AI for process monitoring and operator support

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May 3, 2022

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driving industry by technology

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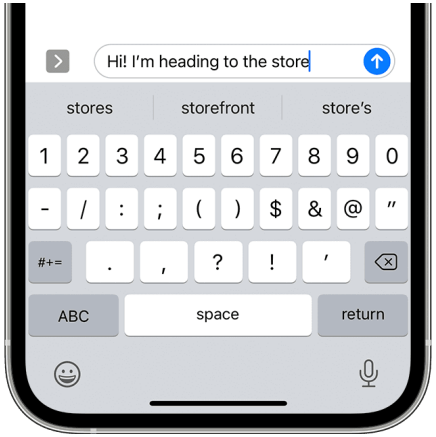
AI is increasingly present in our everyday lives...

Recommendation engines

Image segmentation and number plate recognition



Predictive text

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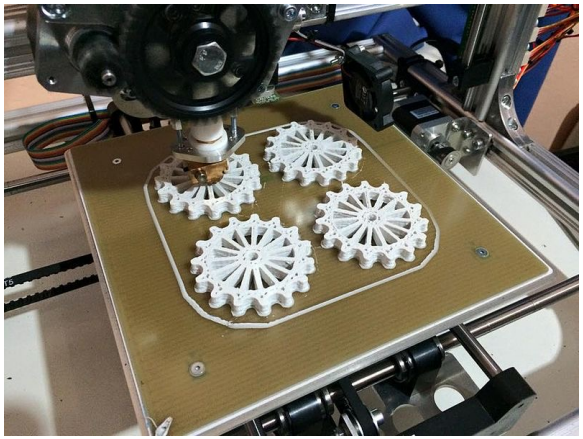
... and is being used in many industrial contexts

Product usage monitoring and optimization



Build time estimation

Predictive building control

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However, building AI-based solutions is complex

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However, building AI-based solutions is complex

no ready-to-use solutions available

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iterative and trial-and-error process

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requires an in-depth understanding of the domain

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However, building AI-based solutions is complex

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iterative and trial-and-error process

requires an in-depth understanding of the domain

it's not about big data, but about qualitative data

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2 inspiring examples

Condition monitoring and performance validation

Proactive operator support

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2 inspiring examples

Condition monitoring and performance validation

Proactive operator support

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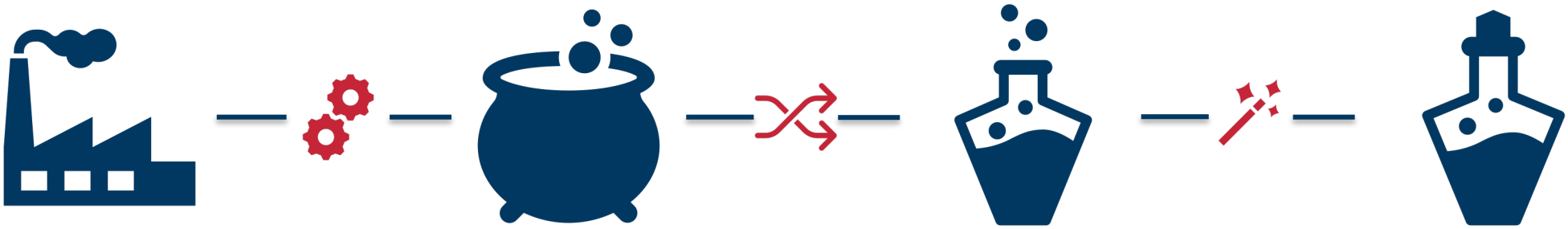
Context-aware condition monitoring



