(IDP) RL for Vision-Based Robotic Grasping on the Husky Platform in NVIDIA Isaac Simulator with Sim2Real Transfer

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Overview

Develop and evaluate reinforcement learning (RL) algorithms for our Husky mobile robot with a manipulator using the NVIDIA Isaac simulator. This project focuses on both vision-based and joint-space grasping tasks. The goal is to build a simulation environment, train RL models on the cloud, and transfer the learned policies to the real robot.

Part 1: Simulator and Real Environment Setup

- Set up the NVIDIA Isaac simulator for the Husky robot.
- Build a portable lab platform to enable close-range manipulation.
  - Install an RGB-D sensor
  - Integrate 6D pose estimation for the target objects.
- Develop simulation scenarios with varied camera configurations, target objects, and flexible settings (e.g., adjusting the camera's position and the mobile robot's placement relative to the base).

Part 2: Cloud-based RL training

- Configure cloud-based RL training environments using Docker containers.
- Develop scripts to manage and evaluate training across multiple environments simultaneously.
- Use visualization tools and performance metrics (e.g., TensorBoard, Weights & Biases) to monitor progress.

Part 3: Reinforcement Learning Integration & Evaluation

- Integrate state-of-the-art RL algorithms (e.g., PPO) to train the manipulator for grasping.
- Train and optimize RL policies using simulation data, incorporating domain randomization for improved Sim2Real transfer (e.g. Autoencoders).
- Conduct Sim2Real experiments, comparing performance and refining both vision-based and joint-space solutions.

Timeline & Application Details

- **Application Deadline: 16.04.2025**
- **Duration:** 2 semesters
- **Group of 2 students** (collaboration is expected).
- **Required Skills:**
  - Proficiency in Python and good knowledge of C++ and ROS2.
  - Solid understanding of reinforcement learning algorithms, basic control theory, and computer vision.
  - Experience with RL frameworks (e.g., PyTorch, Stable-Baselines3, or equivalent).
  - Previous experience with real robots is a plus, though not mandatory.

Please send your CV along with a short paragraph explaining why you are a good candidate at panagiotis.petropoulakis@tum.de. **We value clean, maintainable code.**