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## F O R S C H U N G S P R A X I S

for

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### **Reinforcement learning for grasping tasks in unstructured environments**

#### Problem description:

Although robotic grasping has been a key research topic in the last few years, the problem is still open in unstructured environments where multiple sources of uncertainties are present. Computer vision is a promising technology to allow object recognition and pose estimation in domestic or flexible manufacturing environments. However, computer vision techniques cannot be considered fully reliable when performing autonomous pick-and-place and grasping in unstructured environments, due to variable light conditions, potential occlusions, and measurement noise. The objective of the student work is to leverage reinforcement learning (RL) methods to obtain an increased robustness when robots deal with grasping tasks in presence of pose estimation error. Model-free reinforcement learning algorithms (e.g. PI2 or Monte Carlo based methods) have the potential to learn, by trial and error, systematic errors and to achieve an increased robustness [1]. In order to investigate the effectiveness of the proposed method on a real system, a grasping task will be executed with a KUKA lightweight manipulator adopting RL techniques when the pose of the object is affected by significant uncertainty.

#### Work schedule:

Task:

- Consulting the literature about uncertainties-robust robotic grasping
- Implementing the probabilistic RL method within a ROS framework
- Testing the implemented method on a KUKA lightweight

Supervisor: Dr. Pietro Falco

Start: xx.xx.xxxx

Delivery: xx.xx.xxxx

(D. Lee)  
Univ.-Professor

#### Bibliography:

- [1] Freek Stulp, Evangelos Theodorou, Jonas Buchli, and Stefan Schaal. Learning to grasp under uncertainty. In *Robotics and Automation (ICRA), 2011 IEEE International Conference on*, pages 5703–5708. IEEE, 2011.