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Theme F "Medical Robotics for training and guidance": results and future works

Thème F « apprentissage et assistance aux gestes médico-chirurgicaux » : bilan et perspectives

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Abstract

This paper presents the projects of the Theme F "Medical Robotics for training and guidance" inside the GdR STIC Santé. Three scientific meeting days have been organized during the period 2011-2012. They were devoted to physical simulators of behavior for gesture learning, command of hand prostheses by myoelectric signals or brain activity and the manipulation of objects by the artificial hand, and the last to the use of robots for medical gestures. The next event, scheduled for early 2013, will focus on the evaluation of gesture and especially "Evaluation of gesture - To do what ?".
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Résumé

Cet article présente les activités du Thème F « apprentissage et assistance aux gestes médico-chirurgicaux » du GdR STIC-Santé. Trois journées thématiques ont été organisées durant la période 2011-2012. Elles ont porté sur les simulateurs physiques de comportements pour l'apprentissage du geste, sur la commande des prothèses de main par des signaux myoélectriques ou par l'activité du cerveau ainsi que la manipulation d'objets par ces mains artificielles, et la dernière sur l'utilisation de robots pour l'aide aux gestes médicaux. La prochaine journée, prévue en début d'année 2013, portera sur l'évaluation du geste et plus particulièrement « Evaluation du geste - Pour faire quoi ? ».

1. Aims

The Theme F "Medical Robotics for training and guidance" inside the GdR STIC Santé aims to promote interaction between scientific and medical communities and to improve the visibility of the community. Its secondary goal is to develop mutual response of the ANR (French National Research Agency) to create new collaborations between these two communities.

This research group focuses on three main themes: (1) modeling and visualization of organs; (2) learning tools; (3) interaction human / machine. Indeed, the final goal is to develop pertinent simulators and platforms demonstration for medical training and scientific research.

The scientific challenges concern (1) the definition of new biomechanical models, parallel algorithms and data structures to obtain real-time simulation of organs [1, 2, 3, 4, 5]; (2) the elaboration of pertinent scenarios of training and their evaluation [6, 7, 8, 9, 10]; (3) and the proposition of new physical devices for the user to interact with the numerical simulations [11, 12, 13, 14, 15, 16, 17, 18, 19].

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2. Results for the period 2011-2012

During the last period, three scientific meeting days were organized, each one being focused on a specific research topic, and mobilizing the different communities. Note that, some of these days are organized with research groups of the GdR Robotique.

More details about these meeting days are presented on the research group Web page: http://stic-sante.org/gdr-presentation/45-themef.

November 7, 2011 - The first meeting was devoted on the physical simulation of the behavior. Indeed, physical simulation is essential and coupling numerical simulation / physical simulation remains a scientific lock for learning and assistance actions of medical gestures. Moreover, following the meeting days organized in 2008 and 2009 by the research group, around the modeling and simulation of organs, which have dealt with aspects of numerical simulation and haptic interactions, we wanted to now focus our attention on the simulation of behavior.

November 25, 2011 - The second scientific meeting day was devoted to review the research activities in the field of prostheses active hand in France including commercial products available and developments in laboratories. Moreover, we are interested in the control of prostheses by

myoelectric signals, in the developments of brain machine interfaces, and in the manipulation of objects by artificial hands, as in "full hand" as your fingertips.

May 30, 2012 - The third meeting was an open meeting day with several presentations: design of compliant mechanisms for surgical robotics; co-operation of an ultrasound probe for assisted biopsy of the prostate; handling magnetic gastrointestinal endoscopy; automatic recognition of high level and low level surgical tasks in the operating room from video images; robotics use in confocal endomicroscopy.

Following the different meeting days of the research group, a consortium has been created with LIRIS (Université Lyon 1), laboratory TIMC-IMAG (Université Grenoble 1), CAOR (Ecole des Mines ParisTech), laboratory Ampère (INSA de Lyon), LSE (Université Grenoble 2), Professor Olivier Dupuis (MD, HCL Lyon-Sud) and the society Didhaptic of Laval. This consortium has presented the SAGA project (Simulator for learning medical gestures of childbirth) to the ANR. It has been accepted (2013-2016).

3. Future plans

The next meeting will take place in March 2013 focused on the evaluation of the gesture. Moreover, we plan to organize in 2013 a school about the elaboration of medical simulators for training. This school will present issues of medical simulation (modeling of organs from medical data, biomechanical models, constitutive laws of organs, modeling interactions between organs and medical devices, etc.), and the coupling with suitable haptic interfaces. It will be open to students and researchers in this community.

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