

# HERAKLION 2019

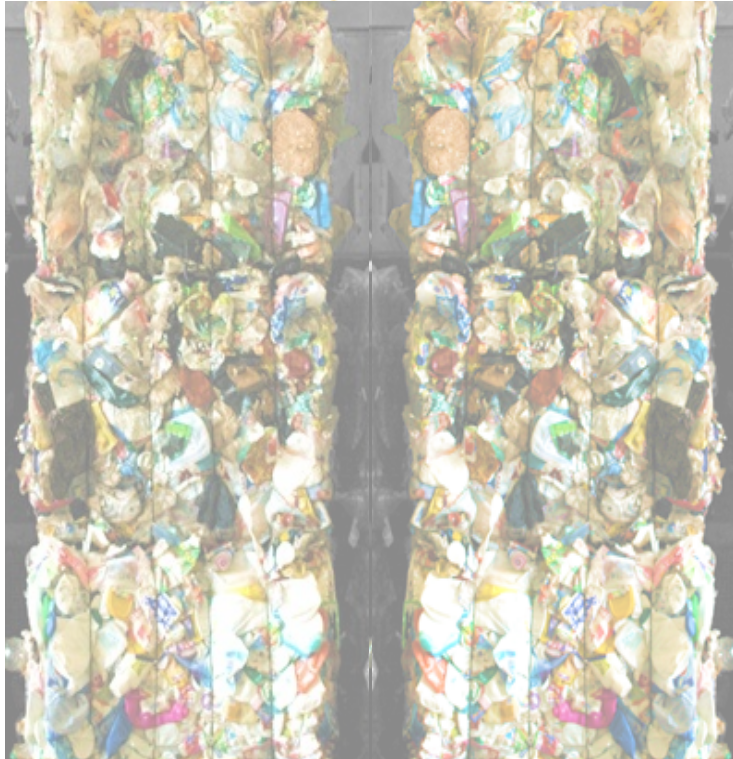
7<sup>th</sup> International Conference on  
Sustainable Solid Waste  
Management

## **Robotics, artificial intelligence and vision applied to waste sorting: ZRR for municipal waste**

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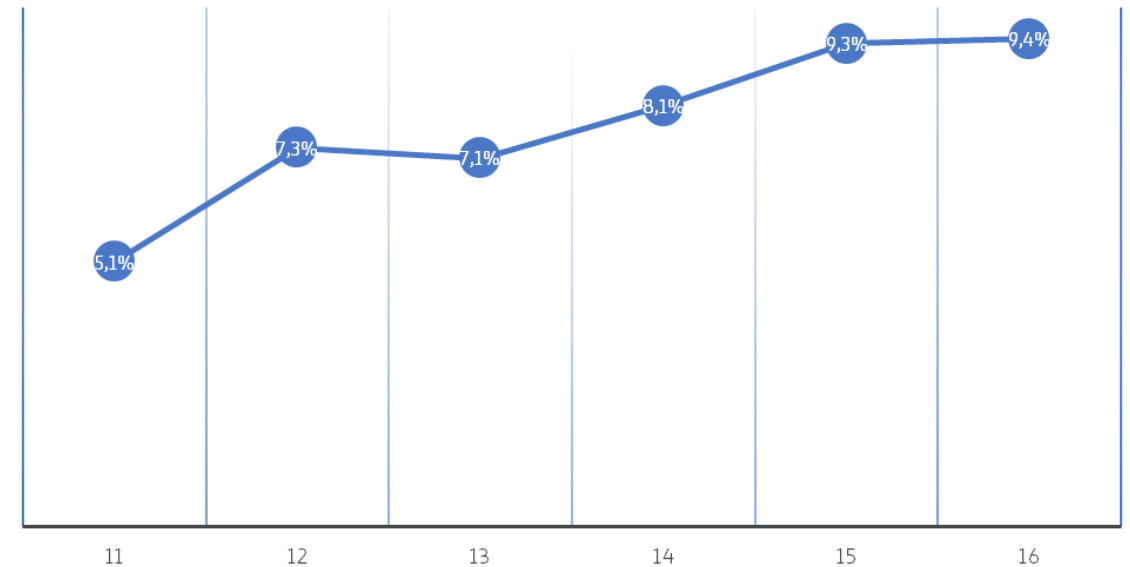
26<sup>th</sup> June 2019

