# Intelligent human-robot collaboration AIHURO

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# Use case (Volvo)

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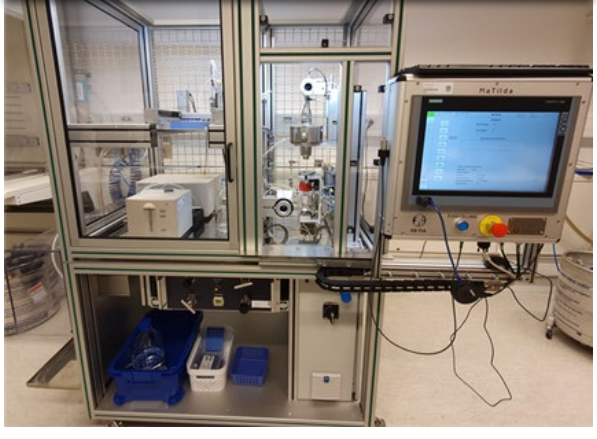
# Use case (AstraZeneca)

## MaTilda Semi-automated system for analyzing inhalers

- Inhaler handling is performed by the human operator.
  Interaction between human and MaTilda takes place during the inhaler dose withdrawal step.
- MaTilda is device agnostic (can be used for any inhaler).
- Suitable for early exploratory work and/or development.

**Goal is to have the Cobot act as the operator and safely provide MaTilda with inhaler samples without being harmful to humans in the lab**

### MaTilda



### Cobot

AIHURO will make it even more safe for humans to work along Cobots in the lab.

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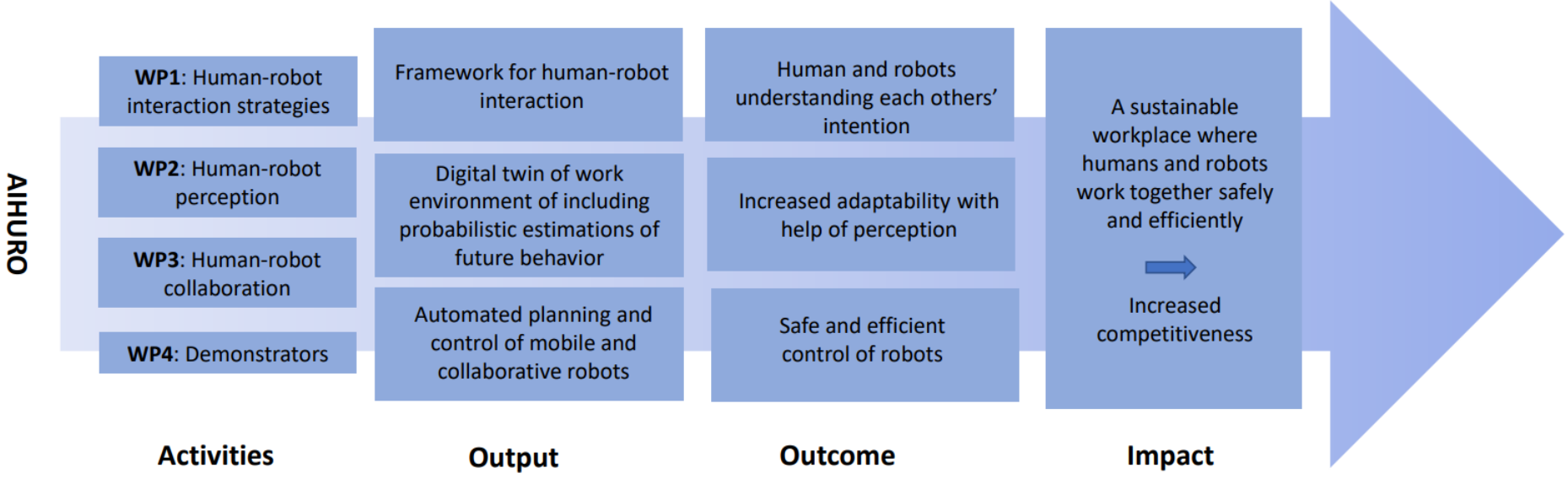
# Research Questions and Impact

- How should human and robots interact to guarantee safe yet efficient operations?
- How can human and robots deliberate and plan to support each other in avoiding risky situations?
- How can intelligent control system support the collaboration among humans and robots?



