Objectives

In this PhD, we propose to address this issue in the context of a flying co-worker assisting a human worker in tasks such as installing, dismantling or repairing a device placed at height. While the global task to perform can be known in advance, sources of uncertainty are numerous, calling for online decisions that take into account human preferences and abilities.

To do so, this PhD aims at extending contributions linked to the concept of Human Robot joint action and at using models for decision making under uncertainty (Markov Decision Processes, Partially Observable Markov Decision Processes). This will involve (1) modelling the human worker behavior, his objectives and the task sequence he tries to accomplish in a flexible way ; (2) using this model to infer distributions on the current objective of the human worker based on partial observations (Bayesian inference, HMM [7]) ; (3) deciding which actions to perform in order to help the human worker while considering uncertainties about his state and his evolving objectives by inference, HMM [7]) ; (4) controlling the execution of the proposed plan and verifying the state of the human-robot interaction during the execution, in order to react accordingly.

Administrative aspects

This PhD thesis will be co-supervised by researchers from both the LORIA/Inria Nancy-Grand-Est and the LAAS laboratories and will be conducted at Nancy.

References


Proposed approach

In a first step, the PhD student will have to propose a formalization of the situation of the flying co-worker. For instance, the autonomous agent has to decide which tools to bring, among several available, to an isolated human worker by considering the probabilistic workflow of his activity.

Then, in a second step, the PhD student will address the questions cited previously: first by finding a way to model the human objective (3, 4) and his adaptation to the robot actions (6), and then by proposing algorithms to build the optimal behavior of the agent based on these models (2) and on reasoning on Human Robot joint action (5).

Finally, the PhD student will investigate several aspects which are not usually considered and seem of paramount importance in Human-Robot Interaction context:

1. how to model the mental state of the human agent and to take it into account for selecting an approach and a communication strategy to improve the mutual understanding of their activities and intentions?
2. how to model explicitly the durations of the human activities and to take them into account for planning the flying co-worker behaviour?
3. how may the flying worker act to gather more information about the human task (with the help of active sensing models and algorithms [1])?

Compétences

We are looking for excellent candidates with a strong interest for artificial intelligence planning, both from a theoretical (maths) and practical (programming) point of view. Knowledge of English is mandatory.

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training (French courses...)
- Social security coverage

Rémunération

Salary:

1982€ gross/month for 1st and 2nd year. 2085€ gross/month for 3rd year.

Monthly salary after taxes : around 1596.05€ for 1st and 2nd year. 1678.99€ for 3rd year. (medical insurance included).