# Why do we need to evolve?



EU Circular Economy package recycling objective for 2025 : 55% for Municipal Waste and 65% for Light Packaging waste

Recovery efficiency in Municipal Waste facilities for P/C, metal, glass, plastic (Cataluña, Spain)



Waste sorting processes need to be rethought if we want to achieve EU recycling objectives

# Areas of improvement in sorting plants



Cutting objects and odours

Low ergonomomy



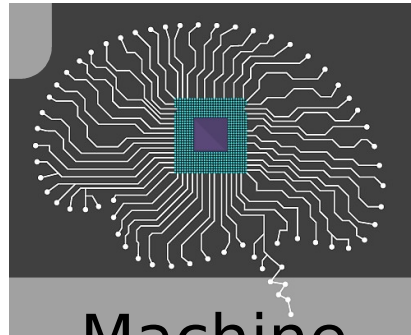
Drop of efficiency



# And how could we evolve?



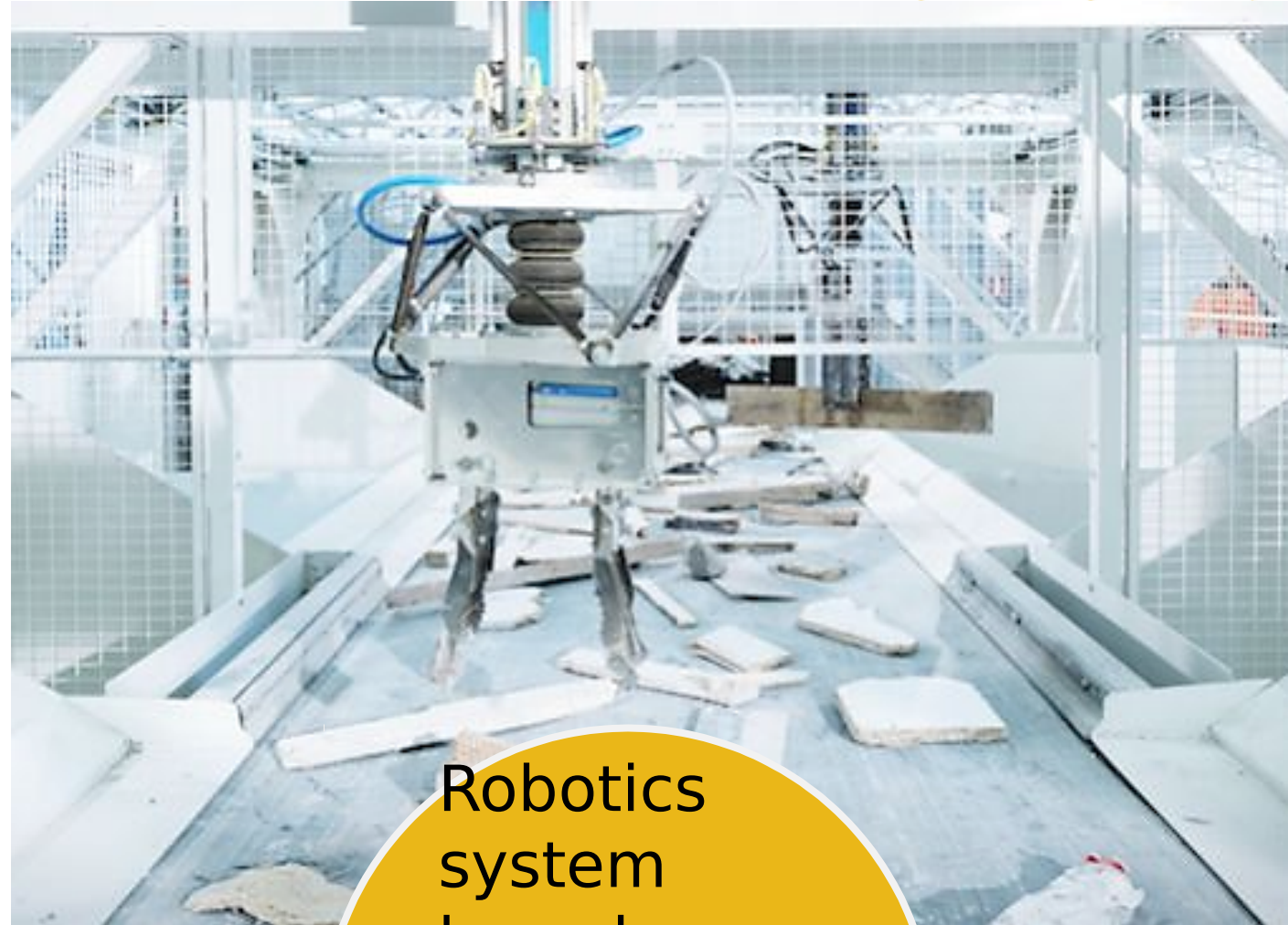
Computer  
Vision



Machine  
Learning



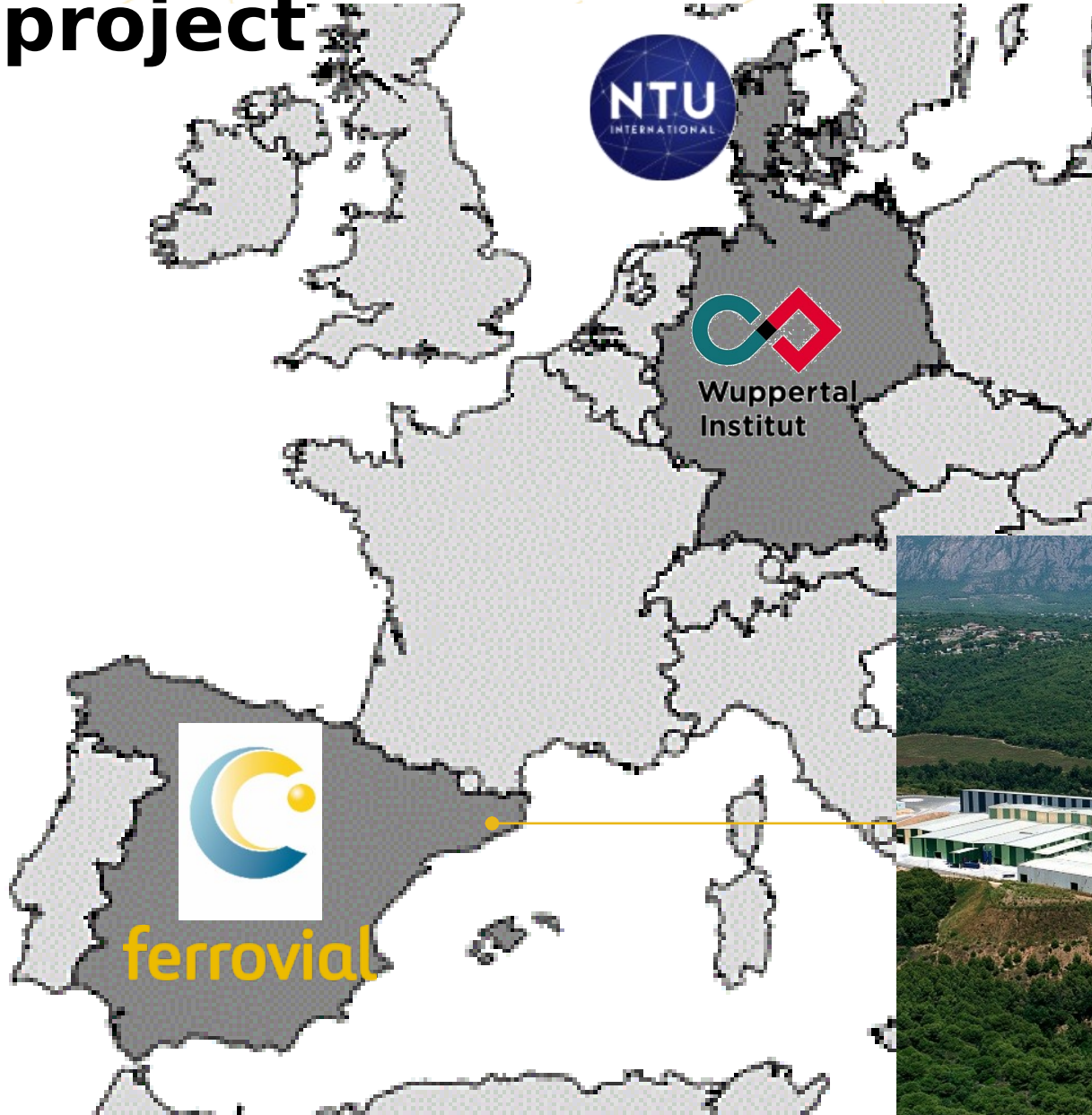
Robotics



