teams that have been able to invent new concepts in this domain, to prove their feasibility, and to turn them into clinically used prototypes translated into widely disseminated industrial products. The Minisymposium offers a unique opportunity to identify how results such as software bricks, structured description of the Medical Benefit and data gathered from clinical experience in this domain can be shared at the international level. We are expecting CAMI-symposium to be a starting point for world-wide cooperation in this domain.

ACKNOWLEDGMENT
Work supported by ANR (Labex CAMI) under reference ANR-11-LABX-0004.