ERA-MIN 2

RESEARCH & INNOVATION PROGRAMME
ON RAW MATERIALS
TO FOSTER CIRCULAR ECONOMY

INSTAnT
Innovative sensor technology for optimised material recovery from bottom ash treatment

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(VITO, Belgium)

ERA-MIN 2 Final Conference and Final Seminar of Call 2017 projects
18-19th November 2021

Co-funded by the Horizon 2020 programme
of the European Union

Consortium

- Topic 4. Recycling of End-of-Life products (4.2 pre-processing, 4.3 recovery and 4.4 increase recycling of through ICT)
- May 1, 2018 – October 31, 2021 (3,5 years) (6M extension Covid-19 e.a.)
- Project consortium
  - VITO, Research Institute, Belgium (Hermesfonds)
  - RWTH Aachen, University, Germany (BMBF)
  - XRE, SME, Belgium (Hermesfonds)
  - SUEZ, Industry, Belgium (Hermesfonds)
  - TOMRA Sorting, Industry, Germany (BMBF)
- TRL 5 › TRL 7
- Project budget 1.14 M€ (871 k€ funding), 98% executed (final reporting)

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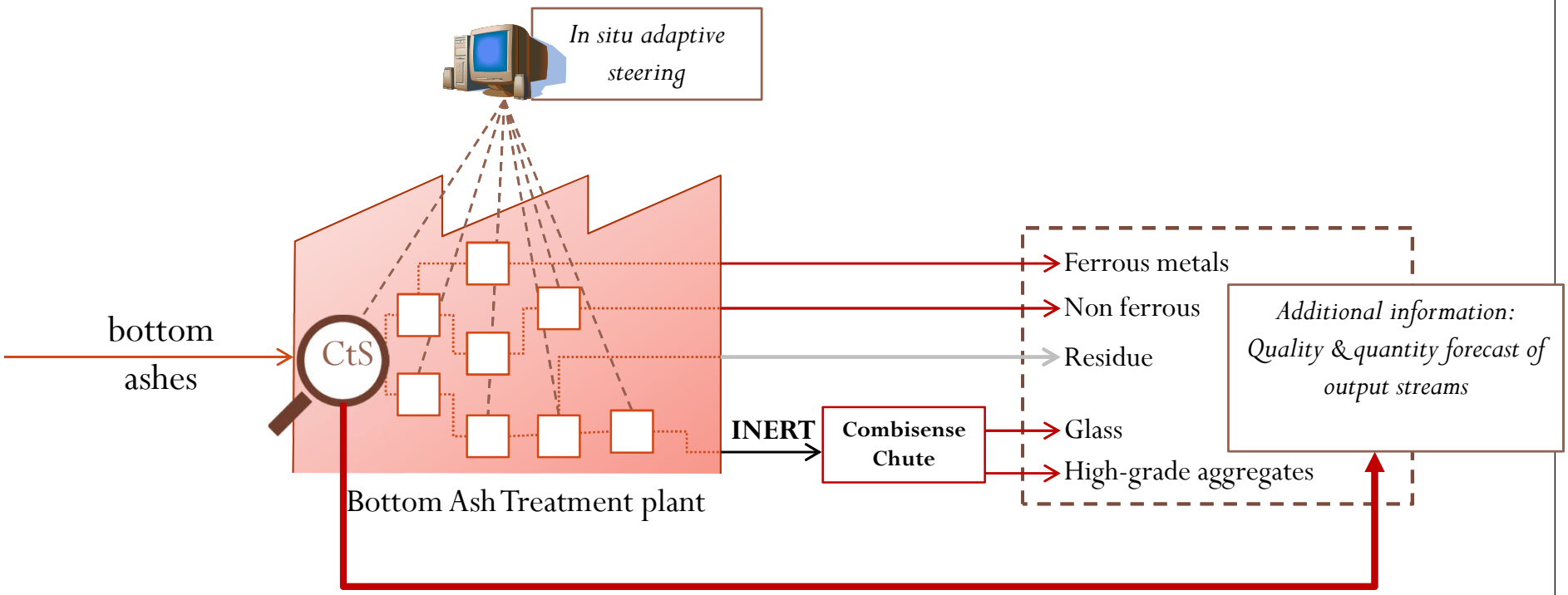
Project Concept



