2 Year Post-doctoral Research Position
Synthesis and Simulation of Surgical Process Models

Environment

To foster research and innovation at highest international level, the french government has launched the program "Investissements d'Avenir". As part of the former, the program "Laboratoires d'Excellence" is assigned 1 billion Euros in capital, for a 10 years period. The CominLabs (http://www.cominlabs.ueb.eu) is an initiative selected as part of the "Laboratoires d'Excellence" program by the French ministry of research and education. It has been assigned 40 Million Euros in capital, resulting in an effective annual funding of 1.4 Million Euros for a 10-year period. The CominLabs has been the only Laboratoire d'Excellence selected in the area of software sciences. One research area of CominLabs is ICT for personalized medicine. Within this challenge, the project S3PM (« Synthesis and Simulation of Surgical Process Models ») has been selected as one of the first funded projects.

Proper computer assistance requires models of both conceptual and procedural knowledge. In surgery, focus has been done on conceptual knowledge with computation of realistic patient specific models from multimodal images and signals. In S3PM, we aim at computing generic models of surgical procedures from synthesis of structured recordings of patient specific procedures from surgical cases observations. We also aim at representing such generic models of procedural knowledge in order to be executed, for instance, on simulation engines. In this project we propose to study and adapt the methods developed by MediCIS, S4, and VR4i for computing, from individual recordings of procedures, generic surgical process models and representing and simulating them. The objective is to develop an enabling technology for procedural knowledge based computer assistance of surgery. In this project, we demonstrate its potential added value for high-level abstraction teaching applications.

Missions and activities

The post-doctoral research is placed in the context of computer assisted surgery. More specifically, it aims at better understanding and formalizing surgical strategies and decision making process. For a specific patient who benefited from a surgical treatment, the followed surgical strategy can be described by a patient specific surgical process model (SPM). This SPM includes the list of the actions performed by the surgeon all along the surgical procedure. The precise objective of the postdoctoral position is to investigate new approaches for generating surgical knowledge from patient specific surgical process models. This surgical knowledge will be modelled by generic surgical process models.

The candidate will have to investigate a methodology for aggregating patient specific SPMs into generic SPMs, as well as new directions for representing, analyzing, and

executing these gSPMs. Graph representations as well as probabilistic networks will be studied. The added value of ontological representation in the modelling of the gSPMs will be studied. Finally the candidate will validate the approaches in the context of surgical teaching applications. Databases of patient specific SPMs in neurosurgery, interventional neuroradiology and eye surgery are already available for testing and validating these approaches.

Competence and Profile

The candidate should have a PhD in information processing, analysis or related subjects. Experience and publications related to process modeling or workflow analysis are a must. Programming skills are required (Matlab, C++, Java, OCaml, or C#). Skills in semantic web technologies (ontology languages OWL, RDFS, RDF) are welcome. Salary: about 2200 Euros / month (net). Duration: 2 years. Location: MediCIS team, Laboratory of Signal and Image Processing, Medical University, Rennes, France.

Partners

Team MediCIS (P. Jannin, B. Gibaud) is one of the five research teams in the LTSI U1099 institute. This institute is dedicated to biomedical engineering, is composed by about 100 researchers and students and is part of the " Institut national de la santé et de la recherche médicale" (INSERM), which is the leading research institute in medicine in France. MediCIS has an extensive experience in Image Guided and Computer Assisted Neurosurgery, Augmented Reality, and Surgical Process Modeling.

Team HYCOMES (B. Caillaud) is a joint Inria Rennes / Irisa team. Its main objective is the development of mathematical models, algorithms and tools supporting rigorous contract-based reasoning methods in embedded systems design. The team has a strong background on the realization by algorithmic methods of concurrent reactive systems from partial and heterogeneous specifications combining both logical properties and operational scenarios.

Team Hybrid (ex VR4i) (V. Gouranton, B. Arnaldi) is a joint Inria Rennes / Irisa team. The main concern is to allow real users to interact naturally within shared virtual environments, as interaction can be the result of an individual interaction of one user with one object or a common interaction of several users on the same object.

Contact. Application and CV should be sent to Pierre JANNIN MediCIS/UMR U1099 LTSI ● INSERM/Université de Rennes I ● 2, Avenue du Pr. Léon Bernard CS34317 35043 Rennes Cedex France ● http://medicis.univ-rennes1.fr ● pierre.jannin@univ-rennes1.fr

Some practical information: http://medicis.univ-rennes1.fr/