Most products are built in more than one step, **but...**

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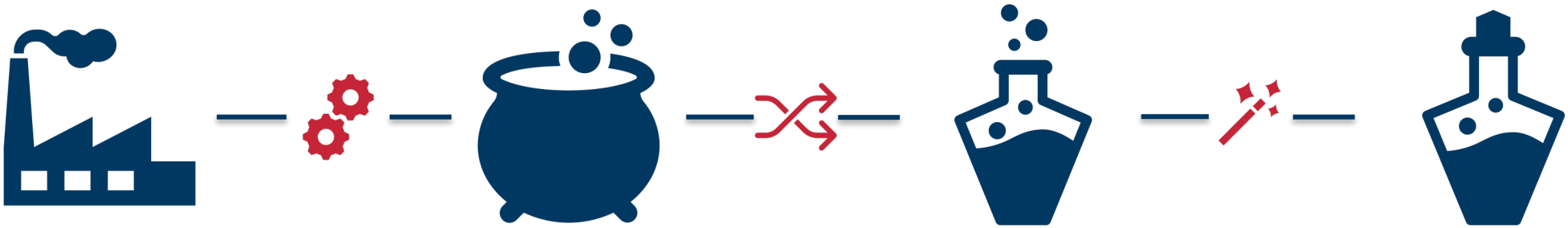
Context-aware condition monitoring



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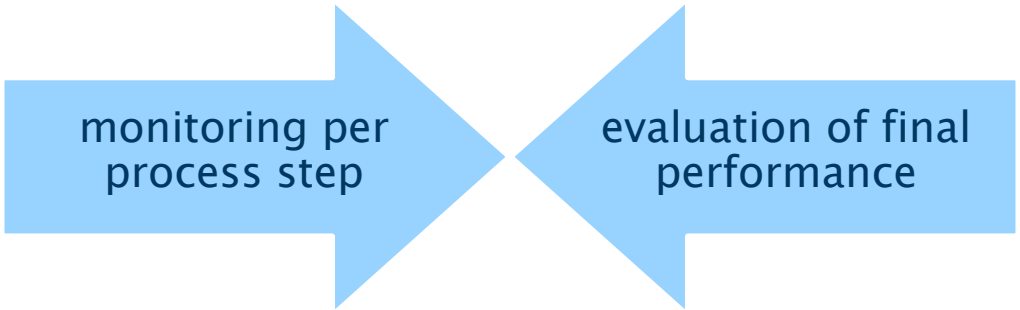

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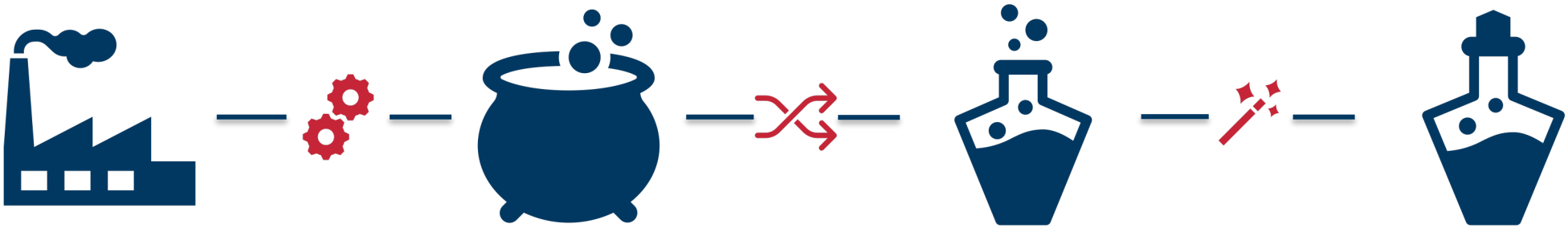
Context-aware condition monitoring



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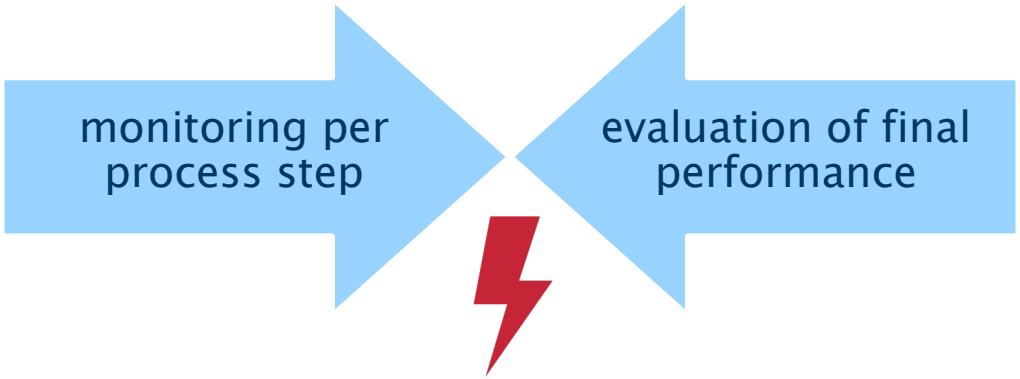


