Webinar: Industry-driven use cases for AI

Online webinar, 3rd April 2024

AI4REALNET has received funding from European Union's Horizon Europe Research and Innovation programme under the Grant Agreement No 101119527

Outline of the webinar

1. Presentation of the AI4REALNET concept **(15min)**
2. Presentation of the project use cases **(30min)**
   - Power grid (RTE, TenneT)
   - Railway (SBB, DB)
   - Air Traffic Management (NAV)
3. Q&A and feedback **(30min)**

AI4REALNET Project Concept

Ricardo Bessa, ricardo.j.bessa@inesctec.pt

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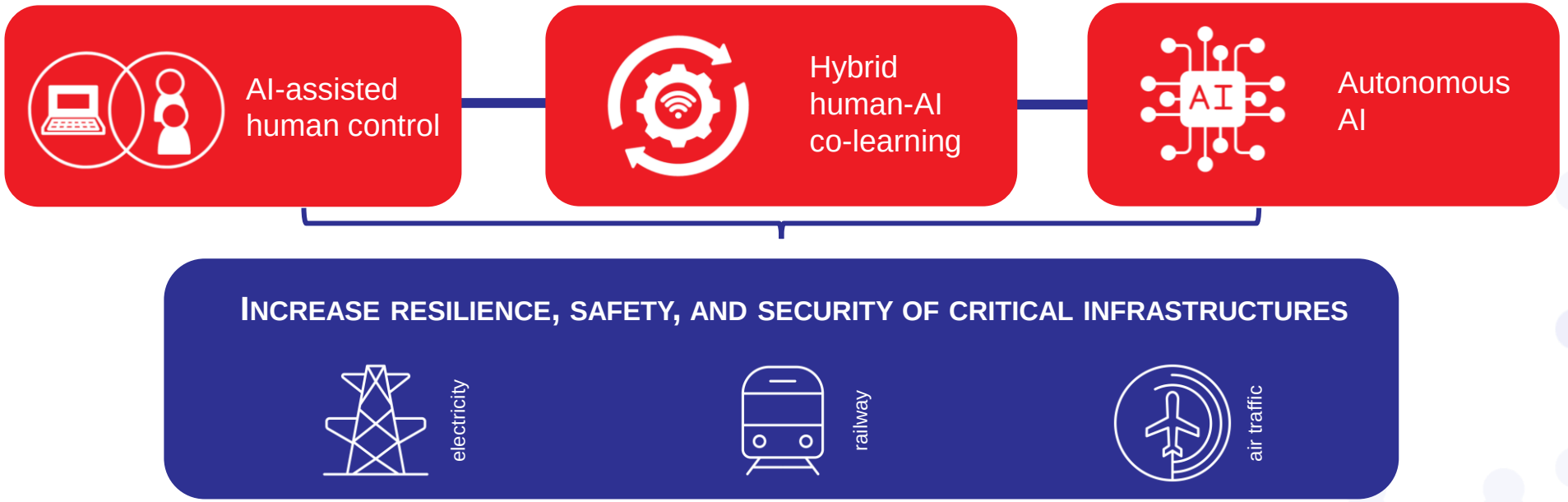
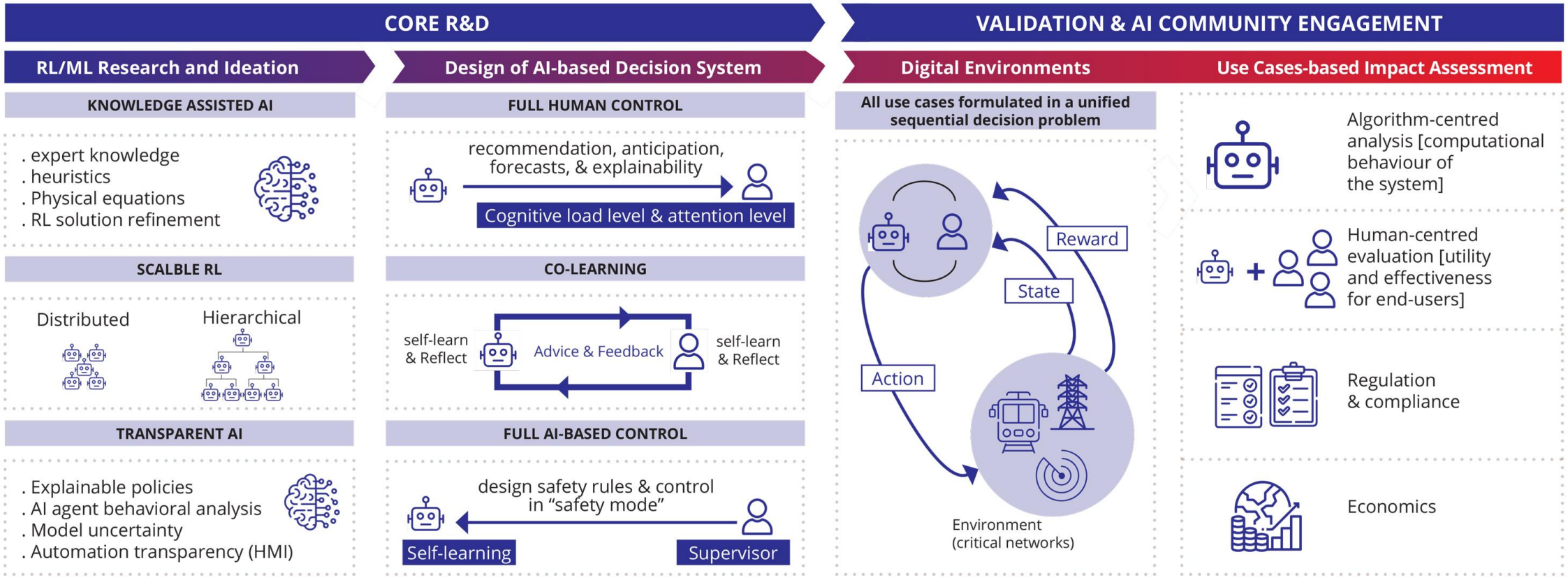
What are our objectives?