The INSTAnT innovation:

Input characterization → *Adaptive steering + improved sorting* → *Higher quality & new valorisable fractions*

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INSTAnT Objectives & Impact

- Objective: Close the material cycle of resources present in bottom ashes (BA) by using smart recycling technologies:
  - an innovative **sensor-based characterization technology** for **BA** allowing for a fast identification of different material fractions which can be used for adaptive steering of the processing plant and for quality control
  - a novel **sensor-based glass separation technology** focused on **BA**
- Impact
  - Increased valorization potential of mineral fractions
  - Improved recovery of metals
  - Optimized recovery for high-grade valorisation

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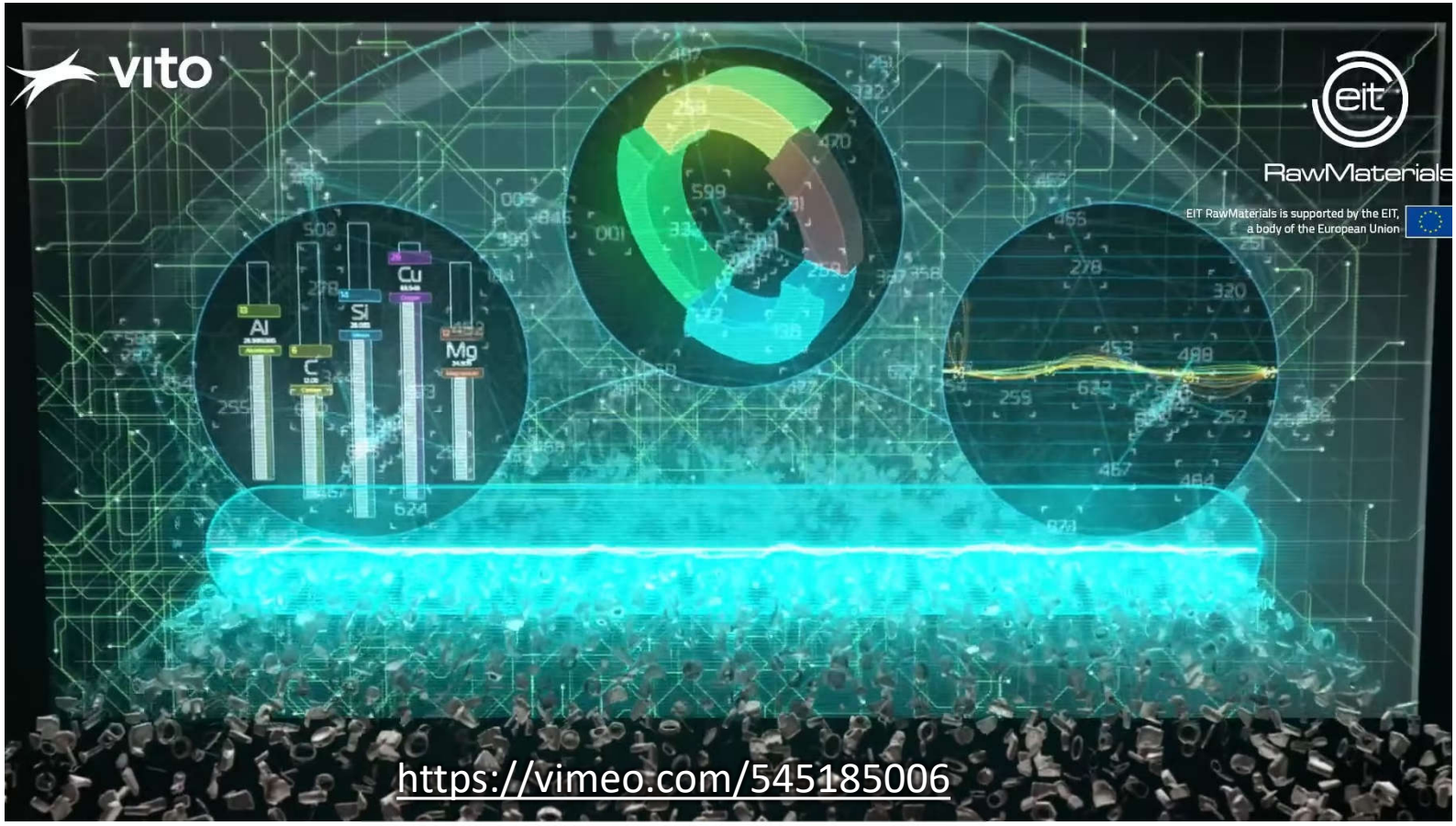
Characterize-to-Sort