# WP1 Human-robot interaction strategies

## Three use cases

- Volvo case: human-robot collaboration operator perspective
- Astra Zeneca case: Chemist-robot coexistence
- Cross-case analysis: theoretical and empirical validated strategies

## Steps

- Evaluation of present robots with operators/chemists
- Identification of suggested human-robot interaction strategies
- Implementation of these strategies
- Evaluation of updated robots with operators/chemists

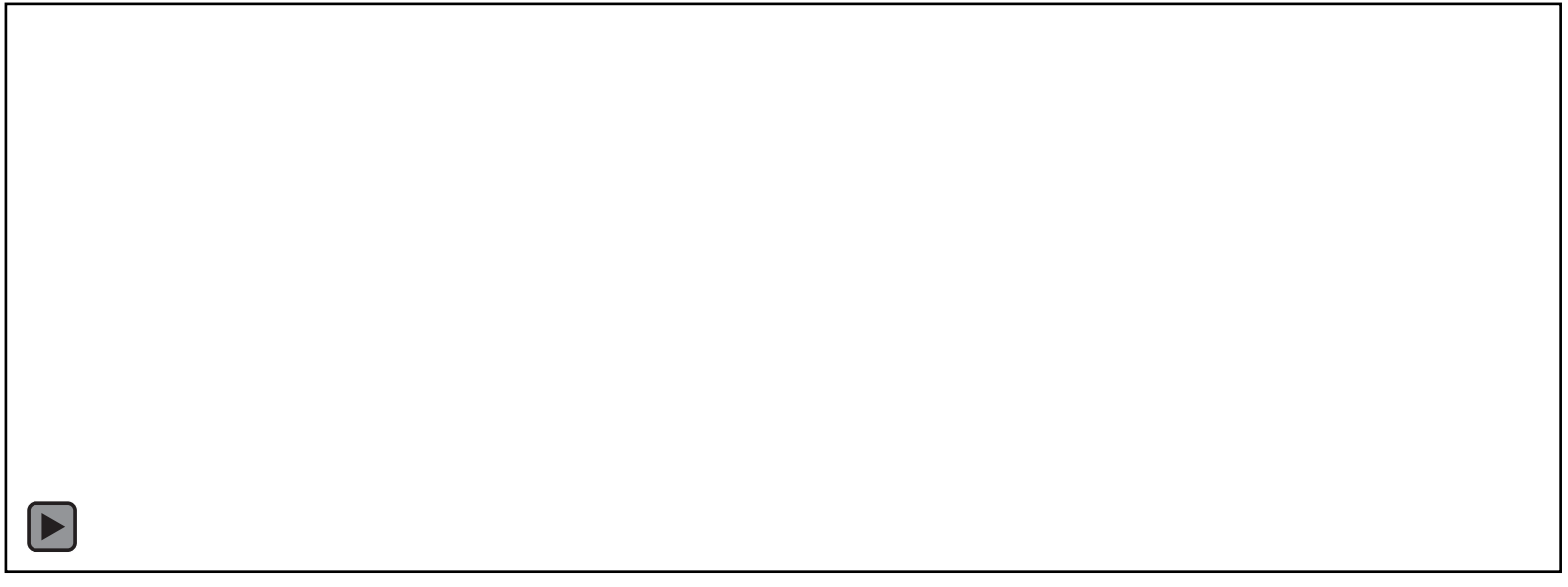
→ Final list of recommended HRI strategies