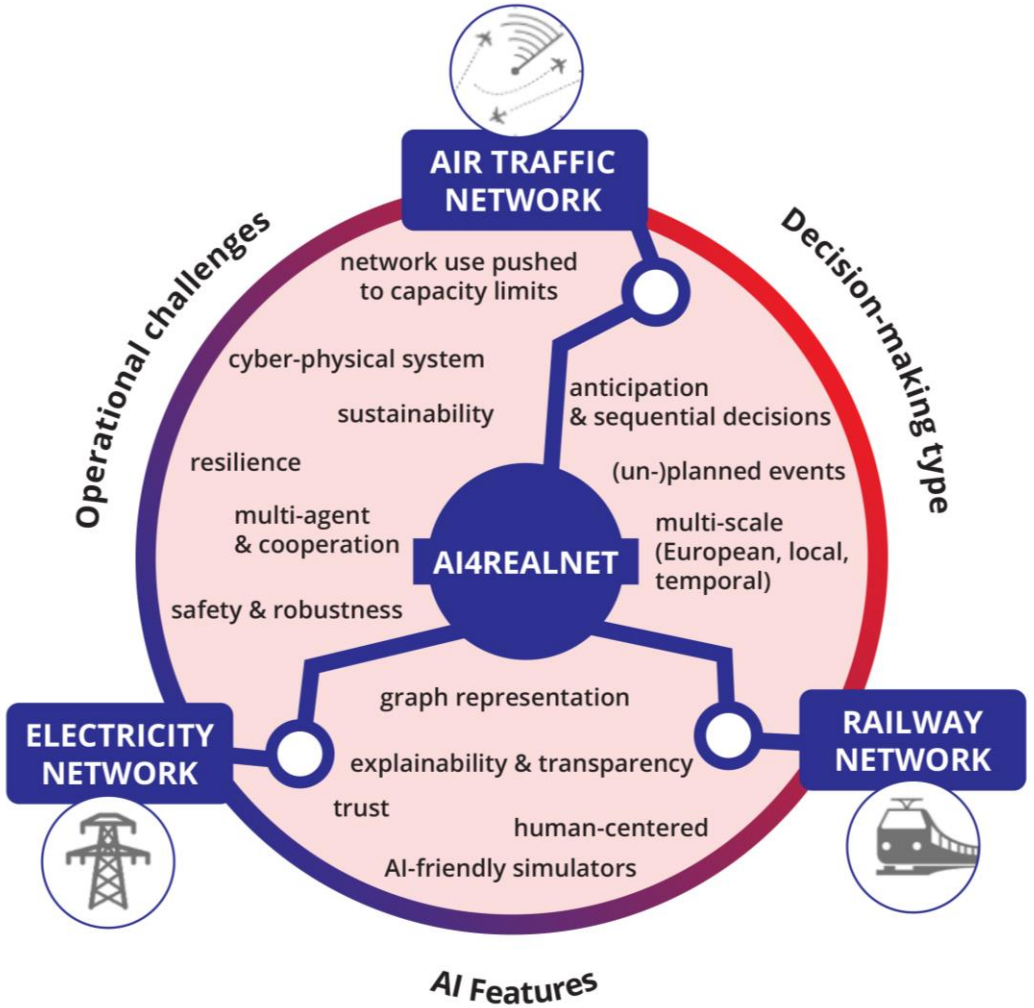
Develop the next generation of decision-making methods



