iCub@ICS-TUM: Semantic Reasoning, Constrained Manipulation and Humanoid Vision enable on the iCub

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Abstract

The main goal of the Institute for Cognitive Systems at the Technical University of Munich, is the proper integration of Science, Engineering and Society in order to “understand through Creating”. In other words, we are developing new methods and algorithms to generate rational, social and intelligent behaviours for robotics systems such as the iCub. Therefore, we validate our contributions using the iCub platform principally because the strong humanoid design of the iCub gives us an appropriate testing platform to show similarities between the observed human motions and the robots execution. This means that our robotic system has new capabilities, such as:

1) Human activity recognition using semantic reasoning: We enable the iCub with high level understanding of human activities using semantic representations with an accuracy of 85%. Our system has been fully implemented on a humanoid robot, the iCub to experimentally validate the performance and the robustness of our system during “on-line” execution within the control loop of the robot [1] and [2].

2) Constrained Manipulation: The joint space impedance control interface of the iCub is used to evaluate our recently presented indirect force control task specification framework on a humanoid robot [3]. Force and positioning subtasks on joint and Cartesian level are combined in a hierarchical way to fulfill a more complex constrained manipulation task in unstructured environments [4].

3) Biologically-Inspired Humanoid Vision: We are investigating how to realize an effective biologically-inspired vision system on humanoid robots. Our approach is based on a hierarchical model of the visual cortex. We enhanced this model to enable the integration of time to model uncertainty in static object recognition by evaluating multiple recognition results of objects observed at different view-points over time using the iCub’s camera system [5], [6] and [7].

Fig. 1. The iCub team at ICS-TUM

REFERENCES


