Action-Based Models for Belief-Space Planning

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Goals

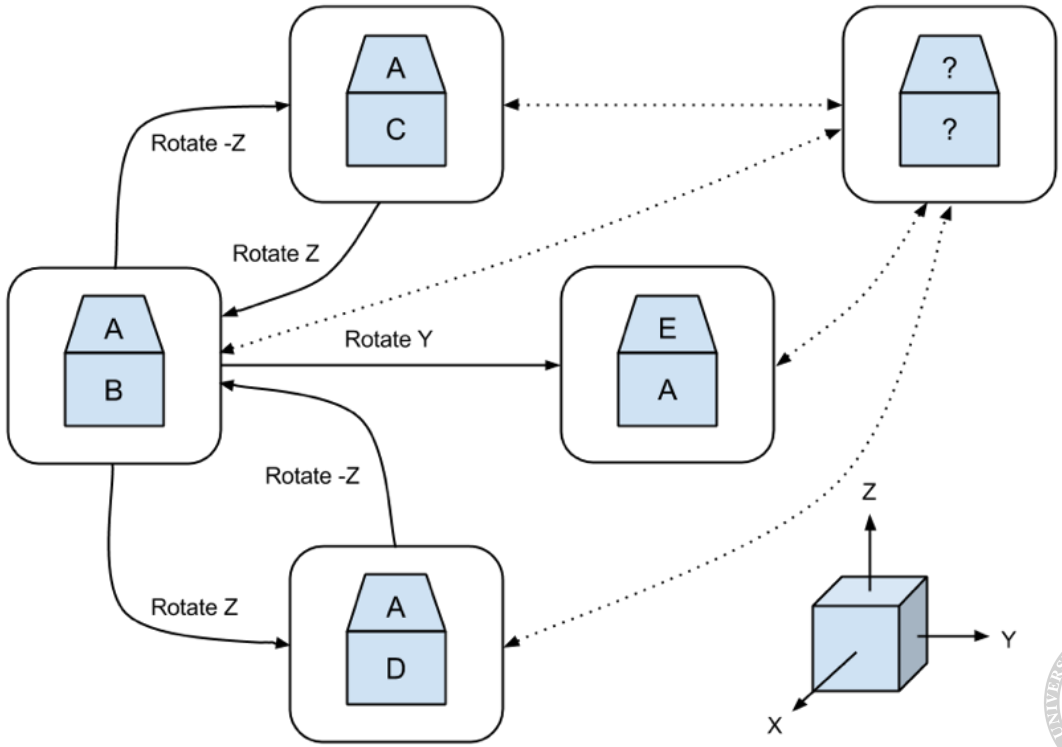
- Address the dual problems of modeling and reasoning by employing an action-based model grounded in the robot's own actions and perceptions

Definitions

- Aspect – The properties of an object that are measurable given a set of sensor parameters
  - the viewpoint relative to an object from which it is seen (visual)
  - the sensor geometry relative to a particular object which it is touched (tactile)
- Actions – May change the state of an object or the measurement parameter and hence lead to a new aspect
  - Rotating a cube changes the viewpoint of observation leading to a new aspect
  - Squeezing a rubble ball changes the state of the ball

Aspect Transition Graph

- Summarized empirical observations of the aspect transitions in the course of interaction
- Represents the relationship between objects/ models, aspects and features