no monitoring of context changes

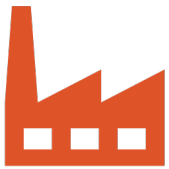
Context and motivation

Identification of rare events or observations that deviate from normal behaviour

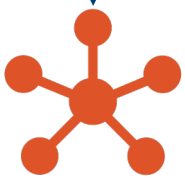
… typically connected to a problem with the industrial equipment

Fundamental aspect for machine health and process monitoring

Industrial machinery



Manufacturing processes



Assets operating in networked environments

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Context and motivation

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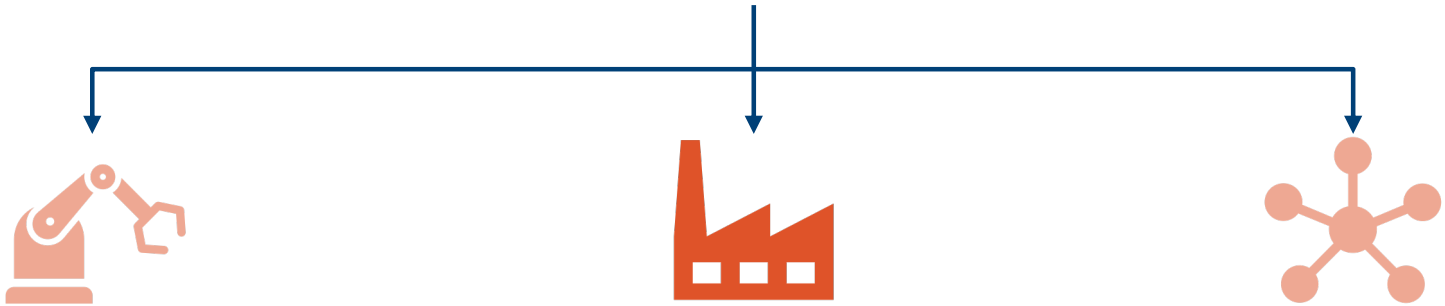

Suboptimal process conditions impacting product quality,
leading to an increased amount of discarded materials,
unplanned downtimes and/or brand damage

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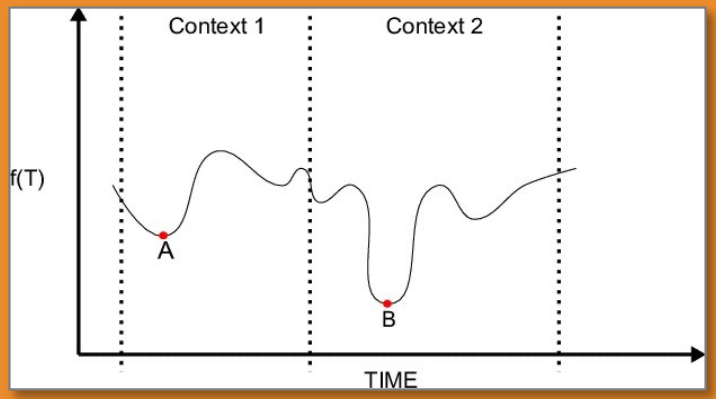
Main challenges

- The timely and accurate detection of context anomalies along an industrial process remains a major challenge:
  - Extremely dynamic machine and process conditions
  - Non-adapting algorithms cannot properly monitor and predict product performance
  - (False) anomalies detected by non-adapting algorithms leading to reduced trust in AI-based solutions

