Human-Machine Interfaces for Service Robotics

Summary

Service robots are rapidly advancing toward becoming fully autonomous and skilled entities in a wide range of environments, and it is likely that more and more people will soon be interacting with robots in their everyday lives. As this happens, it is crucial that robots are designed to be easy to use and understand, reducing the need for people and environments to adapt to the robot. To this aim, in this thesis, different aspects of Human-Robot Interaction (HRI) field in service robotics applications were investigated by spanning the space between semi-autonomous and fully tele-controlled solutions. Despite the broadness of the explored field, through these activities it was possible to realize that HRIs could be classified according to two important correlated dimensions: the spatial proximity between humans and robots (remote or physically collocated) and the type of interaction (i.e., indirect or direct), thus defining the remote and collocated spatial proximity patterns. Research activities reported in this thesis were focused on exploring these patterns to detect the open problems as well as the arising challenges, in order to identify those interfaces that could be regarded as more appropriate and effective. The approach pursued in this dissertation was to explicitly focus on and directly consider HRI in the context of some application domains selected as representative examples of the above proximity categories in order to build robotic interfaces aimed to address the identified research issues. Hence, a set of interfaces were designed, implemented and evaluated by means of several user studies in order to learn from them how people tend to interact with robots depending on spatial proximity patterns, how robots can leverage these findings, and what are the implications for both users and HRI designers. By building on the obtained results, it was possible to identify and outline a set of user interface design requirements that could be considered to improve the HRI and make it more effective in both the remote and collocated spatial proximity patterns. The ultimate goal of this dissertation was to provide researchers with some design recommendations to be used as simple tools allowing them to apply the overall lessons learned without having to investigate the domain in depth again.