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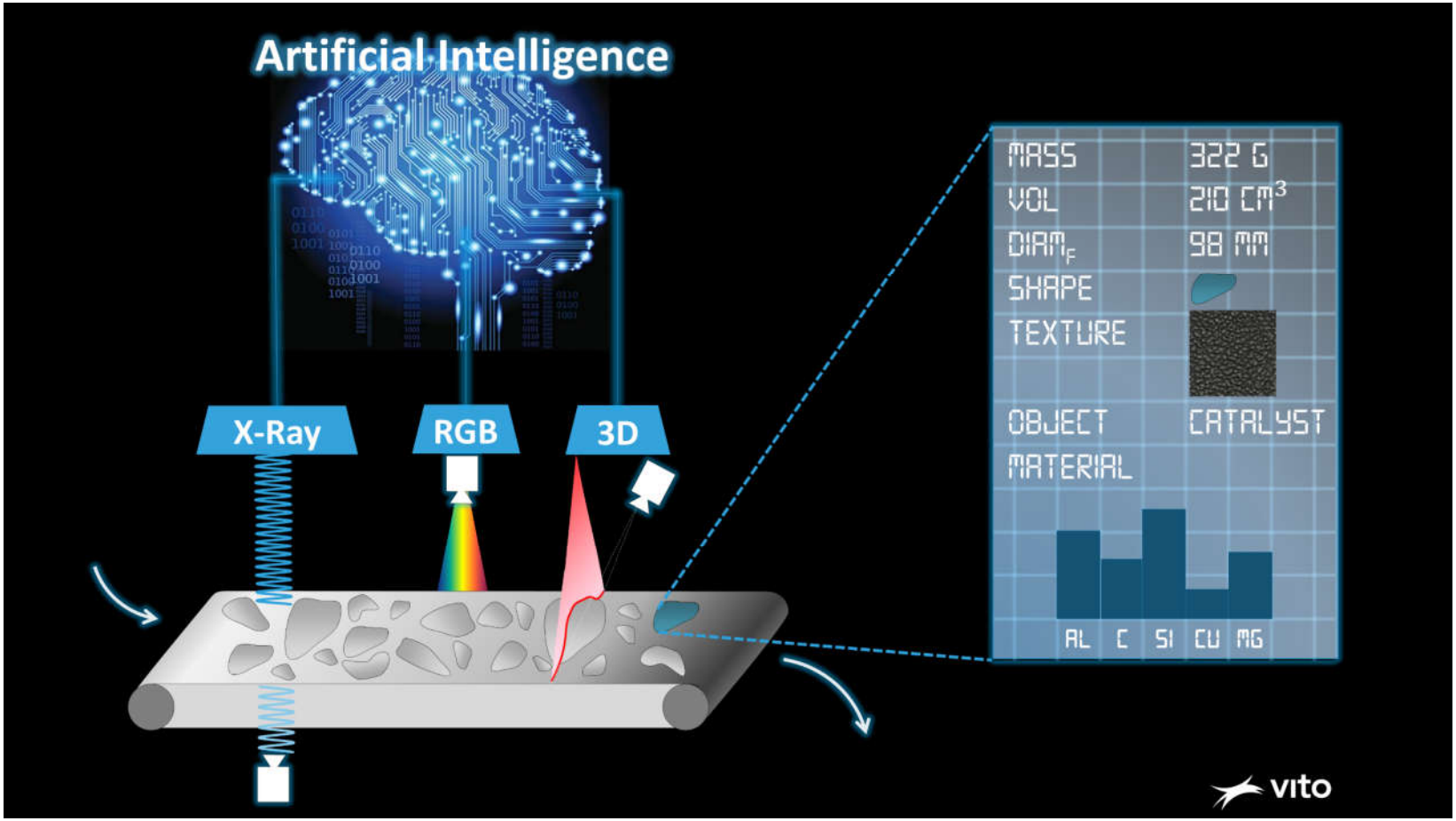
Characterize-to-Sort technology



