Enabling Cobots to Automatically Identify and Grasp Household Objects.

Background
The deployment of Artificial Intelligence (AI) methods into robots are leading to a new generation of intelligent and Collaborative Robots (Cobots). Such Cobots are expected to work in real and dynamic environments to assist human co-workers with repetitive, dynamic, and demanding tasks. The recent advances in autonomous Cobots have rapidly increased with the development of novel data- and knowledge-driven methods. The combination of these methods is making possible that robots can perceive and manipulate different objects. However, the main challenge is to automatically identify objects that robots have not seen before.

Problem and goal
In this project, the students will focus on the task of “cleaning a table” as the one displayed in Fig. 1. Then, the students will investigate and develop a zero-shot learning algorithm to allow robots to identify, segment and label unseen objects categories in new environments. Once the objects are identified, the robot needs to reason about the right location to place the objects. For example, the robot will learn that cups and plates should be stored in the cupboard in the kitchen. Concretely, the students will:

- Segment the objects on the table. As a starting point, the students will use the results of a master thesis shown in the above figure and further explain in this video: https://youtu.be/dsNyZL_mHX4.
- Identify and grasp new objects on top of a table. For this, they will investigate and implement the CLIP (Contrastive Language–Image Pre-training) method: https://openai.com/blog/clip/.
- Implement a control and reasoning algorithm to indicate a robot how to grasp and where to place the objects. The goal is to clean the table and deliver the objects to their correct locations.

Målgrupp: TKAUT, TKDAT, TKTFY, TKELT, TKTEM, TKMAS, TKITE (preferable a mix project group)
Gruppstorlek: 3–6 studenter
Antal grupper: 1
Förkunskapskrav: Basics of Control, Learning algorithms, Basics on Computer Programming (Python or C++)
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