Whole-body Pose Taxonomy

Locomotion in humanoids robots is a very challenging problem particularly when considering the possibility of leaning on your environment to provide more support. This is because the humanoid structure is very complex and the problem is approached as a computational optimization problem with many constraints that need to be satisfied. We propose to approach this problem from an innovative point of view, extending results from grasping, where here is the body that "grasps" the room to balance. To understand all the possible range of poses that can provide stability to the robot we have proposed a taxonomy of whole-body poses similar to those that exists for grasping (Fig. 1) (Borràs and Asfour, 2015).

In this project, using the taxonomy as a starting point, the student will be asked to implement methods to detect support poses and transitions between them from human motion data. The goal is to identify the most common transitions and explore ways to store them, re-formulate them using motion primitives and elaborate rules to assemble them together to create new motions. We will provide support with our group KIT motion database that contains many motions in the Master Motor Map (MMM) format including information about the environment (Fig. 2). The MMM framework allows a unified representation and mapping of whole-body human motions (Terlemez et al. 2014) and provides a good framework for the project objectives. This line of research can significantly contribute to humanoid motion planning, but also has interest for biomechanics, to gain insight in how we act to avoid falls and improve our stability in the situations that we need.

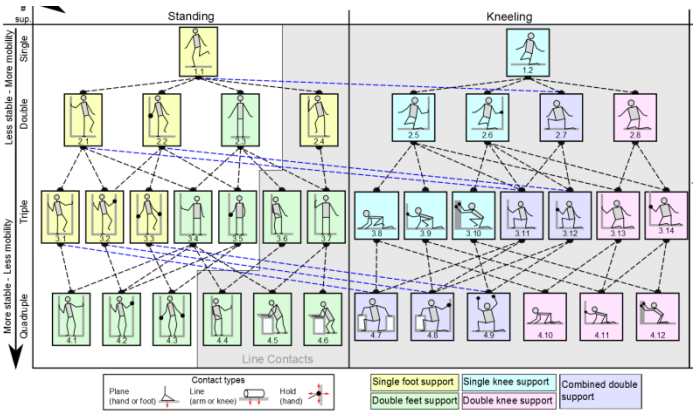

Figure 1: Taxonomy of whole-body poses.

Figure 2: Examples of motions from the KIT Motion Database

J. Borràs, and T. Asfour. "A Whole-Body Pose Taxonomy for Loco-Manipulation Tasks." *arXiv preprint arXiv:1503.06839* (2015).

O. Terlemez, S. Ulbrich, C. Mandery, M. Do, N. Vahrenkamp and T. Asfour, (2014) Master Motor Map (MMM) - Framework and Toolkit for Capturing, Representing, and Reproducing Human Motion on Humanoid Robots, IEEE/RAS International Conference on Humanoid Robots (Humanoids), 2014

Contact: Julia Borras Sol (julia.borrassol@kit.edu) and Tamim Asfour (tamim.asfour@kit.edu)