Automatic Generation of Benchmarks for Human-Robot Collaboration

Background

Robots have yet to make an entrance into many industries (outside mass-manufacturing) and the service sector. In these environments, efficient collaboration or co-existence with humans is necessary in order to respond to the highly variable tasks demanded.

Description

Benchmarking human-robot collaboration (HRC) has been difficult so far. However, benchmarking has proven essential to achieve progress in other fields, such as machine learning for computer vision. We would like to improve human-robot interaction by developing a human motion generator that produces realistic and task-driven motion in a robot’s simulated environment. This motion could then be used to compare algorithms for HRC under varying conditions.

Within this thesis you will develop a human model that can be generated from recorded motions, e.g. motion captures. These motions should be selected, concatenated and blended so that the resulting motion meets a linear temporal logic (LTL) specification. This logic makes it possible to formalize requirements like “take the screwdriver from the shelf and assemble workpiece A”. The human motions are to be executed in a factory environment that represent a robot’s workplace, so path planning and collision avoidance will be needed, too. Variation of motions could be achieved by following different paths of the automaton that solves the LTL formula and by adding noise to the motions being generated.

Tasks

- Literature review on LTL and human-motion generation
- Familiarize with the existing python code
- Extend the existing code to vary LTL solutions
- Build (randomized) factory environments
- Implement faster planning and visualization techniques
References

