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(new Tutoring Behavior) Tutoring System for iCub

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In state of the art Human-Robot interaction, natural interaction is seldom found. Critical features of natural interaction are concerned with contingency, social signals and reciprocity. In the scenario of a tutoring situation, where the use of different objects should be demonstrated to the robot, the presented model aims at achieving improvements of naturalness modelling the behavior of an infant in a tutoring situation. NewTuBe combines a Social Background Behavior, a Tutoring Spotter and a Tutoring Feedback Module. The modules are closely linked and cooperating: The Social Background Behavior produces human-like dynamic cues as default behavior, the Tutoring Spotter detects tutoring situations via applying a contingency measure, and when in a tutoring situation, the Tutoring Feedback Module provides appropriate feedback from the robot to the interactional construct.
Goals:

- induce parent-like teaching (Motionese)
- find tutoring situations
- facilitate learning (action segmentation, goal finding, trajectory learning)
- encourage teacher
- increase user comfortability

The Tutoring Spotter tempts to detect the beginning of a tutoring situation as a starting point of a social interaction. In the context of infant-directed tutoring, the caregiver modifies its behavior in several described modes. For example, there is a rising in the contingency behavior. Via detecting this rising we want to find the starting point of our tutoring situation.
The feedback introduced in newTuBe consists of a background and a foreground feedback behavior. The corresponding background feedback module is random and partly based on statistics on infant behavior derived from a corpus of adult-child interactions. The foreground feedback module should directly respond to the tutor's actions and actively shape the interaction using cues and signals like eye gaze direction, pointing gestures and smiling.

The software structure of the scenario is realized as follows. It is build as a three layer structure consisting of a hardware layer, a high-level layer, and a memory layer. Each layer has its own functionality. The hardware layer controls the information flow to and from the robot. Through this layer, it is possible to make camera data and complex features like face positions, gaze direction and facial expressions of the counterpart of the robot accessible to other processes. Furthermore, an arbiter which allocates hardware resources to the different high-level modules is included in this layer. The extendable high-level layer allows for inclusion of new functions into the system which are called high-level modules. For example the Social Background Behavior, Tutoring Spotter and Tutoring Feedback Module are realized in this way. All high-level modules have access to all data generated by the hardware layer and have the possibility to ask for hardware resources in order to send commands to the robot. To manage the communication between these two layers, the memory layer is integrated. This layer contains a set of databases to store all produced data and to collect all commands. In this way, High-level modules can look up all data by using this memory and the arbiter can react on every hardware request. The memory layer offers the possibility to decouple the two layers mentioned at the beginning. So the task of exchanging one layer, e.g.: using another robot, is easy to fulfill.
In this scenario, the open source platform iCub is used which is controlled by a YARP connection. This way of communicating with the robot has the advantage to easily integrate the robot into Java or C++ projects. In addition, there is a simulation tool to test modules without fearing to damage the hardware.
We show first steps and ideas for building a more complete social robot behavior combining social background behavior with a tutoring spotter and a designed feedback for tutoring with the goal to elicit and sustain a naturalness of human-robot-interaction as it is found in daily human life, while at the same time meeting the interaction partner's expectations.