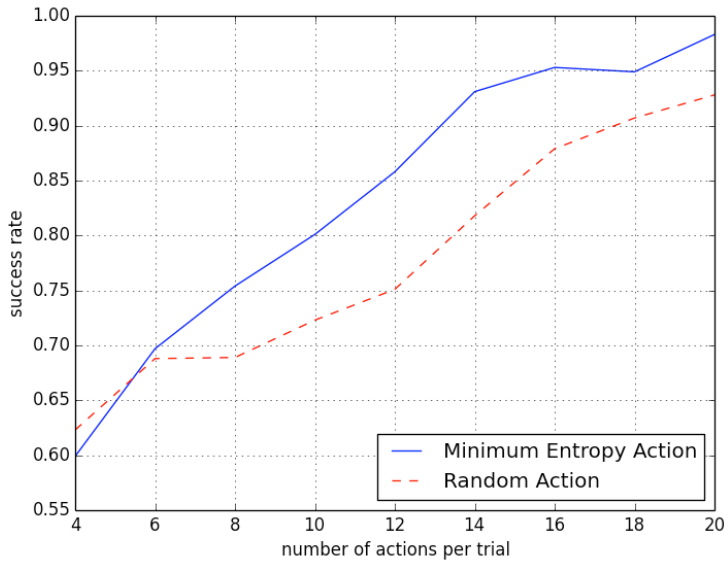
Belief-Space Planner

- Minimizes the expected entropy on object/model identity for the next step

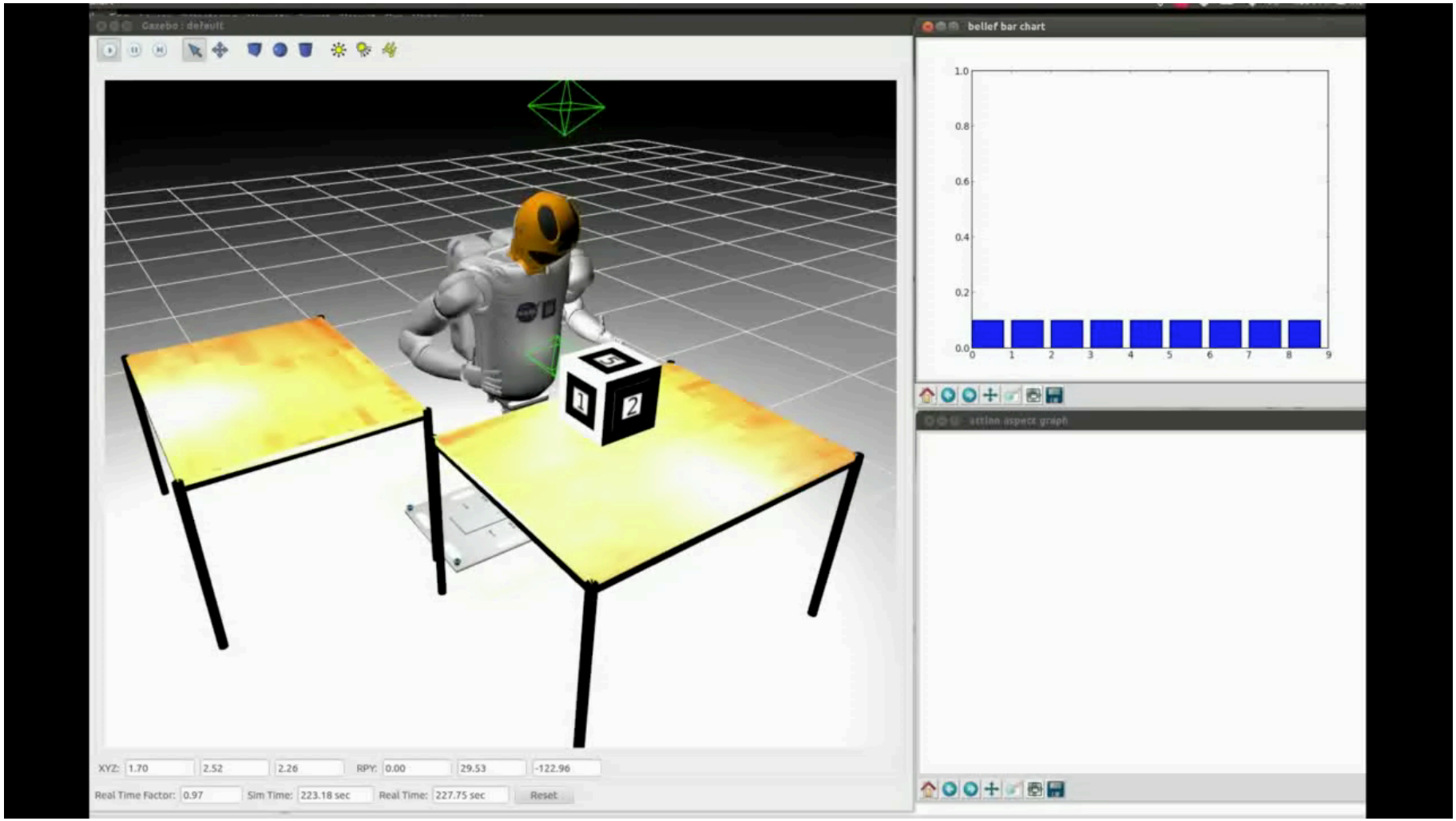
$$\underset{a_t}{\operatorname{argmin}}\ E(H(O_T|z_{t+1}, a_t, z_{1:t}, a_{1:t-1}))$$

- Future observation can be estimated through models learned in the past

- Compared with a random plar



Experiments



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