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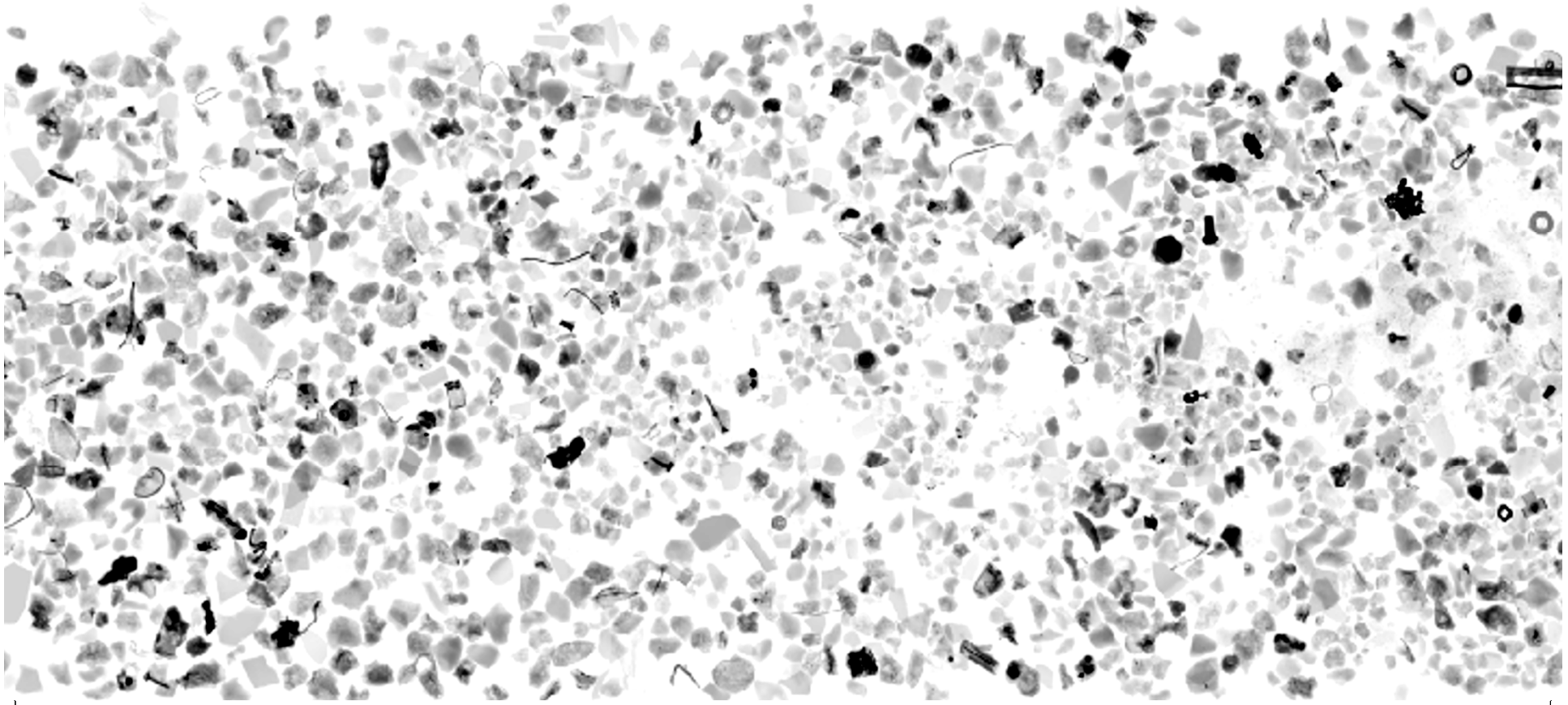
Color