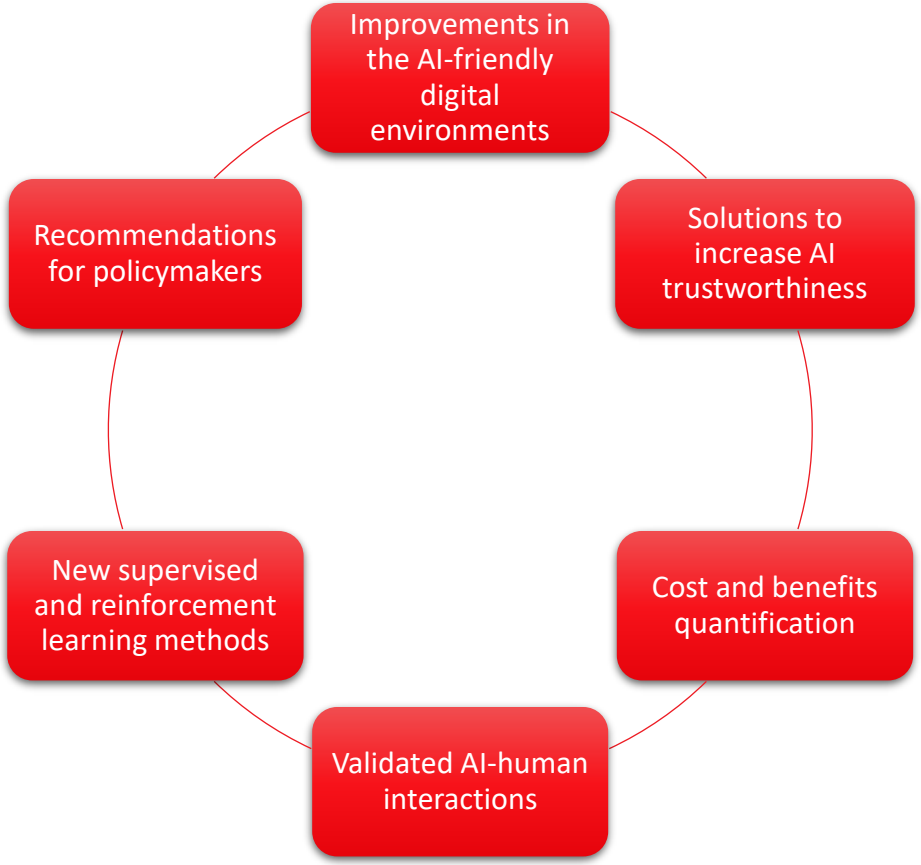
Project concept



Focus on critical infrastructures



What are our expected outputs & ambitions?



Support energy transition & increase resilience to natural and man-made hazards

Provide more flexibility and operational reliability to maximize the capacity of the current infrastructures

Facilitate continuing growth of air traffic demand while maintaining a high level of safety

How do we plan to achieve it?

