IEEE IROS 2020

Workshop

"Robots Building Robots"

Digital Manufacturing and Human-centered Automation for Building Consumer Robots

October 26, 2020

Title of your presentation:

Physical and Social Human-Robot Interaction

Authors' Name and Surname, and affiliation:

Giorgio Metta, Istituto Italiano di Tecnologia, Italy

Abstract

In this talk I will summarize results from research on two important components of collaborative robots: i.e. the ability to control physical interaction with humans and, the dual problem, of interacting in a socially meaningful way. Our team at the Italian Institute of Technology developed the iCub robot to study exactly these two aspects of human-robot interaction (HRI). The iCub robot resembles (in size) a child of about five years of age. One special feature of the iCub is the fact that it is completely covered by tactile sensors and, therefore, it can feel precisely when interaction occurs and measure the interaction forces with the environment.

In a first set of experiments I briefly show how the tactile sensors of the robot (together with force-torque sensor measurements) can be utilized to design controllers that stabilize the iCub in complex situations where unknown external forces – such as when interacting with a human – may in fact unbalance the robot. Along this line of development, we can help the robot by measuring the posture and forces-torques of the interactant through wearable sensors. These sensors help building collaborative controllers which can both help the robot by informing about the intentions of the person and, conversely, guarantee that the robot can be helpful when needed. We show a number of paradigmatic examples where proper human-robot interaction is executed. This approach paves the way to the design of safer and meaningful physical interaction with robots, not necessarily humanoids.

In a second experiment we show that social interaction between the robot and a person is regulated by subtle variations in the parameters of said interaction – such as – the timing of eye movements with respect to the appearance of a stimulus. We used the well-known Posner paradigm and showed how the stimulus onset timing changes human perception with respect to mutual gaze. In particular, a variation on the response to mutual gaze because of the manipulation of the timing of the stimulus is reflected on the reaction time of the subjects of the experiment. We show that timing is an important design element to be taken into account when designing robots for human populated environments, that is, subtle changes in the timing of actions may influence the quality of interaction with people.

In summary, I would like to stress again how physical and social human-robot interaction need to be studied with both engineering and scientific methods. This is a case where roboticists and cognitive scientists truly need to cooperate if we are to deliver robots that interact naturally with us.