Robotics  
system  
based on  
artificial  
vision and



# 'ZRR for municipal waste' project



Demonstration of the technology in Municipal Waste sorting processes

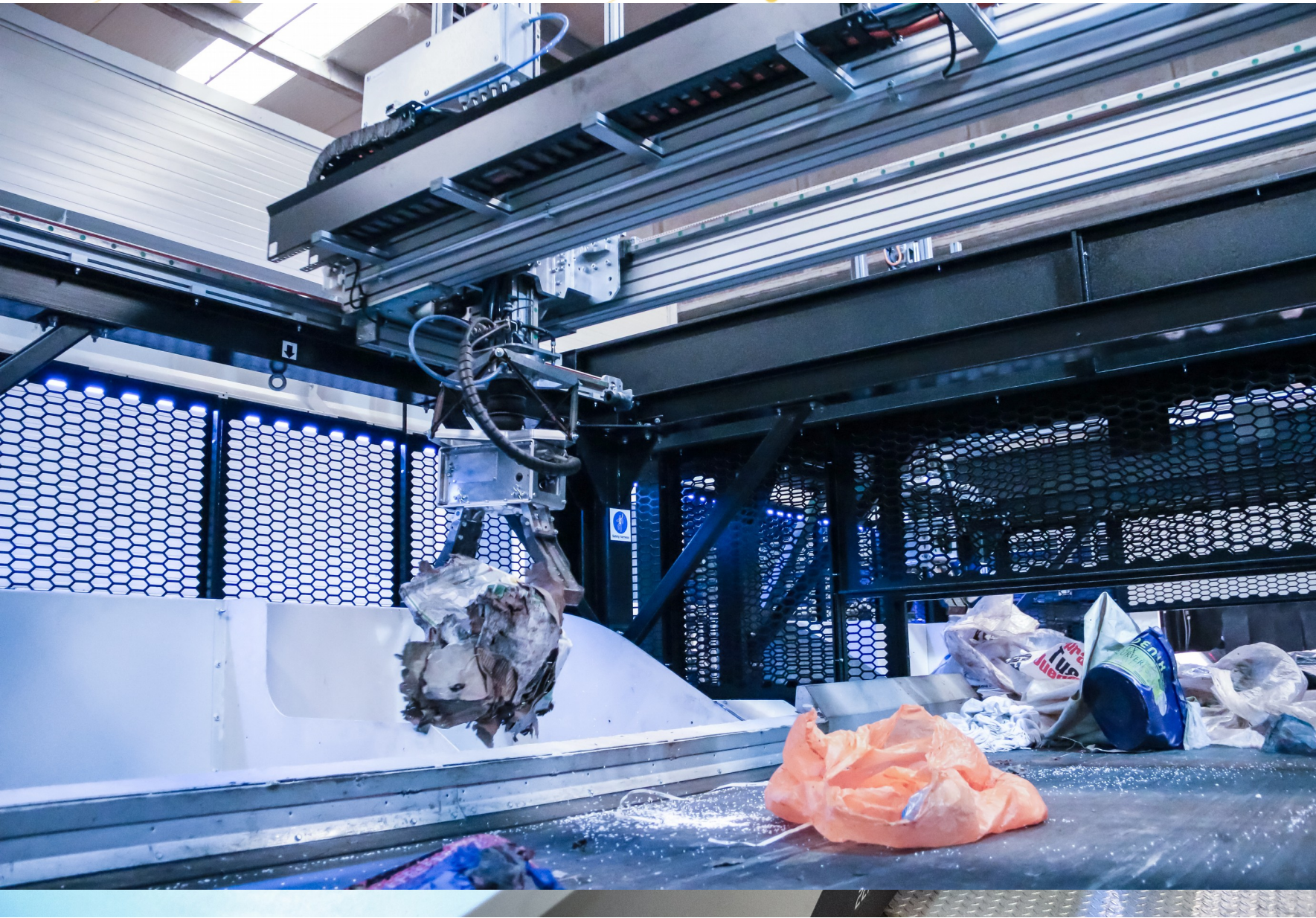


## Ecoparc 4

Execution between April 2018 and December 2019



# Project Development



ZRR at Ecoparc4 main characteristics:

- ▶ 2 robotic arms
- ▶ Sorting up to 4 different materials per arm
- ▶ Finger gripper
- ▶ Max object weight up to 30 kg
- ▶ Project targets:
  - > 90% purity
  - > 4.000 picks/h
  - 13 identified materials
  - < 14 kWh
  - < 87 dB

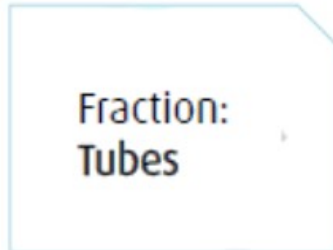


# Project development

## Training: process and tests



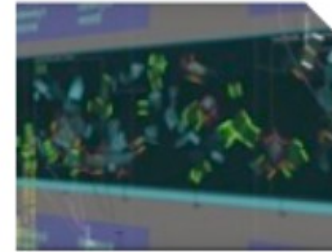
1. Gather samples of the new fraction



2. Name the new fraction in the UI



3. Feed samples manually to the sorting belt



4. ZRR sensor unit scans the new material



5. ZenRobotics Brain analyses data

Between  
500 and  
1.000  
items per  
fraction



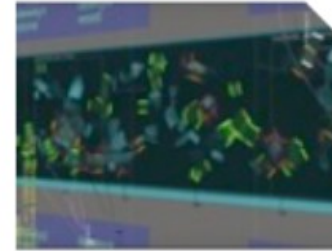
6. ZenRobotics Smart Gripper picks the objects



