



April 26, 2022

A D V A N C E D S E M I N A R
for
Student's name, Mat.-Nr. XXX

Understanding human activities for improved learning from demonstration

Problem description:

Nowadays robots need to be more adaptable and easily programmed, even by non-expert users, to be used in a large variety of fields such as assistive robotics or collaborative robotics. A way to make programming accessible to all is learning from demonstration methods [2] among which are kinesthetic teaching, tele-manipulation, or visual demonstrations. The tasks are taught by the human showing the robot what to do. Understanding the context of the activity the human is involved in and the purpose of the task can help imitation learning [3][4]. It could be useful to obtain a more robust reproduction of motions, to filter the most important part of the task, to detect errors and to re-use knowledge for other similar tasks. During this project your task will be to write a review on the following topics:

- The interests of purposive learning [3]
- Methods of understanding of human activities [5] [1]
- Challenges of purposive learning and the progress made [3]
- Future possible advancement of purposive learning and its applications to improve learning from demonstration techniques

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Technologies and Trends in User-Driven Assistive Devices for Improved Gait and Balance Performance - A Systematic Review

Problem description:

Gait and balance disorders are associated with increased risk of falling [7], which can lead to severe consequences such as impaired activities of daily life and quality of life, as well as institutionalisation or even death [8]. The last decades several new wearable technologies have been developed with the aim to improve gait and postural performance. Among those, wearable exoskeletons [6] and soft robotic devices [3] as well as various feedback and stimulation approaches, such as vibrotactile biofeedback [1, 4, 5] or functional neuromuscular stimulation [2] or have been investigated.

Tasks:

- Perform a systematic search for existing user-driven technologies for improving gait and balance performance
- Document your procedure
- Provide an overview of existing approaches and their target groups
- Evaluate and discuss existing approaches

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A review on control strategies for contact surgical tasks

Problem description:

The use of robots in surgeries has recently received increased attention, with the emergence of new dedicated robot hardware with multiple degrees of freedom and fine motion precision, allowing the surgeon to accurately perform delicate surgical procedure. Clear examples for such devices are the Da-Vinci robot from Intuitive Surgical and the DLR Miro Surge. Unfortunately, due to the clear safety considerations and possible risks, surgical robots are still mostly used in open-loop teleoperation tasks with limited or no force feedback [1]. Fully or partial autonomy however are only used within the research community. Several surgical tasks haven been considered such as suturing [4], blunt dissection [2] and cutting [3]. In this Seminar, the aim is to conduct a literature review on the control strategies used during surgical tasks that can range from simple position control, to more sophisticated methods such as hybrid motion-force control and (variable) impedance control as well as the approaches used to generate reference trajectories for these controllers e.g relying on vision, Learning from demonstrations etc..

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