Analyse and draw on existing AI-friendly open digital environments

Mar/2025 (1st release)

Develop a conceptual framework for critical infrastructures

Sept/2024

Develop knowledge-assisted AI, hierarchical and distributed RL & transparent, explainable AI

May/2024 Position paper

Validate in 6 uses cases driven by industry requirements

Sept/2024

Focus on critical challenges and tasks of network operators

Attend to goals such as decarbonisation, digitalisation, and resilience to disturbances

Contribute to cost-benefit and regulatory analysis

Consortium

Coordinated by INESC TEC

Start: Oct 2023
End: Mar 2027
Budget: ~6M€

Example of expected outcomes

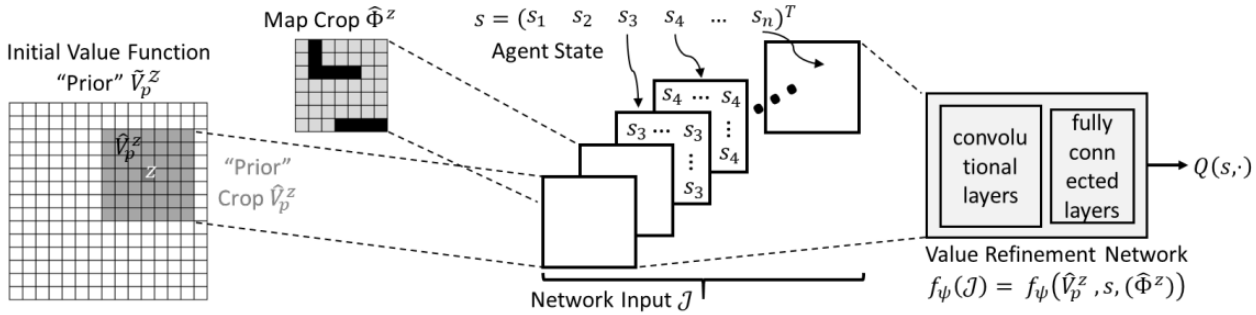
AI-friendly digital environments

	Grid2Op	Flatland	BlueSky
Single or multi-agent?	Single (will be extended to multi-agent)	Multi-agent	Both
Observation space: type & (size)	Discrete & continuous (large, > 4000 dimensions)	Discrete & continuous (large)	Continuous (large)
Competitive or collaborative	Collaborative		Both
Sequential or episodic?	Sequential		
Stochastic or deterministic environment?	Stochastic		Deterministic (stochastic elements are possible)
Static or dynamic environment?	Static	Dynamic	
Discrete or continuous action space or mixed?	Mixed (discrete and continuous actions)	Discrete	Mixed (discrete and continuous actions)
Size of action space	Large (> 65,000 different discrete actions & 200 continuous actions)	Small (5 actions currently)	Large
System represented as a graph?	Yes		No

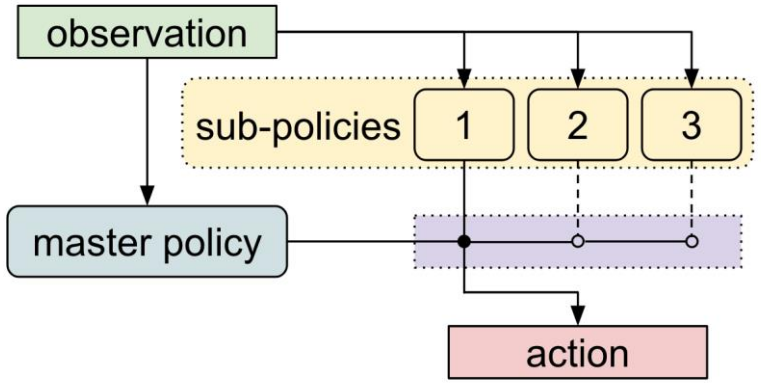
AI building blocks

knowledge-assisted AI: the goal is to use effectively re-use existing tasks knowledge rather than re-inventing the wheel using *tabula rasa* learning