7. Take objects which went to reject



8. Feed those objects again to the sorting belt

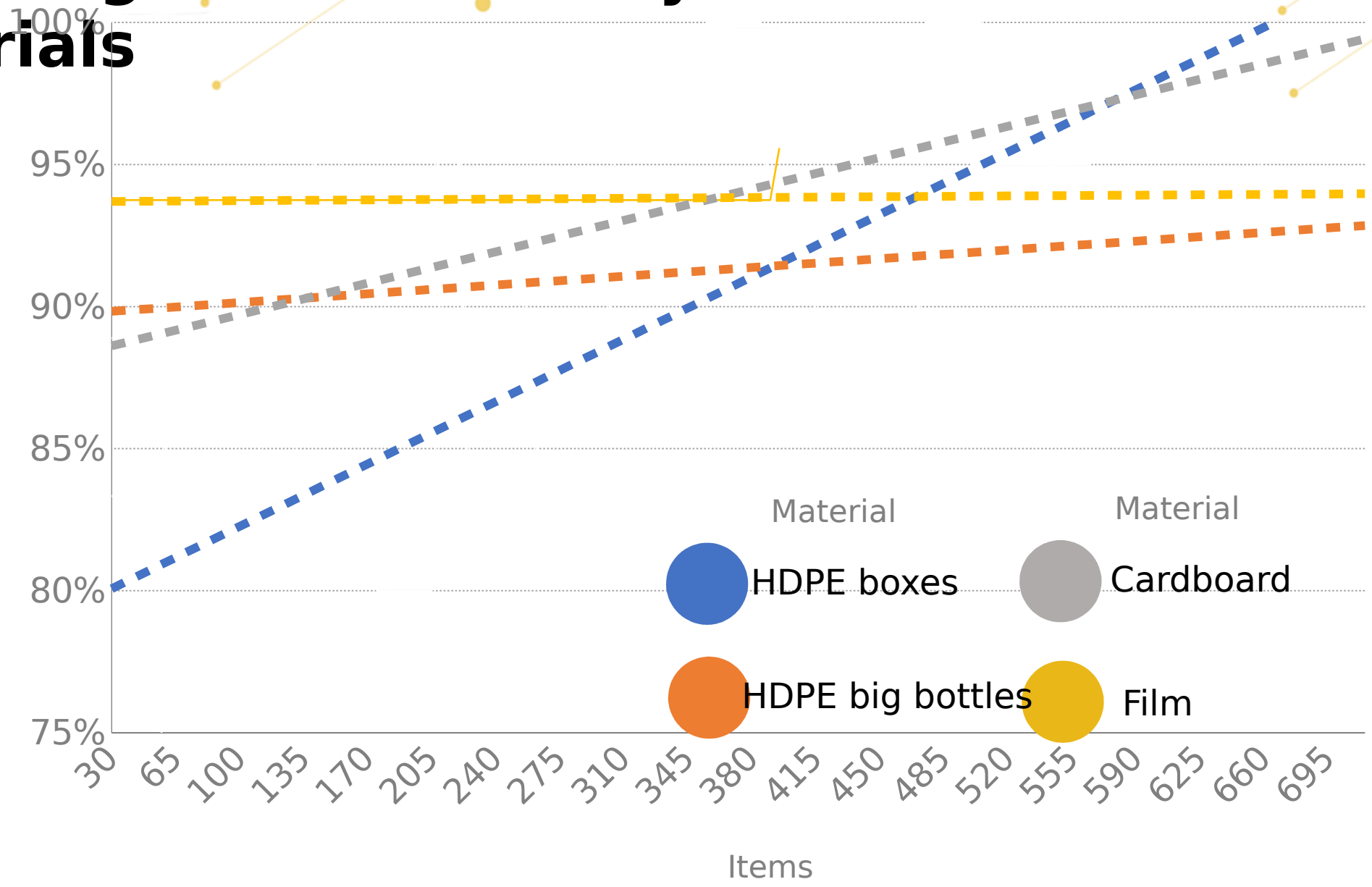


9. ZRR sensor unit scans those objects again



10. Your ZRR learned a new fraction

# A.I. recognition efficiency for different trained materials





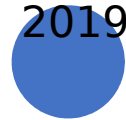
