A dynamic neural field architecture for flexible and fluent human-robot interaction

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Abstract

A major challenge in the field of human-robot interaction (HRI) is the design of autonomous robots that are able to interact with people in a human-like way. This requires to endow the robots with some high-level cognitive capacities like decision making, memory, goal inference and anticipation. The talk presents a control architecture for HRI that is inspired by recent experimental findings about the neuro-cognitive mechanisms supporting joint action in humans and other primates. It implements the coordination of actions and goals among the partners as a dynamic process that integrates contextual cues, shared task knowledge and predicted outcome of others' motor behavior. The control architecture is formalized by a coupled system of dynamic neural fields representing a distributed network of local but connected neural populations. Different pools of neurons encode task relevant information about action means, action goals and context in form of self-sustained activation patterns. These patterns are triggered by input from connected populations and evolve continuously in time under the influence of recurrent interactions. The dynamic control architecture is validated in a task in which a robot and a human jointly construct a toy robot. We show that the context dependent mapping from action observation onto appropriate complementary actions allows the robot to cope with dynamically changing joint action situations.

Keywords: neural field architecture; human-robot interaction;

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