X-ray TRANSMISION



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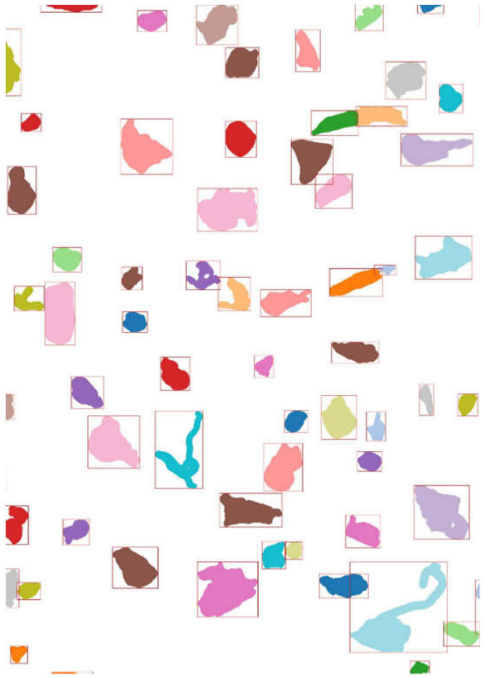
Atomic number

Model training

Scanning → Segmentation → Feature Extraction → Training → Label



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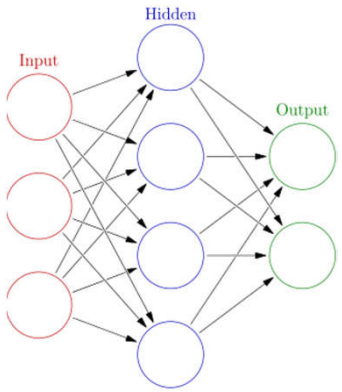

label
Aluminium
Copper
Slag
Ceramic
Aluminium

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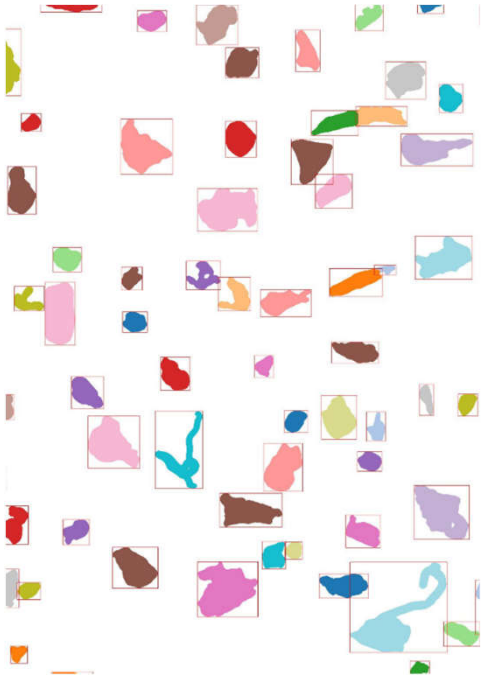
Model prediction

Learning fractions are crucial!

Scanning → Segmentation → Feature Extraction → **Prediction** → Label



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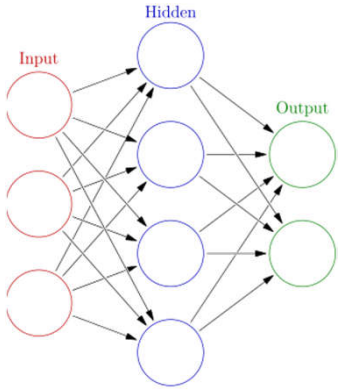