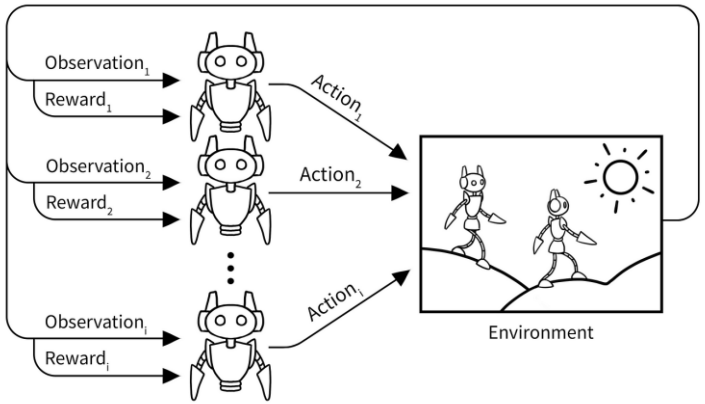
- Example: coarse value-iteration can initialize DQN to learn data-efficiently



Hierarchical RL

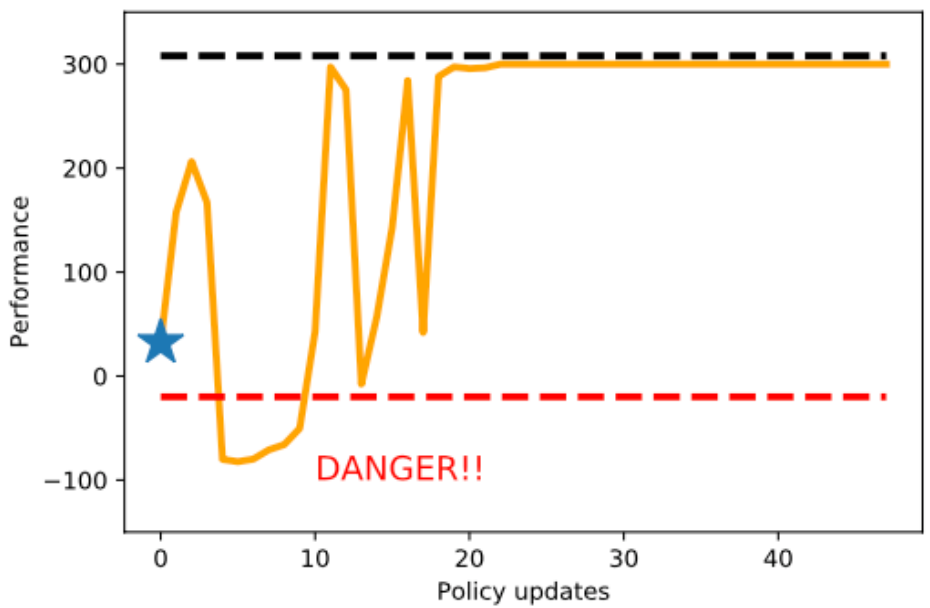


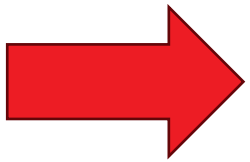
Distributed RL

