Univ. Grenoble Alpes
Université de l'innovation

financé par
IDEX Université Grenoble Alpes

PhD. Position : Artificial Intelligence

SUBJECT TITLE: Learning by Demonstration of Action Models for Cobot Programming

LABORATORY: Laboratoire d'Informatique de Grenoble (LIG) – UMR 5217

DOCTORAL SCHOOL: Mathématiques, Sciences et Technologies de l'Information, Informatique – ED 217

SUPERVISOR: Damien Pellier Damien.Pellier@imag.fr

KEYWORDS: Artificial Intelligence, Automated Planning, Machine Learning, Cobotic

TYPE of CONTRACT: temporary-3 years of doctoral contract
JOB STATUS: Full time
HOURS PER WEEK: 35
SALARY: between 1768.55 € and 2100 € brut per month (depending on complementary activity or not)

SUBJECT DESCRIPTION:

Since their emergence, industrial robots are traditionally programmed off-line by experts in robotics using computer-based coding interfaces. Robots are then placed in working plants to be used by human operators in order to execute repetitive tasks complying with code instructions. When the tasks assigned to the robot have to change, this robot needs to be completely recoded by the robotics experts, which is challenging, takes a lot of human efforts and time, and does not meet nowadays industry needs in supply-chain reconfigurations and flexibility.

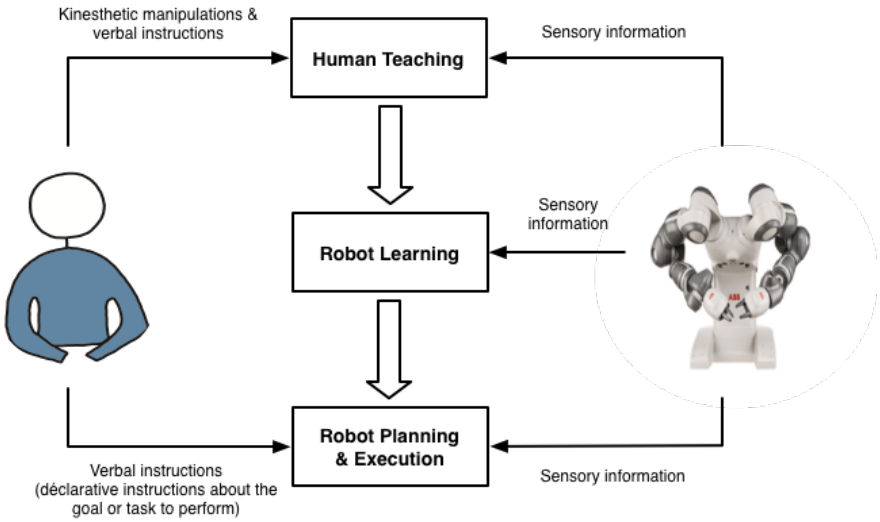

Figure 1: An human-friendly approach for industrial robot programming through human-robot interactions

To address this challenge, the PhD. Student recruited **will have to devise a new human-friendly approach for industrial robot programming through on-site Human-Robot Interactions.** The approach consists of three processes: human teaching, robot learning and robot execution (see figure 1): 1. The human operator that will use the robot teaches it a task by providing verbal instructions and by manipulating the robot's effectors. 2. The robot learning process is based on learning by demonstration techniques [1]. In this process, the human operator and the robot build a common symbolic representation of the task: this symbolic representation is a planning domain description language1. This language uses preconditions and effects to describe changes in the robot's context. 3. The robot task execution is controlled by human verbal instructions that express the objectives of the task that the robot has to achieve. Then, the robot automatically computes a sequence of gestures achieving these objectives: the human operator does not provide the "recipe", i.e., a sequence of gestures to achieve the objectives; the "recipe" is computed by Automated Planning techniques [2]. For this project, we will use the PDDL4J library (pddl4j.imag.fr). The development will be implemented on the Baxter robotic platforms

REFERENCES

[1] B. Argall, S. Chernova, M. Veloso, B. Browning. A survey of robot learning from demonstration. Robotics and Autonomous Systems. Volume 57, Issue 5, 31 May 2009, Pages 469–483.

[2] M. Ghallab, D. Nau and P. Traverso, “Automated Planning”, Morgan-Kaufman, 2004.

ELIGIBILITY CRITERIA

Applicants:

- must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration),

Applicants will have to send an application letter in English and attach:

- Their last diploma

- Their CV

- A short presentation of their scientific project (2 to 3 pages max)

- Letters of recommendation are welcome.

Address to send their application: Damien.Pellier@imag.fr