label

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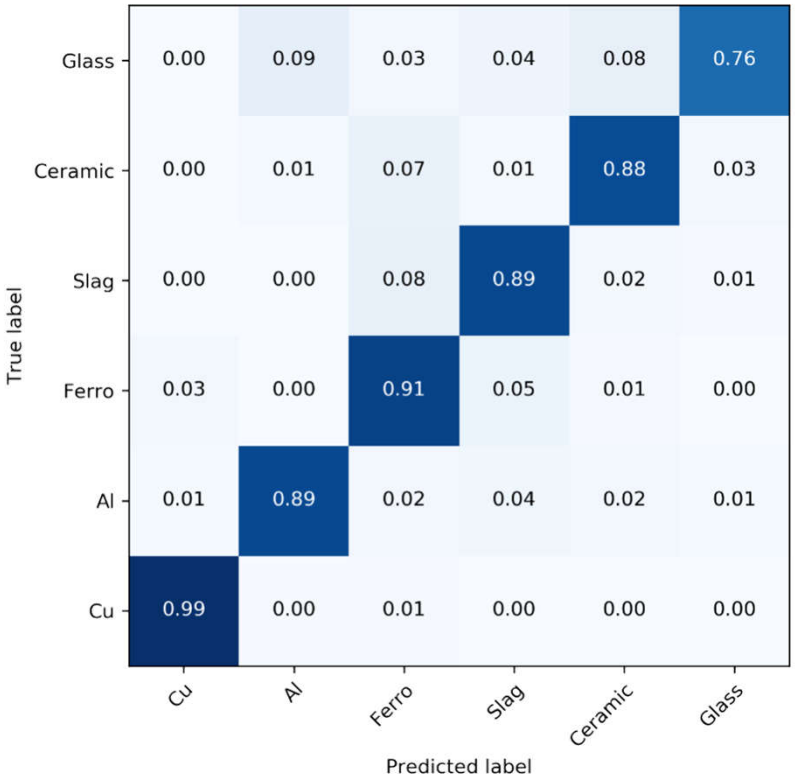
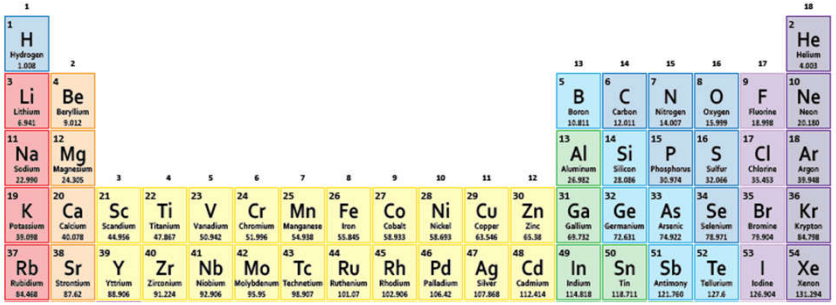
Final Results CtS

- Classification model results
  - Overall good accuracy (~90%)
  - Glass lower accuracy:
    - Mainly confused with Al & Ceramic
    - Due to
      - Similar chemistry (Al/Si) & structure
      - Impure learning fractions (overlap)





