Interactions homme - robot

Thèses en cours

The companion robot: from interactive learning to a model of intuitive human-robot interaction.

Caroline Grand (Dr. Ghilès Mostafaoui, Prof. Philippe Gaussier)

We address the issues related to autonomous learning of different sensory-motor tasks (navigation, grasping) using interaction and imitation. From a theoretical point of view, we will question the concepts of turn-taking and sharing of attention during Human-Robot interaction and their contribution to improve the learning. We would like to make robot able to understand the intentions of his partner.

Here, using a complex task is necessary to confront the robot with situations of failure that will introduce behavioral changes not only for the partner but also for the robot. The robot should be able to self assess both its behavior regarding the current task to learn and its interaction behavior with its partner.

We propose to work on a 'mobile companion robot' capable not only to learn interactively (with his partner) to navigate but also to perform minimal useful tasks (grasping objects). Using interaction games and imitation as a medium of learning and above all of communication, allows to consider new principles of HMI (Human Machine Interface) where the interaction is no longer considered as a 'charge', it becomes rather pleasant.

The robot as a mediative tool in museums. Application to the emergence of artificial aesthetic

Ali Karaouzene (Prof. Philippe Gaussier, Dr. Denis Vidal)

Thèses soutenues

Improvement of control algorithms of electric robot manipulators in physical interaction with their environment through the bio-inspired approach. (2014)

Dr. Artem Melnyk (Prof. Patrick Henaff, Dr. V. Borissenko (Ukraine))

Automated production lines integrate robots which are isolated from workers, so there is no physical interaction between humans and robots. In the near future, a humanoid robot will become a part of the human environment as a companion to help or work with humans. The aspects of coexistence always presuppose physical and social interactions between the robot and the human. In humanoid robotics, further progress depends on knowledge of cognitive mechanisms of interpersonal interaction aiming as robots physically and socially interact with humans. An example of physical interpersonal interaction that plays an important social role in the act of handshake because it is based on physical and social couplings which lead to synchronization of motion. Studying handshake for robots is interesting as it can expand their behavioral properties for interaction with a human being in more natural way.

The first chapter of this thesis presents the state of the art in the fields of social sciences, medicine and humanoid robotics that study the phenomenon of a handshake. The second chapter is dedicated to the physical nature of the phenomenon between humans via quantitative measurements. A wearable system to measure handshakes was built in Donetsk National Technical University (Ukraine). It consists of a set of several sensors attached to a glove for recording angular velocities and gravitational acceleration of the hand and forces in certain points of hand contact during interaction. Experiments have shown that there is a phenomenon of mutual synchrony preceded by the phase of physical contact which initiates this synchrony. Considering the rhythmic nature of this phenomenon, the controller based on the models of rhythmic neuron of Rowat-Selverston, with learning the frequency during interaction was proposed and studied in the third chapter. Chapter four deals with the experiences of physical human-robot interaction. Experiments with a robot arm Katana show that it is possible for a robot to learn, with the proposed model of a bio-inspired controller, to synchronize its rhythm with the human rhythms imposed during handshake. A general conclusion and perspectives summarize and finish this work.

The visual perception as a dynamical system: application to interactive robots. (2014)

Syed Khursheed Hasnain (Dr. Ghilès Mostafaoui, Prof. Philippe Gaussier)