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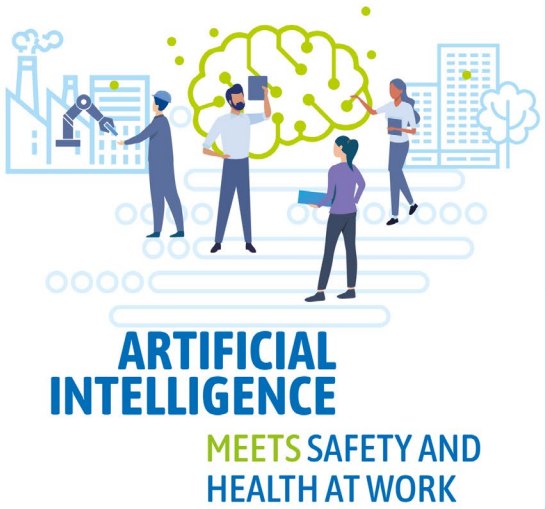

Evaluation and certification for safer artificial intelligence

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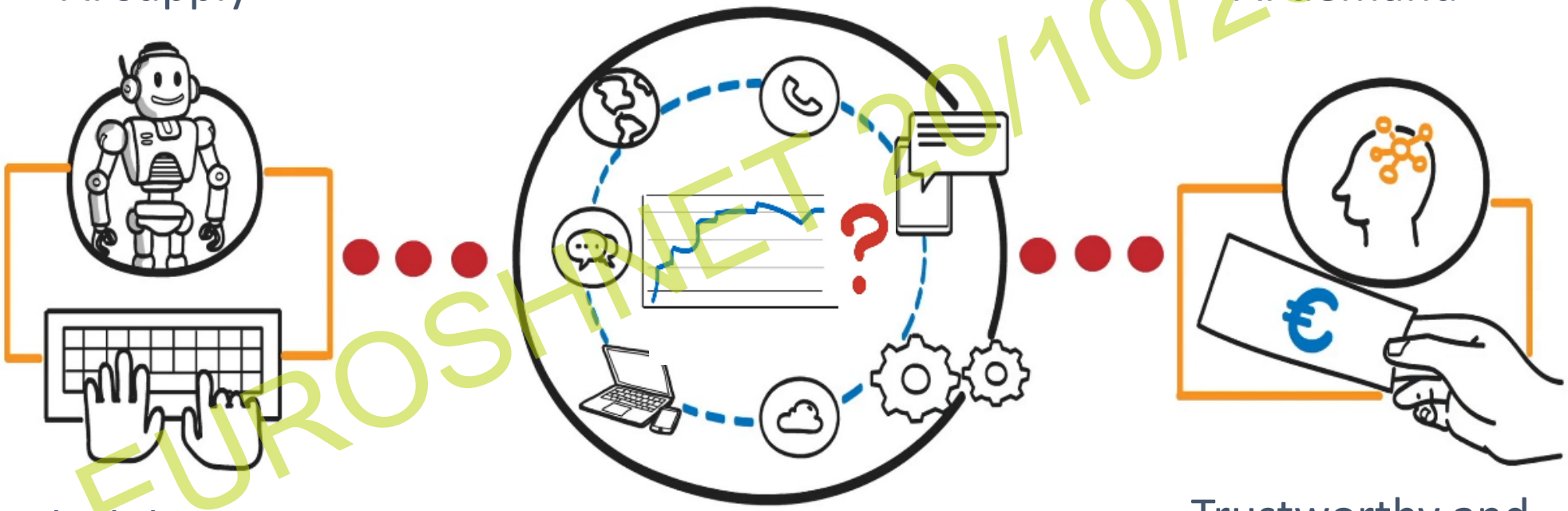
Research engineer in AI evaluation

LNE

Matching AI supply and demand

AI supply

AI demand



Black-box, non convex, evolutive systems

Need: AI evaluation & certification

Trustworthy and efficient functionalities

LNE's activities in AI evaluation

Activity n°1: development of **evaluation standards**

Activity n°2: AI systems **testing**

Activity n°3: **certification** of AI development and evaluation processes

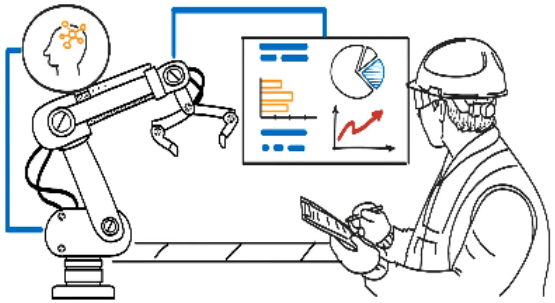
Activity n°4: development of **evaluation tools**

Activity n°5: **professional training** on AI evaluation

Application areas:

- **NLP:** speech-to-text, translation, speaker recognition, etc.
- **Image processing:** person recognition, object segmentation, OCR, etc.
- **Robotics:** Smart MD, industrial robots, inspection robots, autonomous cars, agricultural robots, etc.

