FP7 EU Projects:

Active Contraints Technologies for Ill-defined or Volatile Environments—ACTIVE
FP7-ICT-2009-6-270460 2.1 - Cognitive Systems and Robotics
www.active-fp7.eu

MUltimodal Neuroprosthesys for Daily Upper limb Support—MUNDUS
FP7-ICT-2009-5-248326 7.2 - Accessible and Assistive ICT
www.mundus-project.eu

Realistic Real-time Networks: computation dynamics in the cerebellum—Realnet
FP7-ICT-2009-6-270434 8.8 - Brain-inspired ICT
www.realnet.fp7.eu

ROBOt and sensors integration for Computer Assisted Surgery and Therapy—ROBOCAST
FP7-ICT-2007-1-215190 2.1 - Cognitive Systems and Robotics
www.robocast.eu

EUropean RObotic SURGEry—EUROSURGE
FP7-ICT-2010-7 -288233 2.1 Cognitive Systems and Robotics

www.biomed.polimi.it/nearlab

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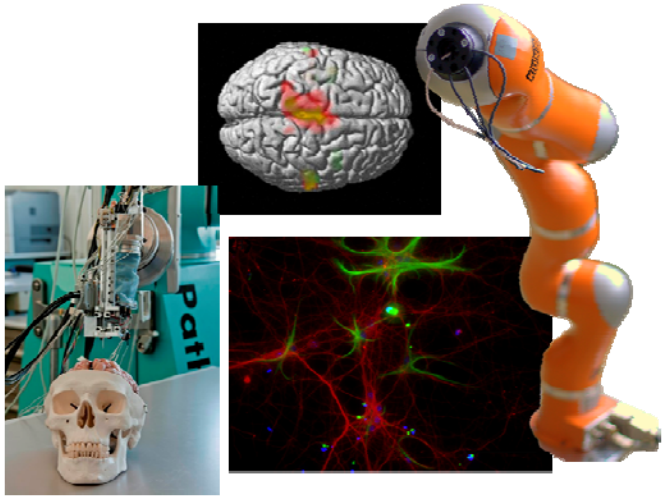
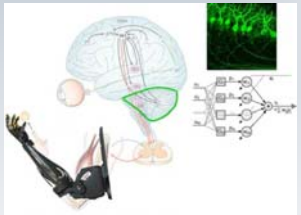
Neuro**E**ngineering and medic**A**l **R**obotics
LABoratory



Politecnico di Milano
Department of Electronics, Information and Bioengineering

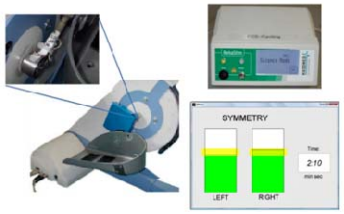
NeuroEngineering and medicAl Robotics LABoratory

The **N**euro**e**ngineering and medic**a**l **r**obotics **Lab**oratory is part of the Bioengineering Department of Politecnico di Milano and includes two sections, one which deals with the neural engineering and one which works in the field of medical robotics. The Neuroengineering Section aims at developing topics in neuroengineering as biomimetic neuroprostheses, bioartificial interfaces, motor control modelling. The Medical Robotics Section is mainly devoted to biomechanics and computer assisted and robotic surgery.



Neurorobotics with brain-inspired controllers in order to link low-level brain circuits with high-level functions in sensorimotor loops; focus on cerebellum and its crucial role in task learning

The ACTIVE EU project exploits ICT and other engineering methods and technologies for the design and development of an integrated multi-robotic platform for neurosurgery.



Methodological and clinical studies to evaluate the efficacy of robotic training in the rehabilitation of patients with neuro-musculo-skeletal pathologies.

Cognitive researches, aimed at robotic behaviour customization, provide scientific and technological impact in the field of adaptive robotic control, by improving system control strategy through experience and on-field learning.

Medical Robotics Section (MRS)

The **Medical Robotic Section** (MRS) main goal is the development of innovative methods and devices for clinical and surgical applications.

Main current research topics at MRS are:

1. **Surgical planning and navigation**

- Automatic and intelligent planners for neurosurgical keyhole interventions (biopsy, DBS electrodes placements and sterero EEG)
- Robust functional Hip joint center identification in knee arthroplasty interventions
- New software for sensors fusion in surgical navigation.

2. **Surgical robotics**

- Sensors fusion in surgical robotics and navigation
- Motion compensation in awake robotic neurosurgery
- Force feedback and haptics in minimally invasive surgery
- Ontologies for robotic surgical systems.

3. **Micro-devices for surgery**

- Micro-robots propulsion and control for soft tissue burrowing.

NeuroEngineering Section (NES)

NeuroEngineering Section (NES) main goal is the development of innovative methods and devices for neuroscience, including neurorehabilitation, clinical and pharmaceutical applications.

NES research activities are organized into three topics:

1. **Motor control and biomechanics**

- Innovative protocols (short and very long term gravity, virtual reality, altered equilibrium conditions, sensorial perturbations) for the study of sensori-motor integration and movement planning control
- Computational and biomechanical modelling and simulations for motor control understanding.

2. **Neurorehabilitation and Neuroprostheses**

- Integration of electrical stimulation with robotic systems for rehabilitation and assistance to daily life activities of people affected by neuromotor diseases
- Methods, devices and new protocols for the study of recovery in neurological patients (fMRI coupled with motion analysis, H-reflex)
- Development and design of neural (soft computing) controllers for functional electrical stimulation optimisation.

3. **Bioartificial interfaces**

- Development of microtechnologies for multisite electrophysiology and photonics coupled with in vitro neuronal coltures
- Software design for quantitative pharmacological and toxicological screening.