BIMROB – Bidirectional Interaction between human and robot for the learning of movements – Robot trains human – Human trains robot[1]

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Introduction

Over the last 50 years, robots have become indispensable in many application fields, e.g., in the car industry, rehabilitation and training. Currently, a paradigm shift is taking place from “classical” robots, which have been rigidly programmed towards a new, more adaptive type that is capable of learning. This new paradigm of common learning of humans and robots has huge potential for changing industrial production processes. The BIMROB-Project aims for a newly established interdisciplinary cooperation within the research areas of motor control and learning in both humans and robots. The core idea is to combine the insights from both fields to lay the scientific foundations for improved robot training, but also for new training and rehabilitation equipment. To accomplish this goal, we combine the best of both mutually beneficial, complementary research topics.

Project description

The main objective of the BIMROB project is to study the bi-directional interaction of humans and robots when learning movements. The research strategy is to study four settings: human-human interaction, and uni- or bidirectional human-robot interaction.

Selected studies and results

Concerning human-human interactions important topics have been identified which are relevant to human-robot learning.
Concerning humans learning from robots, perception of robot movement depending on different factors (perspective and short versus long videos) have been studied. A correct assessment of putting length has only been possible when presenting the complete robot putt movement (long videos - with swing and impact). Putting length had the tendency to be overestimated by 0.5 to 1 meter. Depending on the perspective of human observation (sagittal versus lateral), different training strategies were used. While the frontal perspective group responded to the movements of the robot, the sagittal perspective group showed a relation to their previous iterations.
The bidirectional interaction has been studied in a preliminary study. An iterative feedback-based correction strategy to teach motor skills to humans with the assistance of a robot was developed. In this method, the robot was able to adapt the intensity of its feedback given the previous reaction of the human.

Conclusion

In the BIMROB project, important findings for the integration of robot and human movements have been gained and should be systematically integrated into the next project phase. It is expected that initially robots will benefit more from humans, these relationships will reverse later in the bidirectional movement learning process.

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