Medical Robotics
Overview of the course

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Scope

• Although entitled « medical robotics », this course solely focuses on interventional gestures and surgery.

• 99% of the scope concerns manipulation robots (mobile robots are essentially not concerned).
Objectives of the course

At the end of the course, you should be able to:

• Identify the main pros and cons associated with the use of robotic technology for a given medical application;

• Identify the main technical difficulties to be expected in the deployment of robotic technology for a given medical application;

• Analyze, within the state of the art, the relevance of a given technical proposition to a real medical application (from a technical point of view).
Contents

1: General introduction (overview of the domain)

2: Positioning
   • Positioning a robot: kinematic modelling, trajectory generation, position control
   • Registration techniques
   • Medical applications

3: Image based robot control
   • Visual Servoing
   • Application to the main medical imaging techniques
   • Medical applications

4: Force control
   • Force sensing and force control technologies
   • Medical applications

5: Robots under real-time surgeons’ control
   • Telemanipulation
   • Comanipulation
   • Medical applications
How is the module evaluated?

1. Several quiz during the class sessions, randomly planned & unadvertised: 30% of the final grade.

2. Research report (70% of the final grade).
   • Topic = a clinical application.
   • A 10 pages report is to be produced, including:
     • 1 page to describe the clinical application
     • 1 page to describe what is difficult for the surgeon in this application
     • 5 pages to describe what are the technical solutions currently proposed to the surgeon to solve these difficulties.
     • 1-2 page summarizing the main (clinical) results obtained so far.
     • 1-2 page to analyze this state of the art (and its relevance) and imagine perspectives.

You will add a list of 10 to 20 proper bibliographical research references that you will have read by then and that will be duly cited in the main text.
Schedule for the research report

• Final report due on Monday, Jan 8\textsuperscript{TH}, 2018, 1 PM (email of a pdf report (< 4Moctets) sent to me with the subject: “Report Medical Robotics”).

• The report can be in English, in French, or mixed (w/ low frequency switches).

• Pair work (1 report for 2 students).

• Oct. 10\textsuperscript{th}: deadline for each individual student to provide me with a sorted selection of 3 topics picked among the topic list (see next slide).

• Oct. 20\textsuperscript{th}: deadline for me to build student pairs and to give them a topic chosen among their list.
Topic list

1. Intra-cardiac interventional radiology
2. Vascular interventional radiology
3. Knee arthroplasty
4. Spine surgery
5. Prostate biopsies.
6. Prostate Brachytherapy
7. Radical prostatectomy
8. Liver surgery
11. Protontherapy.
12. Ear surgery.
15. Laparoscopic surgery.
For now

- By Tuesday, Oct. 10\textsuperscript{th}, 1PM
- Send an email to: Guillaume.morel@upmc.fr
- Whose subject is: UPMC - MED ROB TOPIC CHOICE
- If your name is Paul Bismuth and you want to study the topics 7, 10 and 1 (by order or preference), you should write your email as:

Paul
Bismuth
7
10
1

(without any “Hello professor”, nor signature, nor “sent from my iPhone” ad)

My computer is likely to loose emails not respecting these instructions.