Utilizing open source to enable flexible grasp planner and execution for implementation in a High Mix Low Volume applications

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Abstract

For years, robots and cobots have been used in industrial applications to assist humans in their tasks. Most of the executions are pre-planned with little to no capability to dynamically adapt to new profile types. This poses a challenge to adapt to new or large varieties of SKU, such as in operations facility with a requirement for High Mix Low Volume productions. The capability to dynamically adapt with speed and agility offers companies with a competitive edge to distinguish their services as personalization becomes increasingly prevalent in society.

Easy Robotics Manipulation offers the end user, integrators, and technology providers access to a highly scalable and versatile modular package based on the open-source Robot Operating System (ROS), the defacto standard for modern robotics deployment. The packages and libraries provide the ability to leverage on deep-learning to train images as inputs that are then used to identify an object's profile. Using algorithmic-based grasp planner and end effector requirements, the packages reducethe time required to train the model to respond to highly dynamic environments where the operations demandhandling thousands of different SKUs.

In addition, the packages have been tested to provide a new and easy way to configure and define safety parameters for manipulation tasks. This includes collision checking and re-planning capabilities to enable two robotic arms to work together to accomplish a single task.

About research topic

Utilisation of deep learning to improve grasp planning and execution capabilities has been a highly discussed research area. For most grasp planners, the neural networks were trained using the Cornell Grasping Dataset, which predominantly presents an output for a two-fingered grasp, hence limiting the adaptability of different end-effectors required for different object profiles. Additionally, the majority of the current labelling for datasets is performedmanually, thus the generation of custom datasets would tend to be tedious,preventing the effective utilisation of deep learning models.

This study makes use of the open-source ONNX AI format to eliminate any lock-in for a proprietary learning framework and enable the flexibility to transition to a differentframework, should a better framework emerge in the future. The manipulation capabilities provided in this research utilises algorithmic-based grasp planners and motion planning framework agnostic interface grasp execution. The grasp execution is based on the widely used ROS2 MoveIt2, which is an easy-to-use open-source robotics manipulation platform used to develop commercial applications, prototype designs, and benchmark algorithms.

About Institution

ROS-Industrial is an open-source robotic software project that extends the advanced capabilities of ROS software to industrial relevant hardware and capabilities. ROS-Industrial operates as a consortium in three major regions, USA, Europe and Asia Pacific at present. ROS-Industrial aims to proliferate robotic adoptions through the development of advanced robotics applications utilising open-source ROS.