Contextual anomalies



Data points that are considered abnormal with respect to the local context associated with the data points

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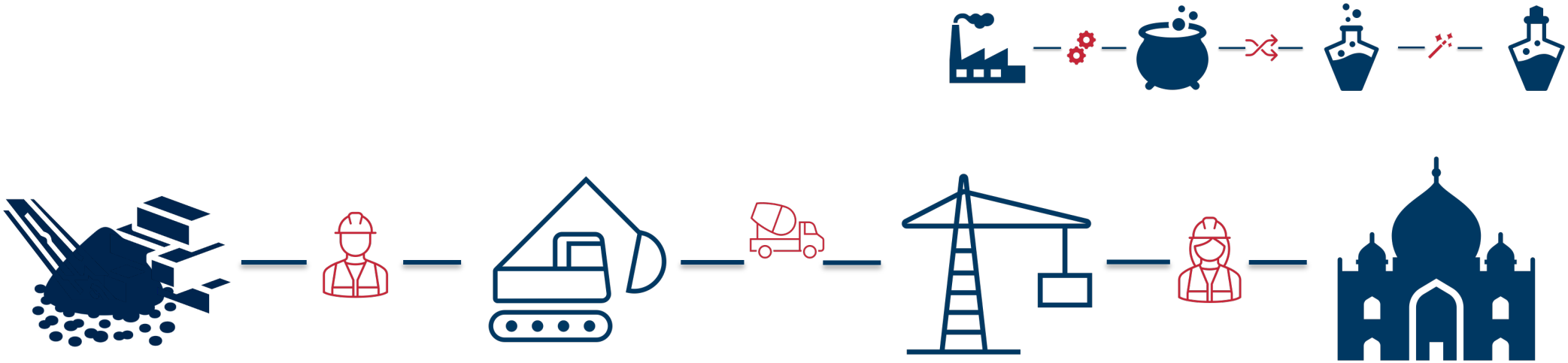
Context-aware construction site condition monitoring



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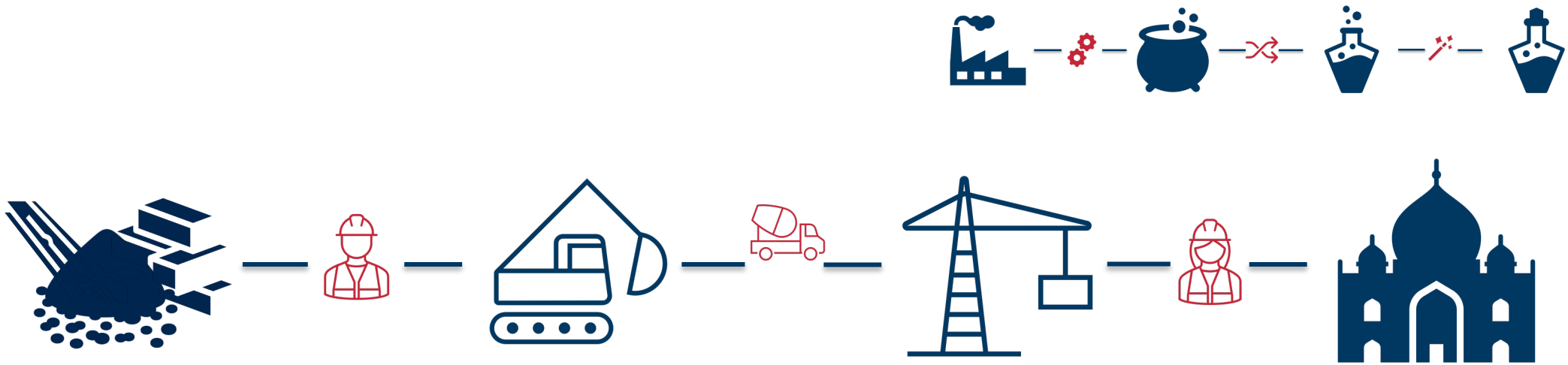
Context-aware construction site condition monitoring



