



Erasmus+



Open lecture

Neural networks for learning sensorimotor loops: application to mobile robotics

Prof. Patrick Hénaff
LORIA UMR 7503, Université de Lorraine - CNRS
Nancy, FRANCE

The short course will address biological inspired sensory motor loop for robotic applications. The goal is to understand how we can be inspired from biology to solve difficult problems in robotics. The lessons will focus on the sensorimotor loop applied to mobile robotics: How to learn an unknown control law? How to learn this low online? How to learn control law and reflex behavior?

Lectures

Tuesday, March 20, 2 pm -- 5 pm

- Lecture 1: Neural modelling for robotics
 - Introduction
 - Motor nervous system
 - Neural networks models for mobile robotics:
 - Reactive approach : Braitenberg vehicle
 - Reminder on multilayer perceptron and back-propagation algorithm
- Lesson 2: Neural learning control for mobile robots
 - Learning the control with multilayer perceptrons and back-propagation algorithm:
 - Learning off-line
 - Learning on-line

Practice

- Practice 1 (**Tuesday, March 20, 5 pm -- 8 pm**), Practice 2 (**Wednesday, March 21, 2 pm -- 5 pm**): Practice with the Vrep Simulator (laptop is necessary, whatever the OS)
 - Simulation of Braitenberg vehicle with the Vrep Simulator
 - Backpropagation for learning on-line to control a mobile robot
 - learning on-line a control law and reflex behavior

Preparing for the practical lessons:

- **Prerequisites:**
 - read a course on multilayer perceptron

- understand the back-propagation algorithm and some applications
- Python programming
- **Software:**
 - install VRep (Pro-EDU) on your laptop :
<http://www.coppeliarobotics.com/downloads.html>
 - Install Python 3.5 on your laptop
 - Do the tutorials of VRep : <http://www.coppeliarobotics.com/helpFiles/index.html>

Registration form

<https://goo.gl/forms/0FCdZI1cUqPclPlo1>

Registration is needed to define the required room capacity.

Brief CV

Patrick Henaff is full Professor at the Ecole des Mines de Nancy (Information & Systems department), University of Lorraine, ARTEM Campus. He works as researcher at the LORIA lab (CNRS UMR 7503), Cortex team and leads the “complex systems, artificial intelligence and robotics” department of the LORIA lab. He received a M.S degree in Robotic in 1989 and a PhD in Robotic in 1994 at the Paris Robotic Laboratory, “Pierre et Marie Curie” University. From 1997 to 2013, he was Associate Professor at the Institute of Technology of Cergy-Pontoise. He worked as a researcher at the LISV (Systems Engineering Laboratory of the University of Versailles) from 1997 to 2009. From 2009 to august 2013 he was researcher at ETIS (CNRS UMR 8051) lab, University of Cergy-Pontoise.

His topic of interest concerns the biologically inspired control of humanoid robots, particularly the neural network biological models dedicated to genesis of adaptive rhythmic movements.

He is a recognized expert in adaptive neuronal controller architecture for robotics, CPGs and learning in sensori-motor loops. He participated to several robotic projects especially for legged locomotion and rhythmic movements. He is regularly reviewers for international journals (IEEE TRO, Frontiers in neuro-robotics, IJARS, JAR, neurocomputing) and conferences (IEEE ICRA, IEEE IROS, IEEE IJCNN, IEEE AIM).

Prof. Patrick Henaff developed and leads several important cooperation projects between France and Ukraine since 10 years (Erasmus+, French-Ukrainian master program, French-Ukrainian Dnipro scientific projects, mentorship PhD programs).