# Recovery efficiency

**% Recovery**

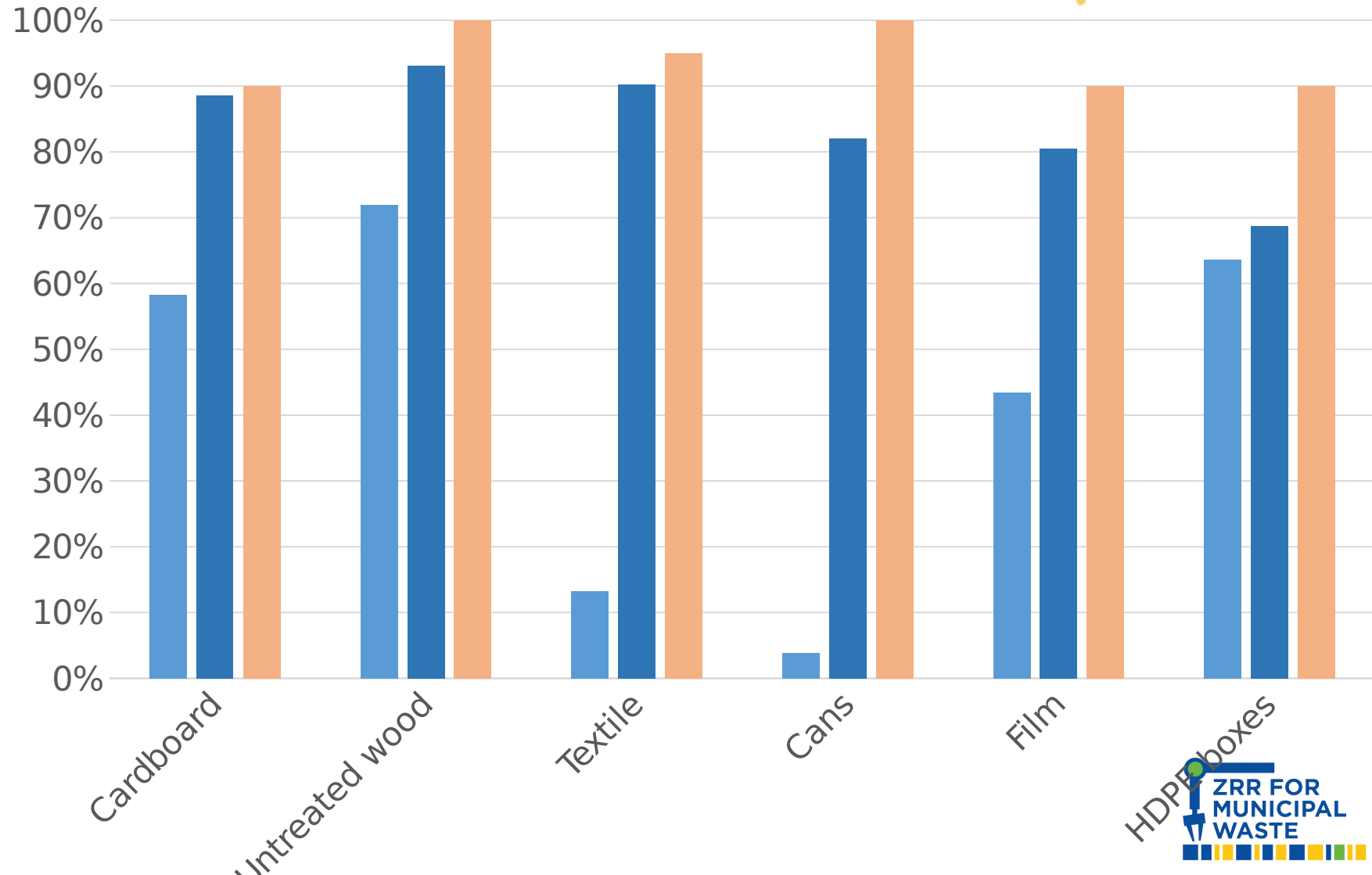
Nov 2018



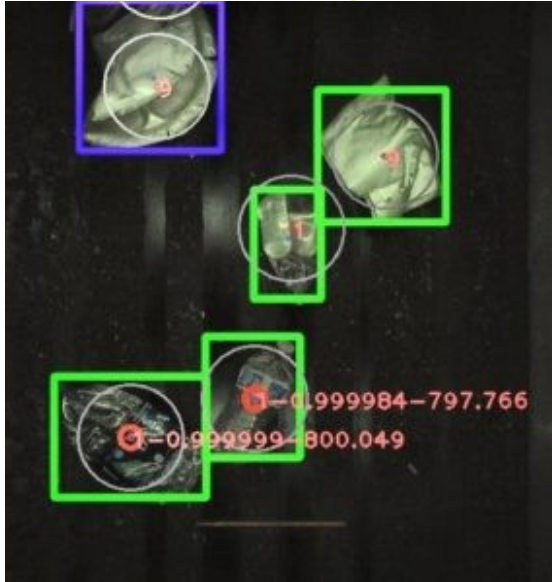
March 2019



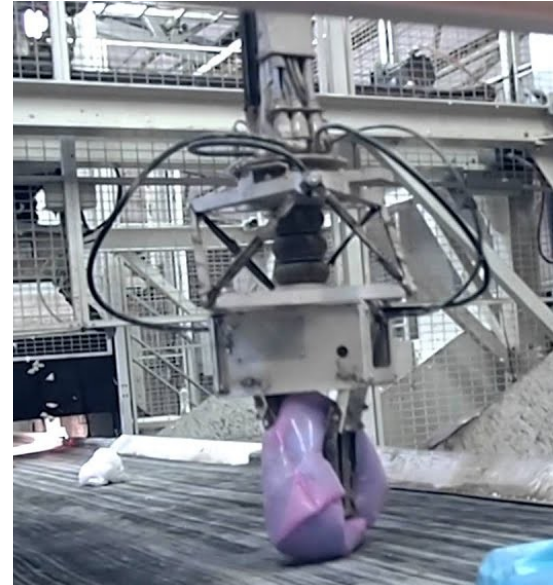
**% Purity**



# Lessons learned

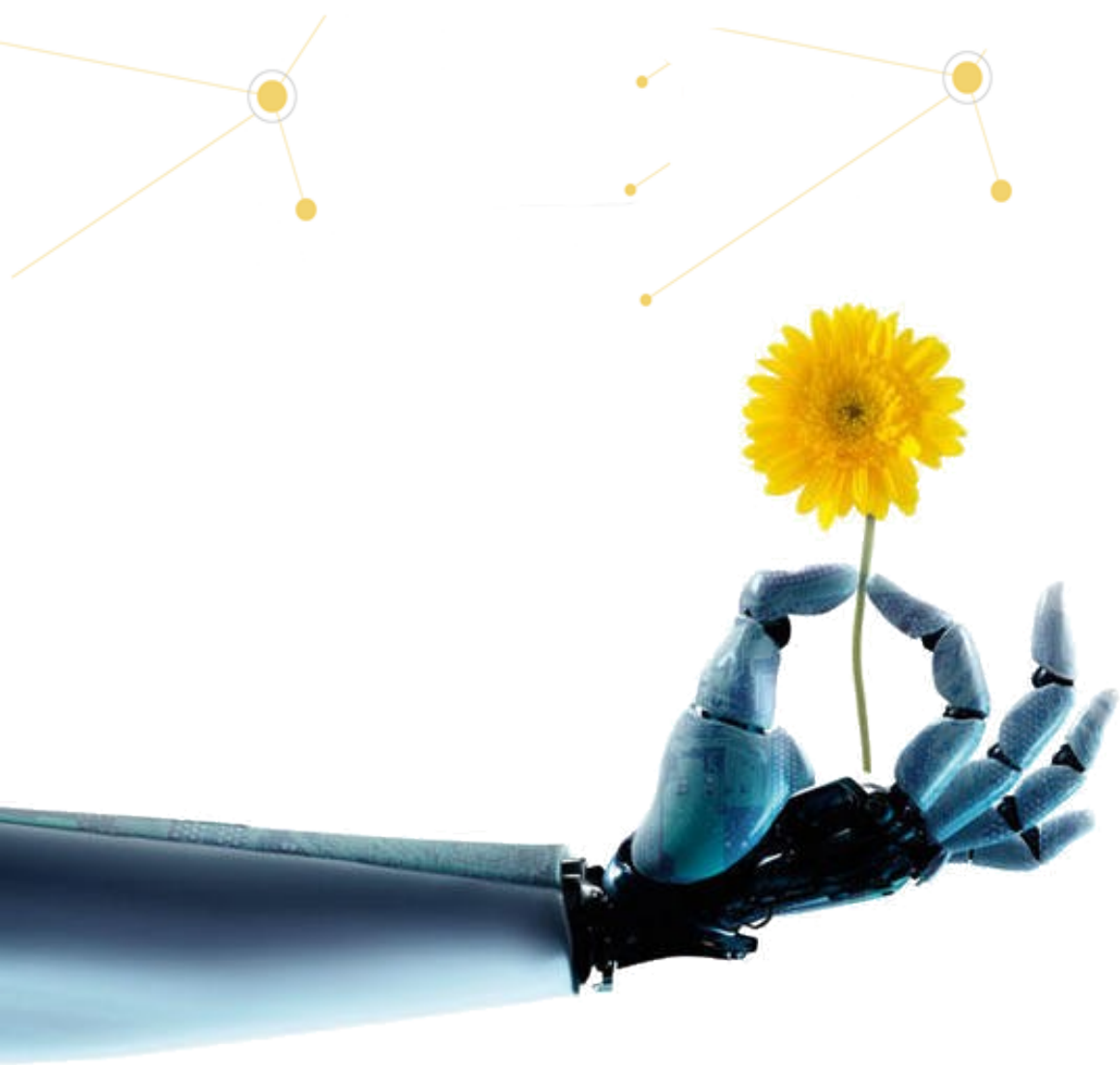


High efficiency in material recognition



Grasping difficulties in the adaptation of the technology

Technology has a great potential for automation of sorting tasks. Future sorting facilities would be designed to integrate advanced robotics and therefore the major part of the problems found in the ZPP project would be minimised



# ‘Stay human where it matters’

Henrik Scharfe  
Geminoid-DK Android  
designer



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