- Integrate BIM and planning data with actual values
- Analyse the influence of (harsh) climate conditions and other (external) factors
- Identify risky and possibly dangerous situations for the building and your staff

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Partners

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen
AI-ICON

Research partners

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EluciDATA Lab
KU LEUVEN
University of Antwerp

Industrial partners

ENGIE
I.care™
DURACELL
skyline communications
yazzoom

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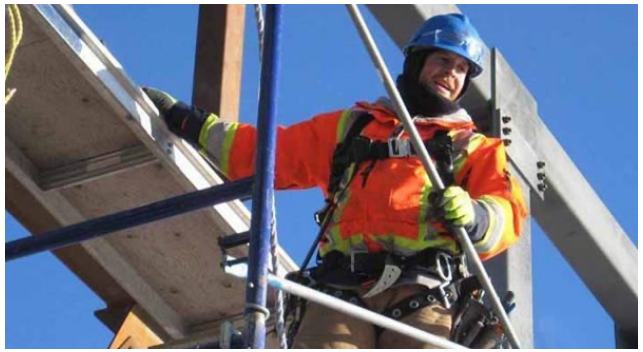
2 inspiring examples

Condition monitoring and performance validation

Proactive operator support

Rationale



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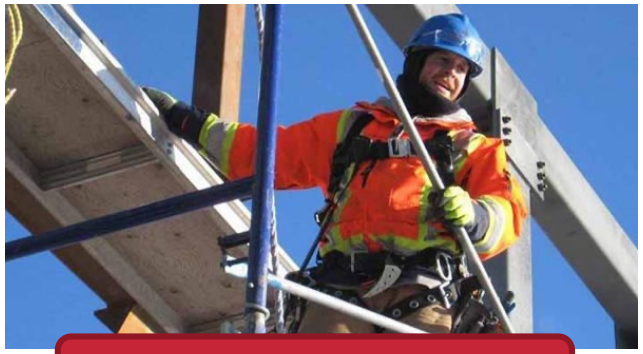
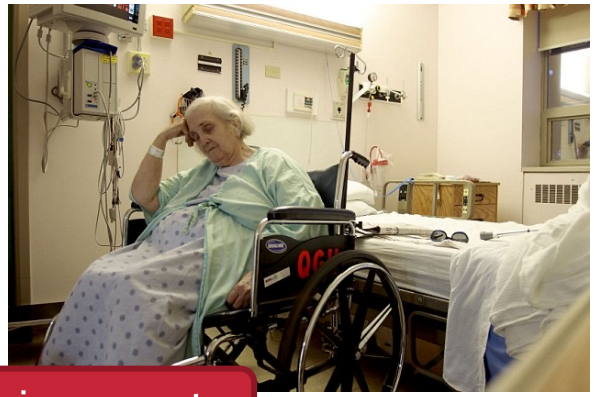
322
Victoria Rd.
MacKay Bridge
MacDonald Bridge
7
Windmill Rd.

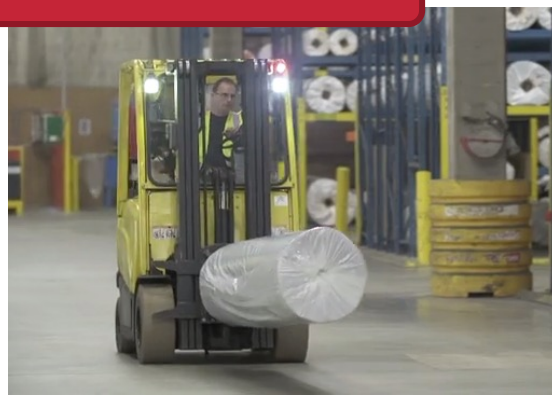
Rationale



outdoor environments



indoor environments



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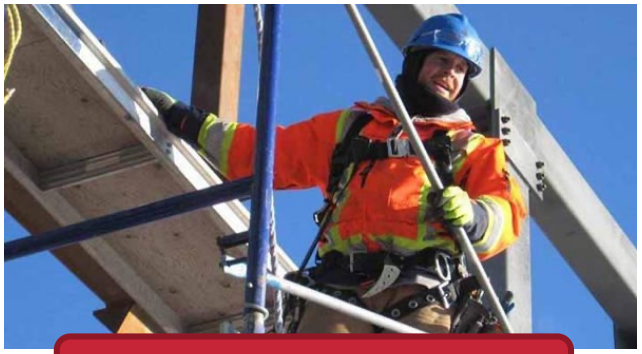
Rationale



