“Cognition in planning for robotic systems in neurosurgery”

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Abstract

It is straightforward to parallel machines and humans and in particular embedded systems involving robotic devices. Common features are sensing and motor skills, but also intelligent supervising capabilities as planning, modeling and reasoning. In the surgical robotic area, planning activity is usually left to the surgeons and clinicians (radiologists, neurologists etc.), but there is some research carried on that is aimed at providing the human decision maker with cues based on optimization policies extracted from surgeon's knowledge. The AI expert bottleneck often hinders such an access, but with the help of interdisciplinary engineers (biomedical engineers), some good solutions are at hand, empowering the humans' capabilities. Modeling with probabilistic workflows surgical procedures allows for a smooth and seamless execution and for best practices stabilization, but also for the enforcement of safety features, as the forecast, by model, of expected inputs (e.g. tools positions) that if not consistent bring the whole system in safe state. The example of the ACTIVE (FP7 EU ICT project 270460) will be used to illustrate such features. In neurosurgery the above mentioned issues are still more complicated since the machine is cooperating with OR staff and working on the patient and this is particularly challenging, given the size of operating volume that, if injured, can lead to severe permanent damages to the patient.

Figure 1. Computer assisted planning of multiple trajectories of StereoelectroEncephaloGraphy electrodes in brain for epileptogenic zone detection.
References


Speaker Bio

Giancarlo Ferrigno (MSc in Electronic Engineering and PhD in Bioengineering), after few years as senior researcher in a private rehabilitation foundation, started his academic career at Politecnico di Milano University where he is today full professor at the Bioengineering Department. Former chairman of PhD School of the University (2004-2006) and of the Bioengineering Department (2006-2009) he is currently director of the Neuroengineering and Medical Robotics Laboratory. He teaches at the undergraduate level Biomedical Instrumentation and Medical Robotics and Technologies in Surgery at the graduate level. He is responsible of several projects funded by Italian Space Agency, Italian Institute of Technology, industrial partners and FP7 EU grants. He is coauthor of more than one hundred peer reviewed journal papers and sixteen patents. His research interests cover the fields of spatial localisation technologies, motor control, neuroprostheses, bio-artificial interfaces, computer aided surgery and medical robotics.