- 10+ years of experience
- 15+ ongoing R&D projects
- 950+ systems evaluated
- 10+ experts on AI evaluation



How and why performing evaluation?

One-off evaluation

- **Description:** Evaluation of the performance of a system at a specific time in a specific test environment
- **Example:** To assess its compliance with regulations

One-off benchmarking evaluation

- **Description:** Comparative analysis of the performance of different systems on the same evaluation task in the same test environment at a specific time
- **Example:** To allow the user to make an informed choice between different existing technologies

Repeated evaluation campaign (« challenge »)

- **Description:** Comparative and repeated analysis of the performance of different systems on the same evaluation task
- **Example:** To evaluate the progress made by these different technologies and to encourage "coopetition"

Evaluation: overview of approaches

Definition of the evaluation task → Provision of test **data** and **environments** → Human → References / System → Outputs → **Comparison metrics** between outputs and references → error analysis and **performance estimation**

Evaluation in representative environments

Evaluation on representative data

References: human annotations

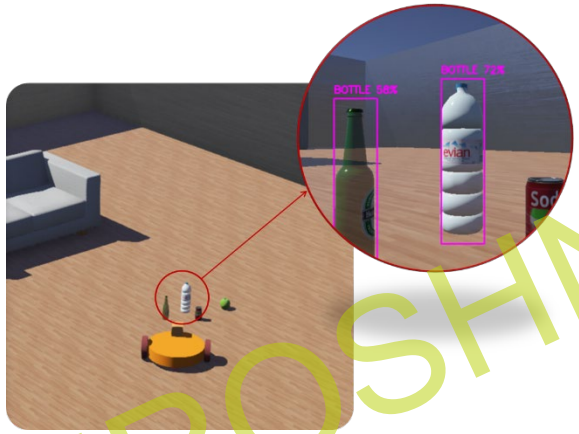
Outputs of the smart camera

Metric:

$$EGER = \frac{\sum_{k=1}^{N} C_k + FP_k + FN_k}{\sum_{k=1}^{N} R_k}$$

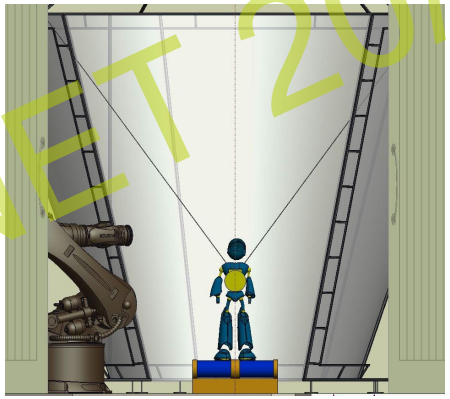
Test beds configuration (example: LNE's LEIA evaluation infrastructure)

LEIA1
Software In the Loop

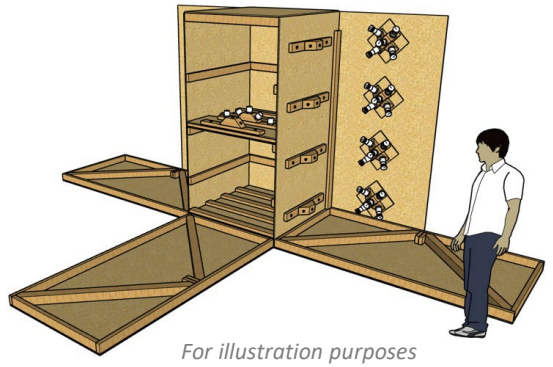


For illustration purposes

LEIA2
Robot In the Loop
Camera In the Loop



LEIA3
Testing in realistic environment



For illustration purposes
Source: ASTM E54.09

Exhaustivity

Realism

Does evaluation make AI safer?