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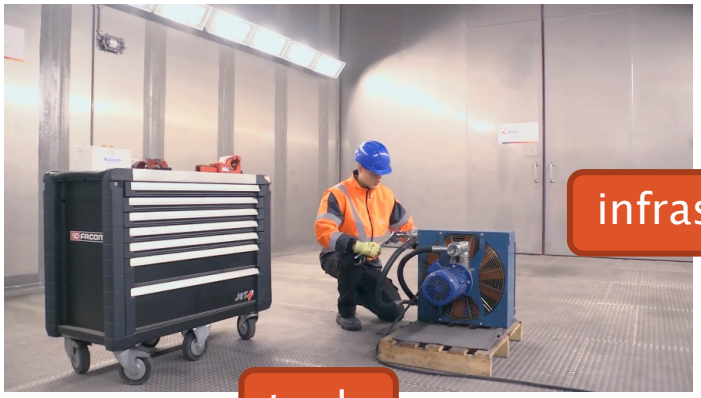

tools

infrastructure

indoor environments

machinery

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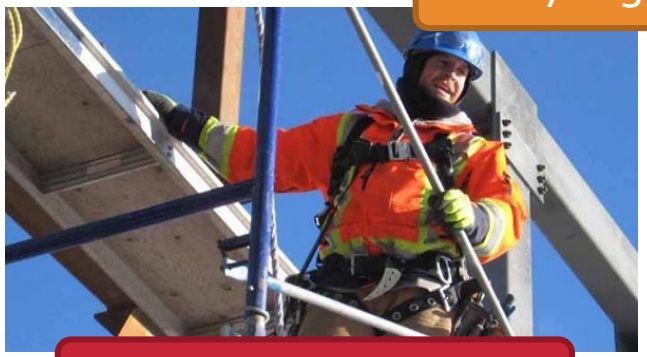
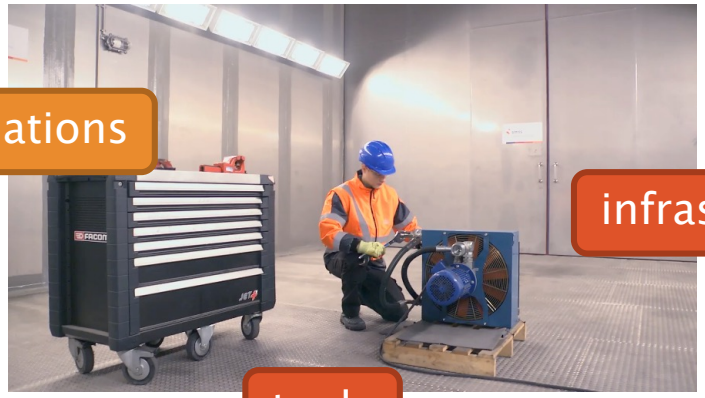
Rationale

safety regulations





infrastructure

tools

outdoor environments

indoor environments

working rules

machinery

eco-friendly practices

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Troubleshoot assistant for in-the-field industrial assets

Context

- Operators need to follow a strict set of instructions to optimally perform a certain task
- Skilled technicians are difficult to dispatch on-site
- Unskilled or new technical personnel need to perform these instructions without external assistance

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Troubleshoot assistant for in-the-field industrial assets

Objective: provide interactive and pro-active operator assistance by

- Guiding the operator through the foreseen procedure and steps
- Answering operator questions based on current status and context
- Informing the operator when a task is performed incorrectly

