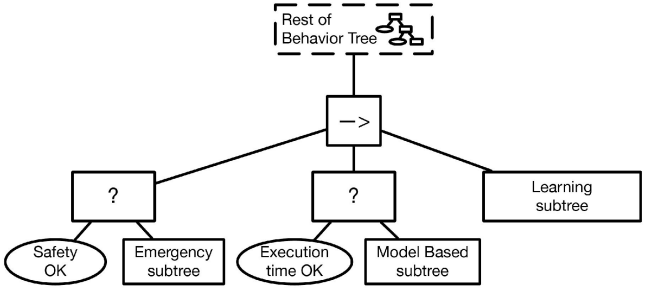
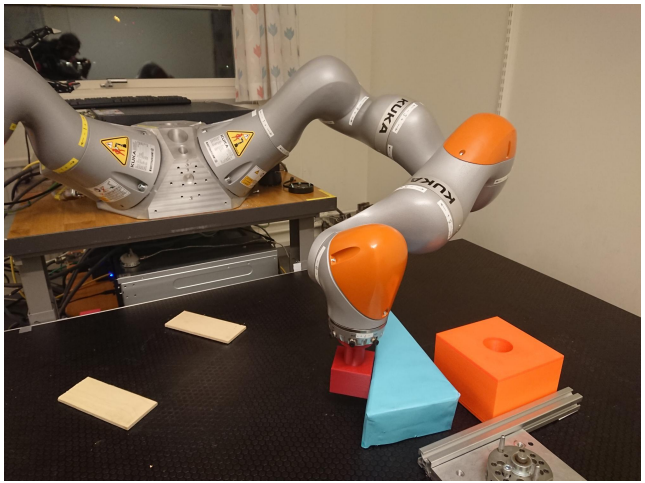
Safety Constraints for Reinforcement Learning (RL)

- RL can be dangerous for
  - The robot itself
  - Tools and the environment
- Constant supervision is often not possible
- Safety rules need to be formulated
  - Avoidance of areas
  - Maximum forces
  - Maximum joint angles
- Recovery behaviors need to be defined
  - How to be able to continue to learn
- Effects on RL algorithms need to be assessed
  - How does it affect the learning?

Goal: Implement framework to define and monitor safety constraints and recoveries

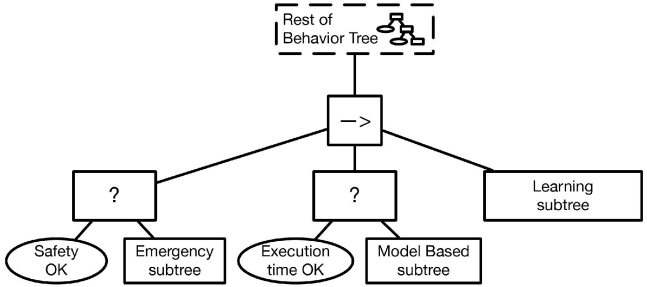




Supervisor: Matthias Mayr (matthias.mayr@cs.lth.se)

Reactive Planning and Acting using Behavior Trees (BTs)

- BTs are a plan representation and execution tool
- They allow reactivity
  - Periodic tick signal and action switching



However, when planning as task, the outcome is often a (fixed) skill sequence.

The paper “Towards Blended Reactive Planning and Acting using Behavior Trees” implements an approach to craft a BT that can solve a task

Goal: Integration into SkiROS2 (Skill-based platform for ROS)

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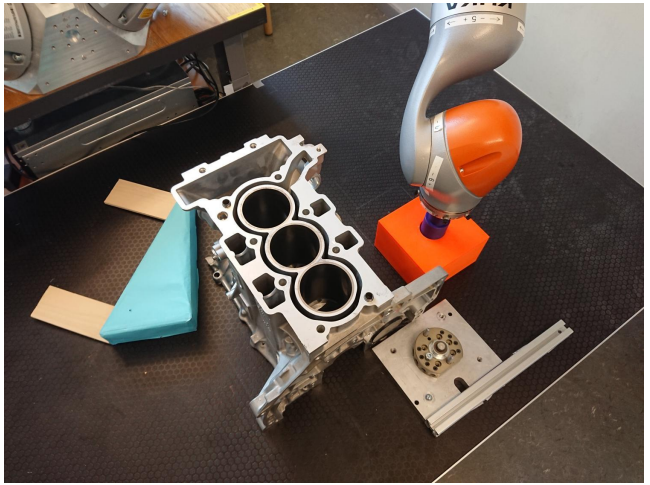
Data Analysis tools for Design & Learning of Robot Tasks

- Design learning problems
  - Reward functions
  - Objectives
  - Parameters
- Visualize data & calculation of reward functions
  - When does the robot retrieve good reward?
  - How much reward?
- After learning:
  - Which configurations were evaluated?
  - Which rewards were achieved?
  - Which ranges are observed



Goal: Implement tools for data analysis of RL with robots

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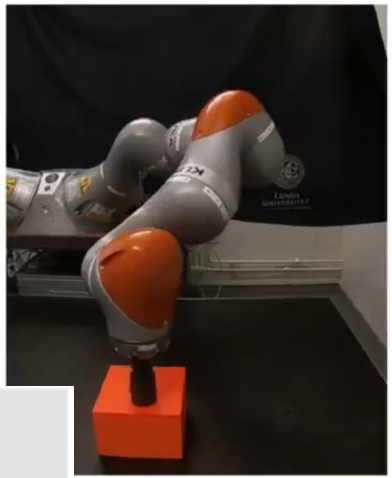
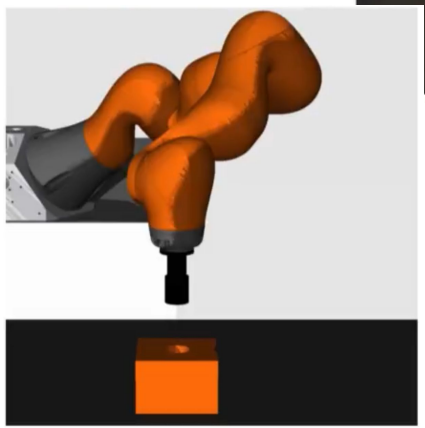
Influence of Domain Randomization on sim2real transfer

- Learning in simulation is much easier to parallelize
- However, learned solutions need to transfer
  - Often overfitting in simulation
- Domain randomization can vary
  - Robot start positions
  - Locations of objects
  - Material properties
- Longer learning times
- Which variations are actually needed?





Goal: Evaluate the importance of different DR techniques on sim2real transfer

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