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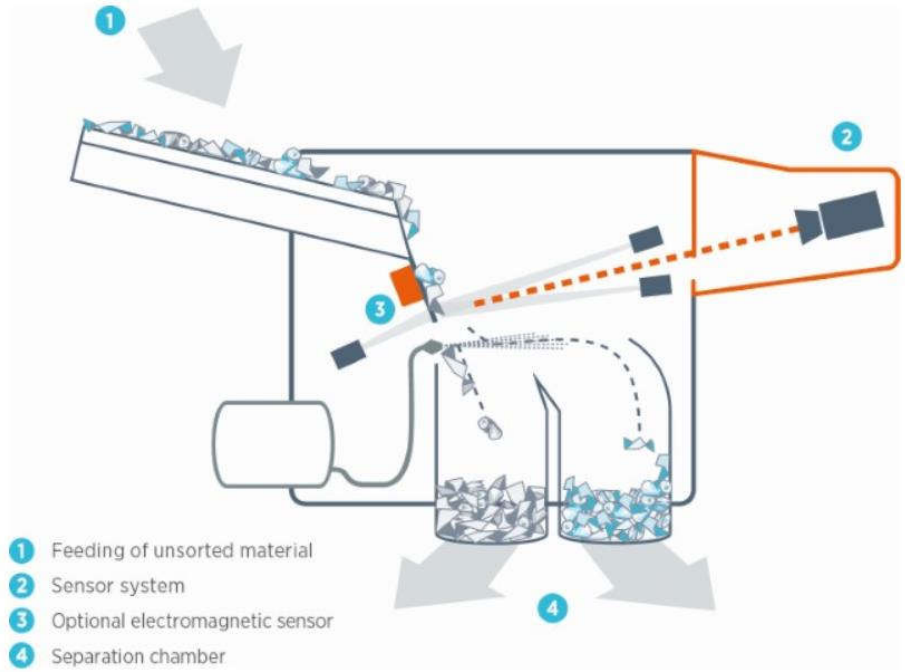
Final Results glass separation



Combisense Chute principle

Glass

- Purity increase from 10% to 82%
- Recovery 94%

- Minerals (slag)
  - Purity from 86 % to > 99%
  - Meeting criteria for high-quality concrete application

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Lessons learned

- A bottom ash classification model was developed (based on DE-XRT & 3DLT images) for 6 classes: Slag, Glass, Ceramic, Ferrous, Aluminium, Copper with overall accuracy 90%
- Glass separation improved mineral fraction for high-quality applications

BUT

- **Preparation of representative learning fractions crucial** for quality control and process steering
  - high purity, avoid overlap, long term representativeness
- Further cleaning steps needed for high purity glass (economics?)

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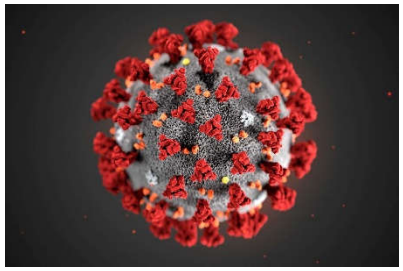
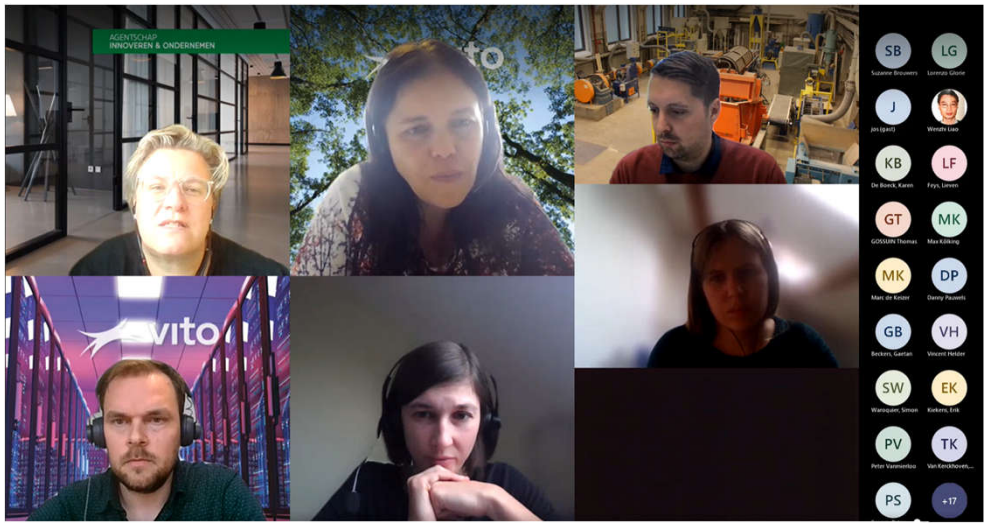
Dissemination





- Online Demo-event 26 October 2021 (46 participants)
- Sensor Based Sorting Conference 2022 (13-14 April, Aachen, Germany)

- Looking for other opportunities to disseminate & collaborate

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- Questions?

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