# WP2 Human-robot Perception

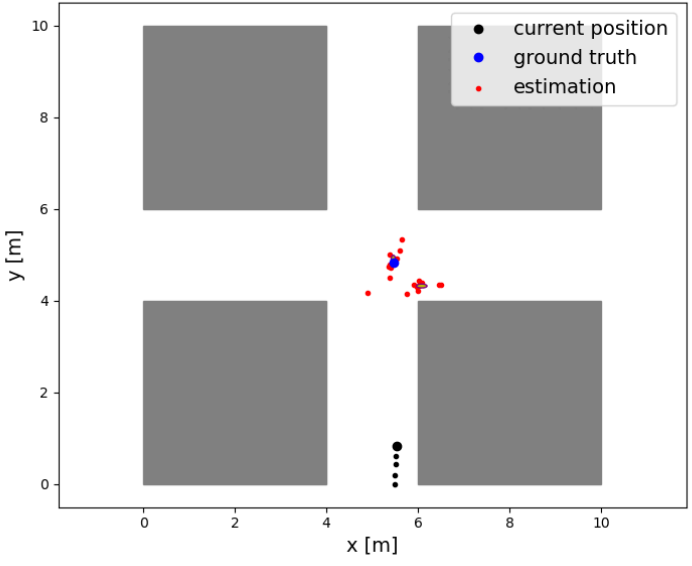
**Estimation of current state:**

Semantic segmentation, tracking, and 3D-reconstruction

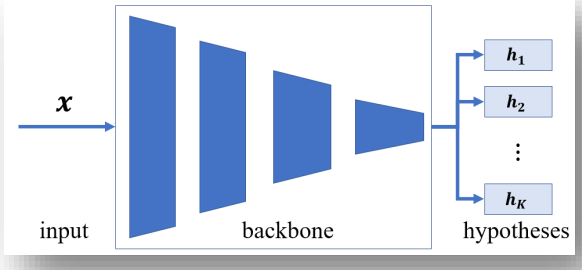
Techniques: Deep machine learning, computer vision, and sensor fusion



# Multimodal Motion Prediction

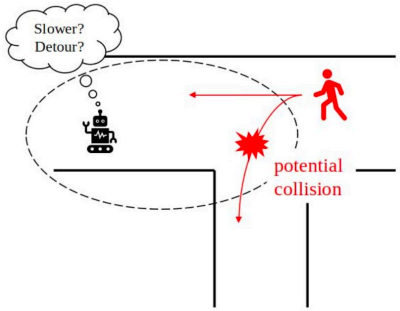


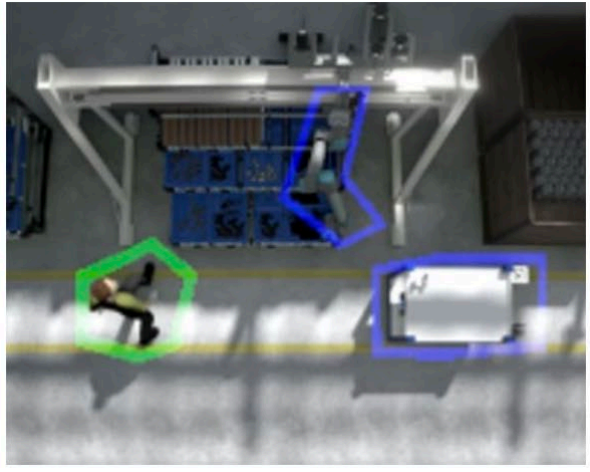

- Future motion is uncertain in terms of **probabilistic distribution** and **multimodality**.
- Motions of objects have **patterns**.
- Using **deep learning** to **learn** the pattern of motion, while also estimating the uncertainty.



# WP3 – Human-robot collaboration

- Plan the actions of mobile and collaborative robots for collaboration with a human.
- For smooth collaboration, need to continously predict what the humans will do next (WP2)
- We cannot know for sure: need to take uncertainty into account when planning the next actions
- Plan with additional objective to reduce the effects of this uncertainty
- Example: plan a trajectory that has a high probability of being collission



# Next steps

- AstraZeneca and AB Volvo are finalizing the hardware for their use-cases
- Formulation of interaction strategies for the different use-cases
- Further develop of perception and planning algorithms focusing on how to handle the inherent uncertainty
- Implementation of interaction strategies on the use-cases
- Evaluation and refinement

Finally, a safe and efficient workplace where humans and robots can work together.

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