TECHNISCHE UNIVERSITÄT WIEN
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Autonomous Systems
UNIV.-PROF. DR.-ING. DONGHEUI LEE
AUTONOMOUS SYSTEMS

MASTER'S THESIS

Mixing it Up: A Human-Robot Collaboration in Crafting Cocktails

Problem description:

The use of robots in various industries has increased rapidly over the past few decades. From manufacturing to healthcare, robots are playing a significant role in increasing efficiency in unpopulated scenarios. However, the use of robots in collaboration with humans when executing a common task is still a challenge. Human-Robot collaboration (HRC) requires the robot to understand not only the task to execute but also the scene and the humans nearby. This thesis will explore the benefit of understanding human actions when assisting a human in a cocktail-making task.
In particular, the student will adopt deep learning methods to recognize human actions, both on low-level (human-object interaction) and high-level (human intention). Using this knowledge the robot will anticipate the next steps to follow [1]. and assist the human [2] in the cocktail preparation process. The student will fine-tune existing deep-learning methods for a collected HRC cocktail dataset and evaluate the models in real-world experiments. By the end of the thesis, the robot should be capable of assisting a human in the crafting of cocktails task.

Tasks:

- Task1. Literature research on Human-Robot Collaboration using computer vision algorithms.
- Task2. Review of our own existing HRC cocktail dataset and extension with additional data if needed.
- Task3. Fine-tuning of existing deep-learning algorithms for the cocktail crafting task.
- Task4. Ablation study and improvement of the algorithm for the given task.
- Task5. Evaluation of the system's ability to assist a human in the cocktail crafting task.

Bibliography:

[1] Esteve Valls Mascaró, Hyemin Ahn, and Dongheui Lee. Intention-conditioned long-term human egocentric action anticipation. In *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, pages 6048–6057, January 2023.
[2] Hema S. Koppula and Ashutosh Saxena. Anticipating human activities using object affordances for reactive robotic response. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 38(1):14–29, 2016.

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