

Intention recognition using state-dependent dynamical system in physical human-robot joint action

Mahdi Khoramshahi and Aude Billard

École Polytechnique Fédérale de Lausanne EPFL, Switzerland

One of the basic principle needed to design robotic systems that can physically interact with humans is “intention recognition”. To be an assistive follower in a joint-action task, it is crucial for robots to recognize the task intended by the human-leader and to adapt their motions and forces accordingly. While humans easily interpret their partner activities using several modalities (e.g., gestures, gaze, natural language, etc.), robots are more limited in their inference capacities and ability to read out non-verbal cues. Our work participates in robotic trends to enable robots to be more perceptive of human intention. In human-human joint actions, the human partners share a similar task representation. This common, and often implicit knowledge, allows them to predict each other’s actions and intentions. Following this line of thought, we propose to employ state-dependent dynamical systems for task representation. Dynamical systems have been extensively used in the literature to learn and perform robotic tasks. In this work, we further show that they can be utilized as inference machines to recognize human-intention from interaction forces and motions. Through several robotic experimentations, we show the effectiveness of this approach in recognizing human intention, controlling robot’s motion and forces, and delivering a fluid interaction.

Keywords: Physical human-robot interaction, intention recognition, dynamical system,