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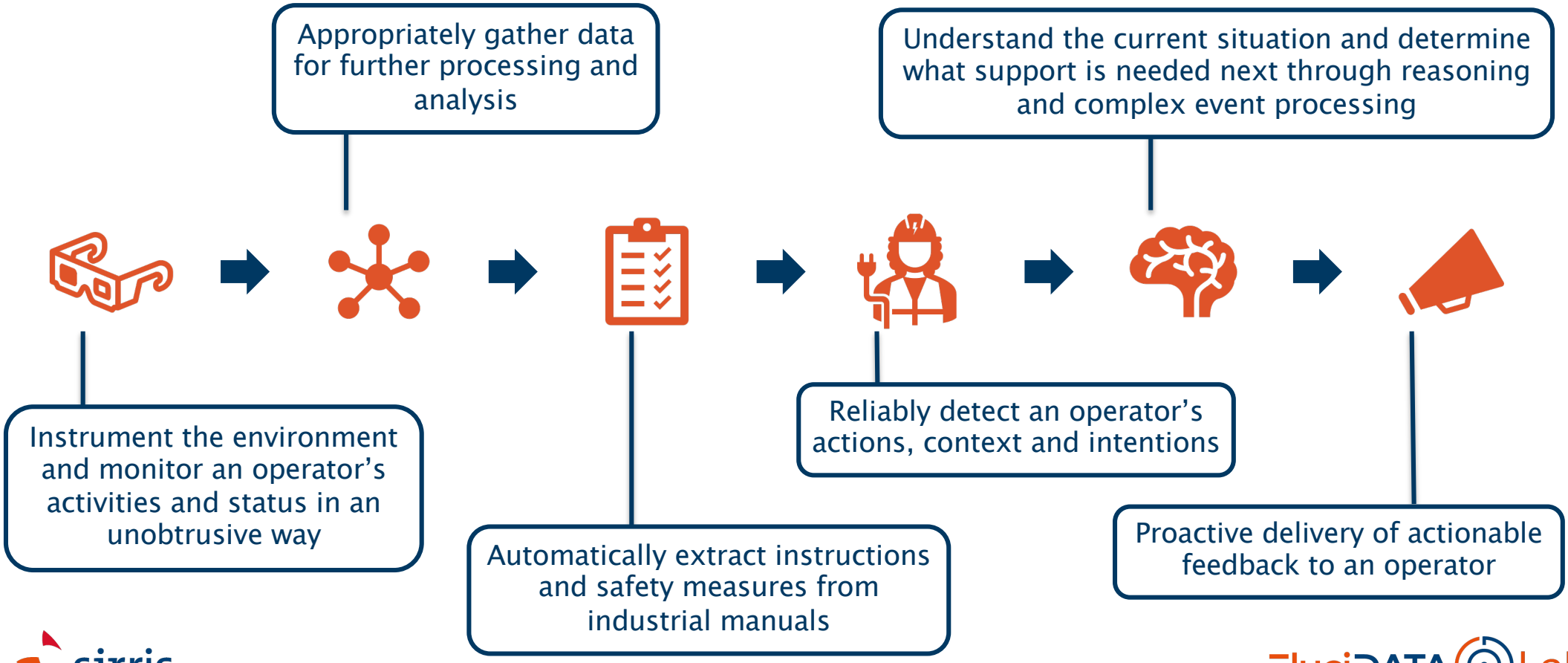
Main challenges



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Partners

Flanders AI Research Program

KU LEUVEN

PSI processing speech & images

University of Antwerp

CLIPS

- Component identification using video and images
- Speech recognition
- Sound source identification
- Video-based activity identification

- Natural language processing and understanding
- User feedback format

VUB mobi

imec IDLab INTERNET & DATA LAB

GHENT UNIVERSITY

waves

- Reasoning on current and future tasks & instructions

- Emotion detection

- Sound-based activity identification

VUB DIMA: Digital Mathematics

- Information extraction and textual relation identification from complex documents

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- Detection of current operator's task and context
- Complex event processing in view support delivery
- Proactive and actionable feedback delivery

