Knowledge-Level Planning for Robot Task Planning and Human-Robot Interaction

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Object manipulation with a humanoid robot

Images: fortiss GmbH
Industrial manipulation with a mobile robot

Image: STAMINA project (stamina-robot.eu)
Robot bartending

Images: fortiss GmbH
What’s the connection?
Knowledge-level planning for robotics tasks

This work combines domain independent, high-level symbolic planning with low-level geometric and motion planning, with a focus on applications to robotics domains.
Knowledge-level planning for robotics tasks

We use the off-the-shelf PKS (Planning with Knowledge and Sensing) planner (Petrick & Bacchus 2002, 2004) which builds plans by reasoning about how the planner’s knowledge changes due to action.
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action grasp(?x : object)
  preconds:
   K(holding = nil) &
   K(onTable(?x)) &
   K(extern(isReachable(?x)))
  effects:
   add(Kf, !onTable(?x)),
   add(Kf, holding = ?x),
   add(Kf, weight = extern*(objWeight(?x)))

(Petrick and Gaschler 2014b)

The planner can build contingent plans, model sensing actions, and interface with externally-defined procedures...
Knowledge-level planning for robotics tasks

...allowing it to support a wide range of applications, with very different types of actions...
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(Gaschler et al. 2013)

...and architectures.
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// Configuration and debugging
void reset();
string getPlannerProperty(string);
bool setPlannerProperty(string, string);

// Domain configuration
bool defineDomain(string);
bool defineSymbols(string);
bool defineActions(string);
bool defineProblems(string);

// Plan generation and iteration
bool buildPlan();
string getCurrentPlan();
Action getNextAction();
bool isNextActionEndOfPlan();
bool isPlanDefined();
bool setProblem(string);
bool setGoal(string);

(Petrick and Gaschler 2014a)

It also supports a high-level application programming interface.
KNOWLEDGE-LEVEL PLANNING FOR ROBOT TASK PLANNING & HUMAN-ROBOT INTERACTION

KNOWLEDGE-LEVEL PLAN GENERATION WITH PKS

CURRENT APPLICATION: INDUSTRIAL KITTING TASKS
OBJECT MANIPULATION WITH A HUMANOID ROBOT


