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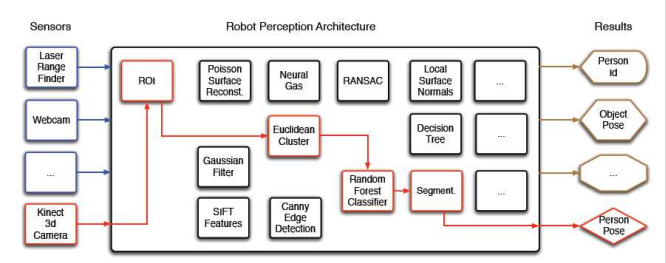
Design and Development of Adaptive Robot Perception Architectures

Problem Statement

To meet the challenges of service robotics we need concepts, methods, and tools for designing and developing **robot perception architectures (RPAs)** in a very flexible manner.

Robot Perception Architectures



The design space of RPAs includes the following elements:

- heterogenous sets of sensors,
- processing components
- Task-relevant information and knowledge, and
- perception graphs.

Robots should be able to **autonomously adapt** their RPA to the wide range of situations.

Levels of Adaptation

1. Selection and Execution of RPAs
2. Modification of RPAs
3. Synthesis of RPAs

To achieve adaptation in an autonomous manner we need:

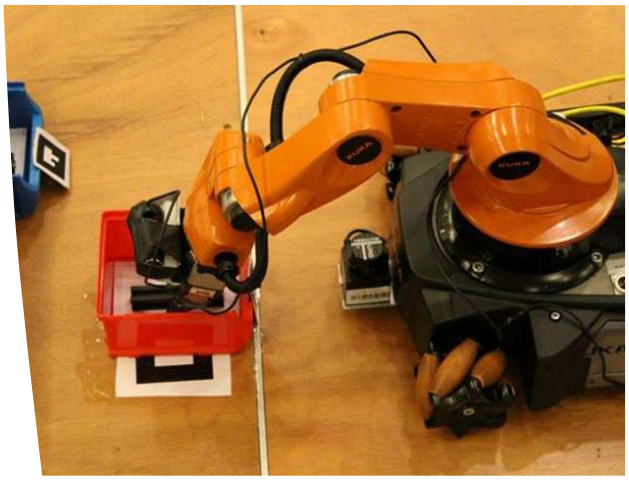
- **Representations** to model perceptual capabilities and functionalities.
- **Methods** to enable adaptation.

RPSL: Robot Perception Specification Language

Up to now we developed the RPSL a domain-specific language which enables to explicitly model the integral parts of RPAs, namely:

- Algorithms,
- Components,
- Perception Graphs, and
- Conceptual Spaces

Robots need to perceive their environment in order to achieve their tasks. A **robot perception architecture** must be designed and implemented. RPAs are developed by **domain experts** during design time. RPA design is significantly influenced by many **design decisions**, which often remain **implicit**. These design decisions concern the robot **platform**, the **tasks** the robot should perform, and the **environment** in which the robot operates.



As long as task, environment, and platform specifications remain as assumed during design time, the RPA will operate properly. However, if an event concerning robot capabilities, task requirements, and environment feature occurs, systematically ensuring an appropriate reaction by the RPA is a great challenge.

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