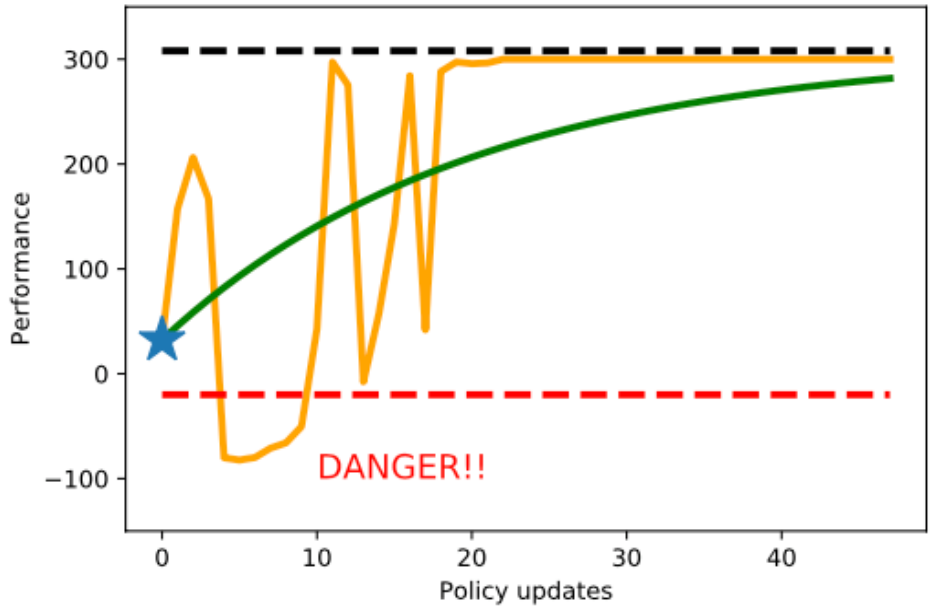


Safety while learning

We may want to be safe during the **learning phase**



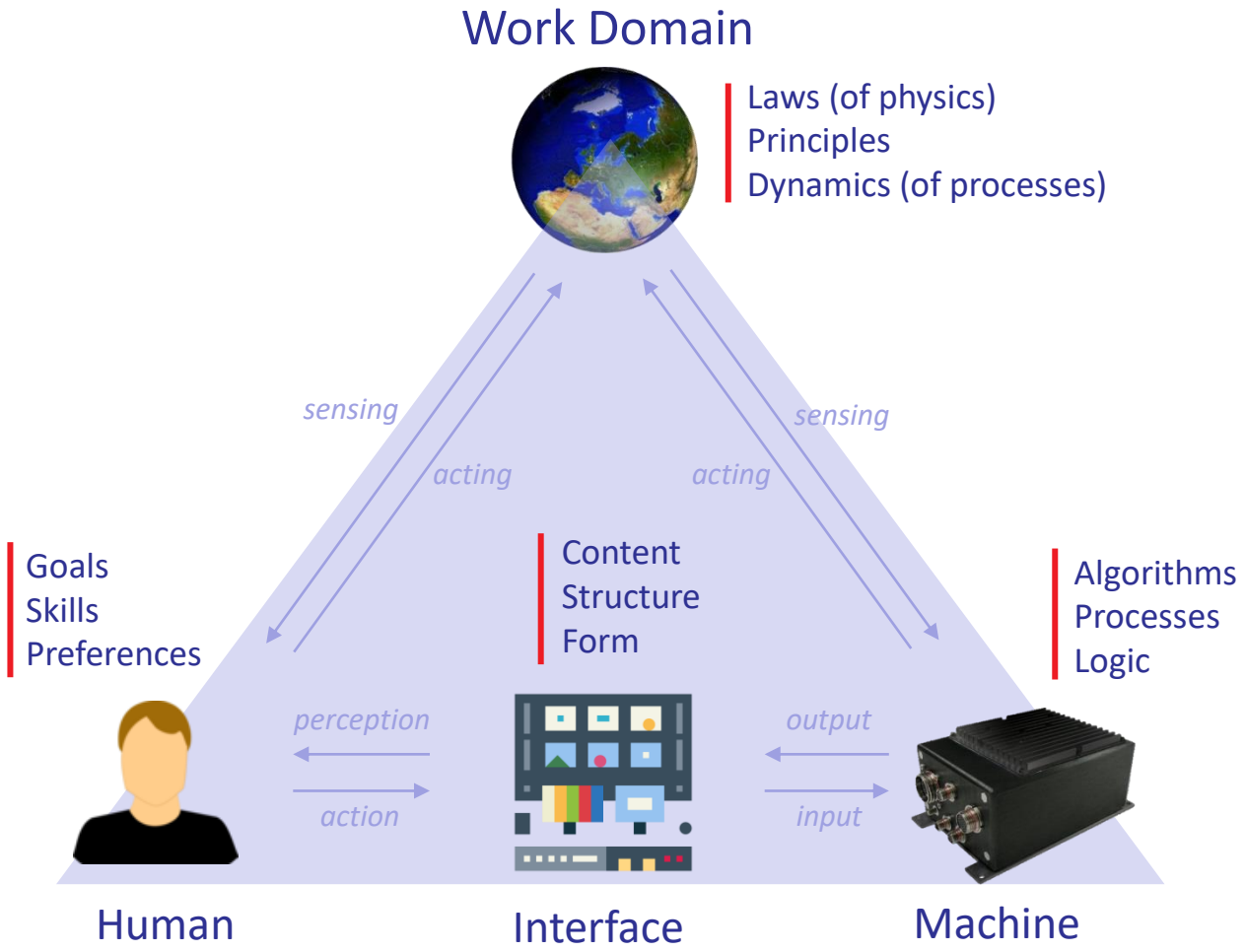




Non-safe learning

Safe learning (monotonic improvement)

