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

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.