- Some elements are required (and not fully available yet):
  - Identify forbidden and/or compulsory outputs
  - Trade-off between exhaustivity/realism (cost, existence of infrastructure)
  - Acceptable thresholds: minimum performance rates
- Contributes to safety:
  - Risk assessment drives the selection of test scenarios
  - Test results highlight areas of underperformance
  - Estimate the impact of mitigation strategies

Certification: overview of approaches

Process certification:

The AI functionality has been properly constituted (evaluation of the learning, evaluation and maintenance phases)

- ➔ Create confidence in the AI developed based on process control
- ➔ Analogous approach to creating trust via processes (management system certifications, CE marking of medical devices, aerospace etc.)

Product certification:

The AI functionality has a compliant behavior (test of the functionality)

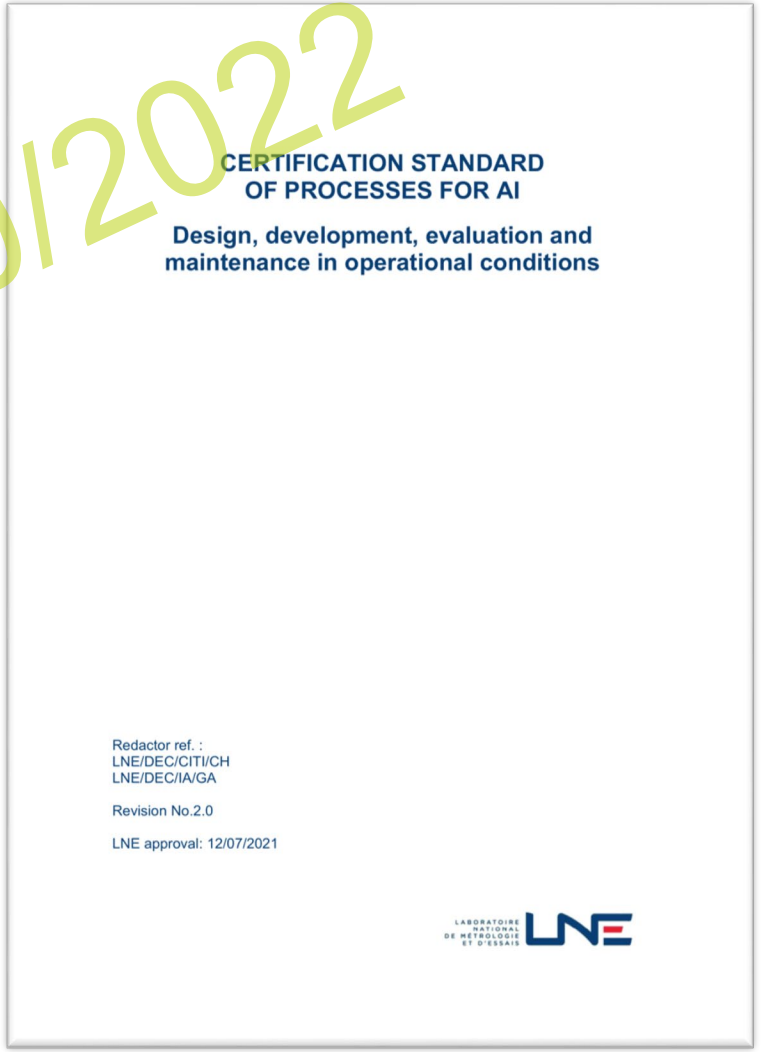
- ➔ Potential limitations to overcome (sectorial specificities, testing cost, test methods)

People certification:

Those involved in the development or use of AI throughout its life cycle are competent.

Certification of processes for artificial intelligence

- https://www.lne.fr/en/service/certification/certification-processes-ai



Overview of the certification

- Not meant to certify the AI product itself, but guarantee that it has been **designed correctly**.
- Contributes to ensuring a trustworthy product, through **control of the processes and use of good practice**.
- Voluntary certification.
- For Machine Learning (and hybrid ML/expert).
- Processes analyzed:
  - Design, development, evaluation and maintenance in operational conditions

Contribution of evaluation and certification to safety

Evaluation

- Allows verification
- Provides valuable insight into the system's risks

REQUIRES

Exhaustive coverage of factors influencing safety
Methods (testing, data qualification, etc.)
Infrastructure (accessible, affordable, standardized)

Certification

- Allows validation
- Provides checkpoints that guarantee compliance

REQUIRES

Exhaustive coverage of factors influencing safety
Acceptable "thresholds"
Frame(s) of reference (derived from regulation)

Thank you for your attention

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MEETS SAFETY AND HEALTH AT WORK

QUESTIONS FROM PUBLIC

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