recAIcle :: Recycle-oriented collaborative waste sorting by continual learning

Action recognition support system for recycling and sorting facilities

Pro²Future

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MOTIVATION & GOALS

Waste composition is constantly evolving, demanding **innovative** approaches for effective **sorting**. Our project aims to develop an **assistance system** that: **(i) Learns** from sorting workers, and **(ii)** Provides **cognitive support** to sorting tasks. The key system's components are **object tracking**, and the ultra-wideband **(UWB) localization** to support **object detection**. Segmented objects of interest are projected **directly** onto the conveyor belt to assist workers.

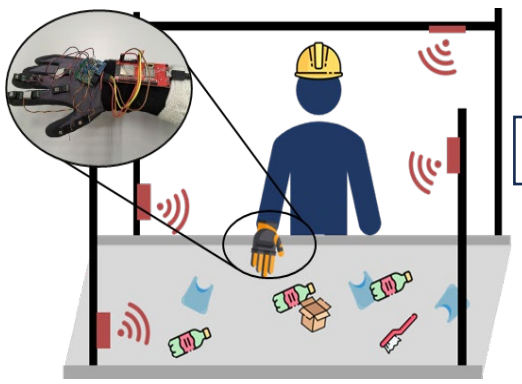
Project FactBox

Project Name recAIcle
Project ID FFG No. 892220
Duration 36 Months

Area 1
Perception and Aware Systems
Area 4.1
Cognitive Products

Project Lead
DI Dr. Michael Krisper

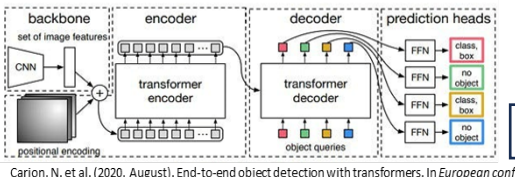
UWB LOCALIZATION



The glove's position is determined using **Trilateration** with (red) **anchors** attached to the corners of the sorting area. The **3D position** of the **glove** is **converted** to the 2D coordinate system of the camera to be **compared** with the prediction of the **neural network.**

Multi-modal transfer learning

OBJECT DETECTION

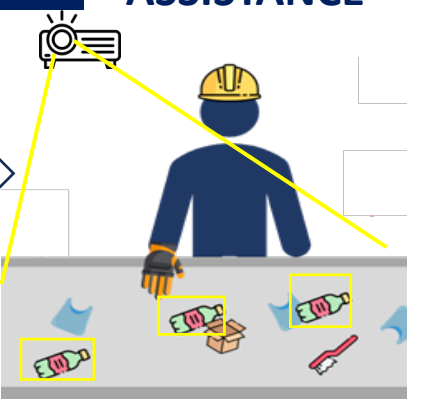


Carion, N. et al. (2020, August). End-to-end object detection with transformers. In *European conference on computer vision* (pp. 213-229). Cham: Springer

Neural networks (NN) are employed to **detect** the **position** of **objects** in the image. The NNs are **fine-tuned** and trained with **custom data** to fit the use case. However, **deviations** from the training environment can lead to **outliers**.

Sorting Assistance

ASSISTANCE



The **visual waste assistance** system supports workers during sorting tasks. Each **item** to be **removed** is **highlighted** with a segmentation mask or surrounded with borders, **projected** via a **beamer** based on the previous models.

RESULTS

CONTRIBUTION

Scientific contribution
- Enhancing object detection with transformer mechanisms
- Portable ultra-wideband localization with off-the-shelf hardware
- Multimodal self-adaptive task learning

Economic contribution
- Self-learning system for recycling sorting plants
- Learning for sorting workers
- Supporting sorting workers

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