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- Focusing on data-driven AI, i.e. addressing real-world industrial challenges
  - which cannot be solved via straightforward application of prediction/classification learning paradigms
  - and where data is not immediately suitable for consumption by traditional AI algorithms

- Proven track record in realizing data-driven proof-of-concepts in diverse industrial application scenarios

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What we offer

Setting up feasibility studies and R&D projects

- Identify relevant use cases
- Perform state-of-the-art studies
- Identify technological challenges
- Perform preliminary data analyses
- Draft an innovation plan

Industrial research as an independent R&D partner

- Realize state-of-the-art AI-based methods directed towards practical application
- Validate research results using impact-oriented evaluation metrics
- Contribute to the exploration of data-driven business models

Knowledge transfer

- "Data Innovation beyond the Hype" mastercourse
- Interactive starter kit platform
- Student academy
- EluciDATA Community

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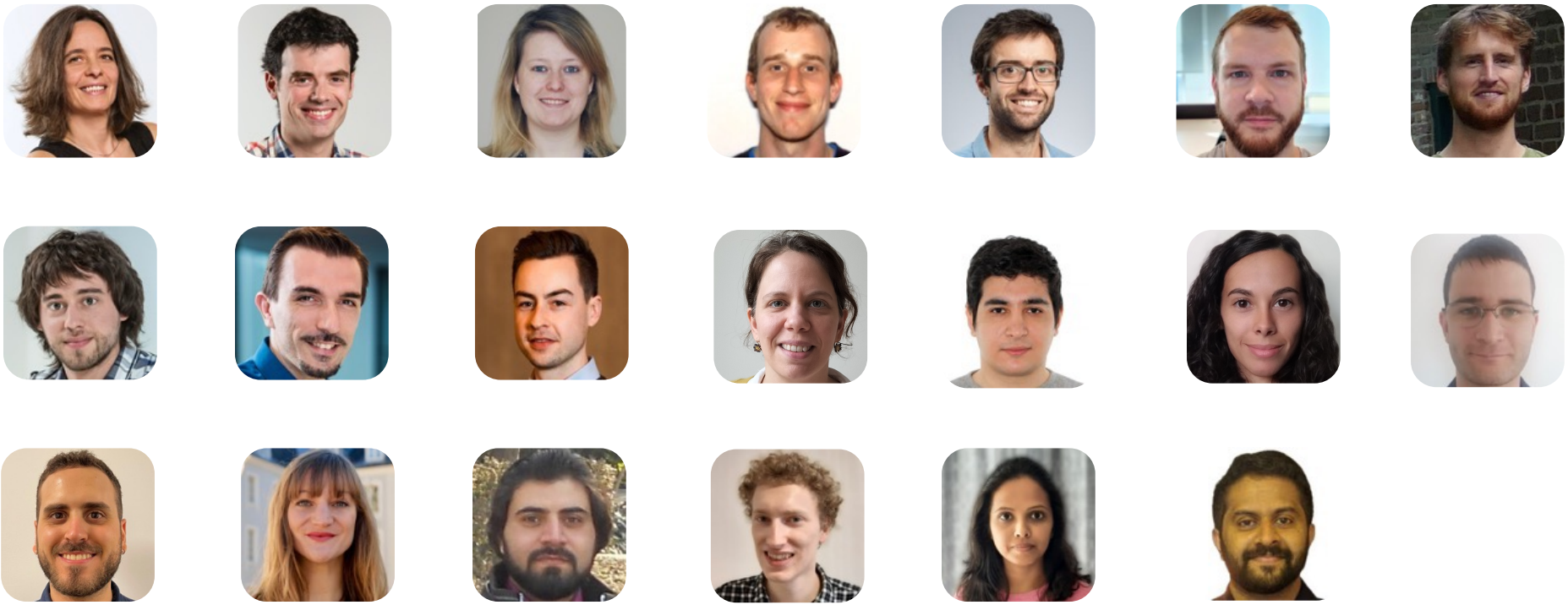
The team



20 scientists, 11 with PhD, 10 different nationalities, 6 women

Florence Guillaume

Henrique Cabral

Nicolás González-Deleito

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