Designing for transparency in complex systems



What is the machine's intent, solution and its achieved result (e.g., KPIs)?

user-centered *approaches, e.g., Situation Awareness-based Transparency (SAT) model*

What physical and intentional constraints govern the machine's solution(s)?

ecology-centered *approaches, e.g., Ecological Interface Design (EID)*

How does the machine explore the solution space? What does and doesn't it consider?

model-centered *approaches, e.g., reward decomposition, search trees, decision trees, …*

Zou, Y., Borst, C. (2023). Investigating transparency needs for supervising unmanned air traffic management systems. *SESAR Innovation Days*, 1–9. https://doi.org/10.61009/SID.2023.1.15

To conclude

How to provide feedback to the use cases?

- How would you improve the description of the use case?
- How would you improve the scenarios of the use case?
- How would you improve the consideration of the role of human operators?
- Which threats, concerns, and vulnerabilities do you detect or are missing for this use case?
- Are you aware of standardisation initiatives or standards relevant to these use cases?
- Which requirement would you add to the use cases?

Answer this survey:
https://survey.inesctec.pt/index.php/946661?lang=en

What are our contacts?

@AI4REALNET Project

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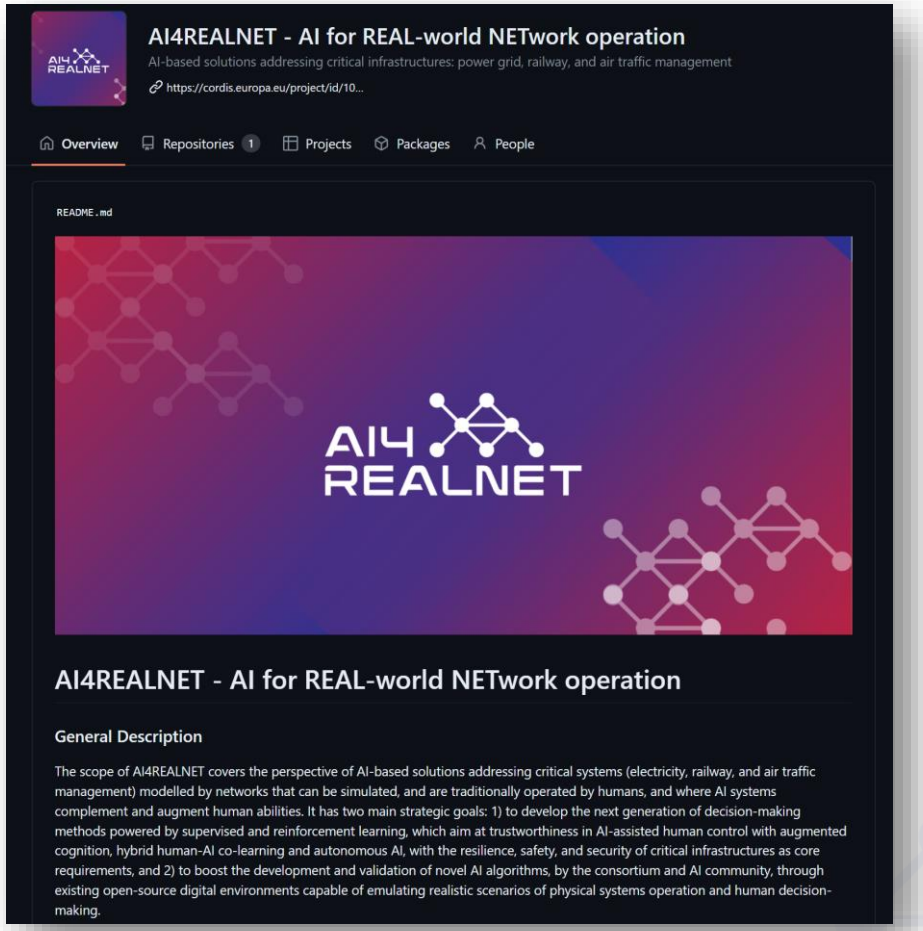
github.com/AI4REALNET



Next webinar

Distributed and Hierarchical Reinforcement Learning

24th of April, 12h00 CET

AI4REALNET

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