AI for an economically, socially and environmentally sustainable future in Europe

Creating trustworthy and resource-efficient AI requires co-optimization of technologies over the full technology stack

Sabine Demey

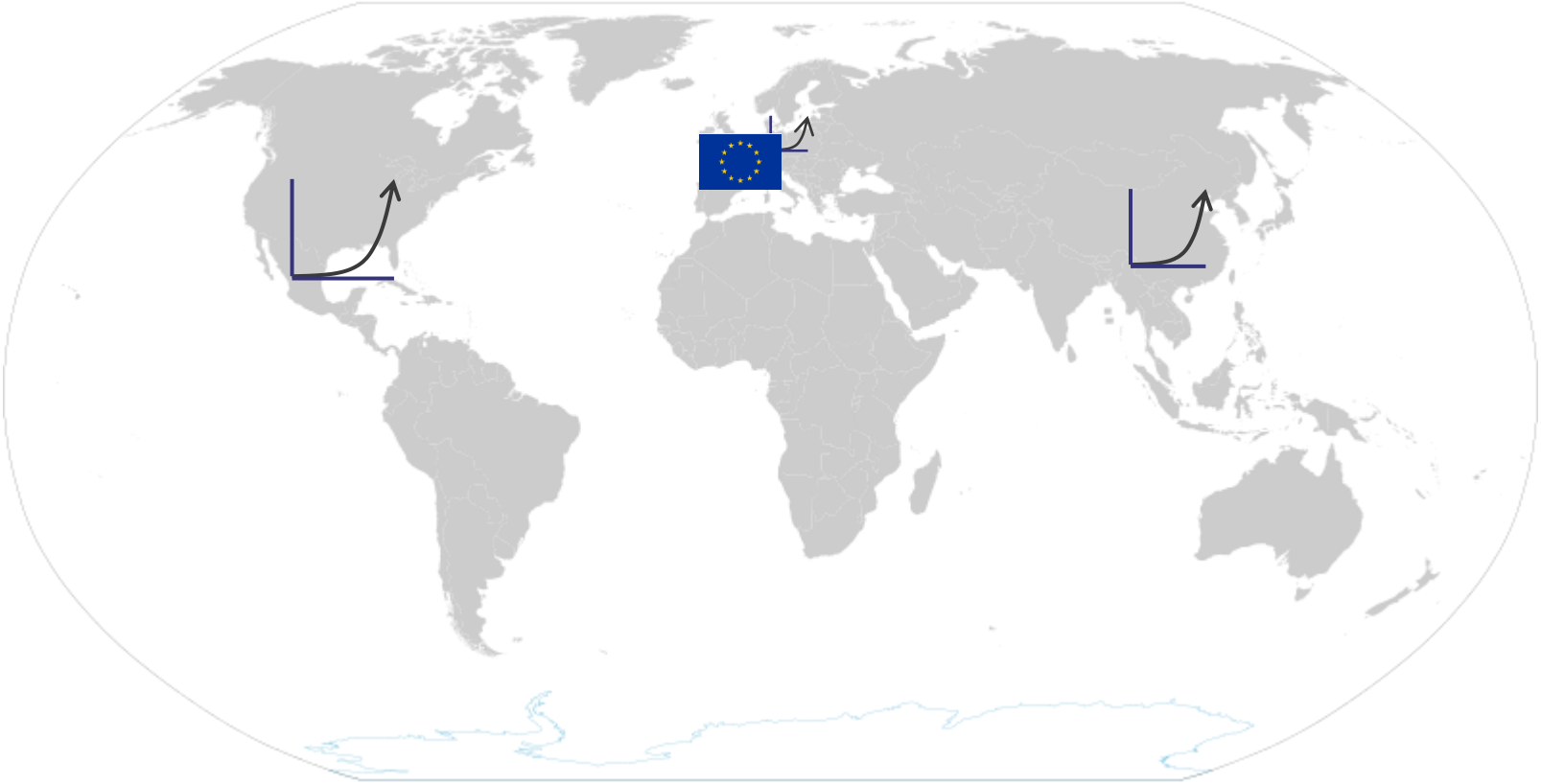
Director Flanders AI Research Program, imec

ADR Forum, 5 November 2024, Eindhoven

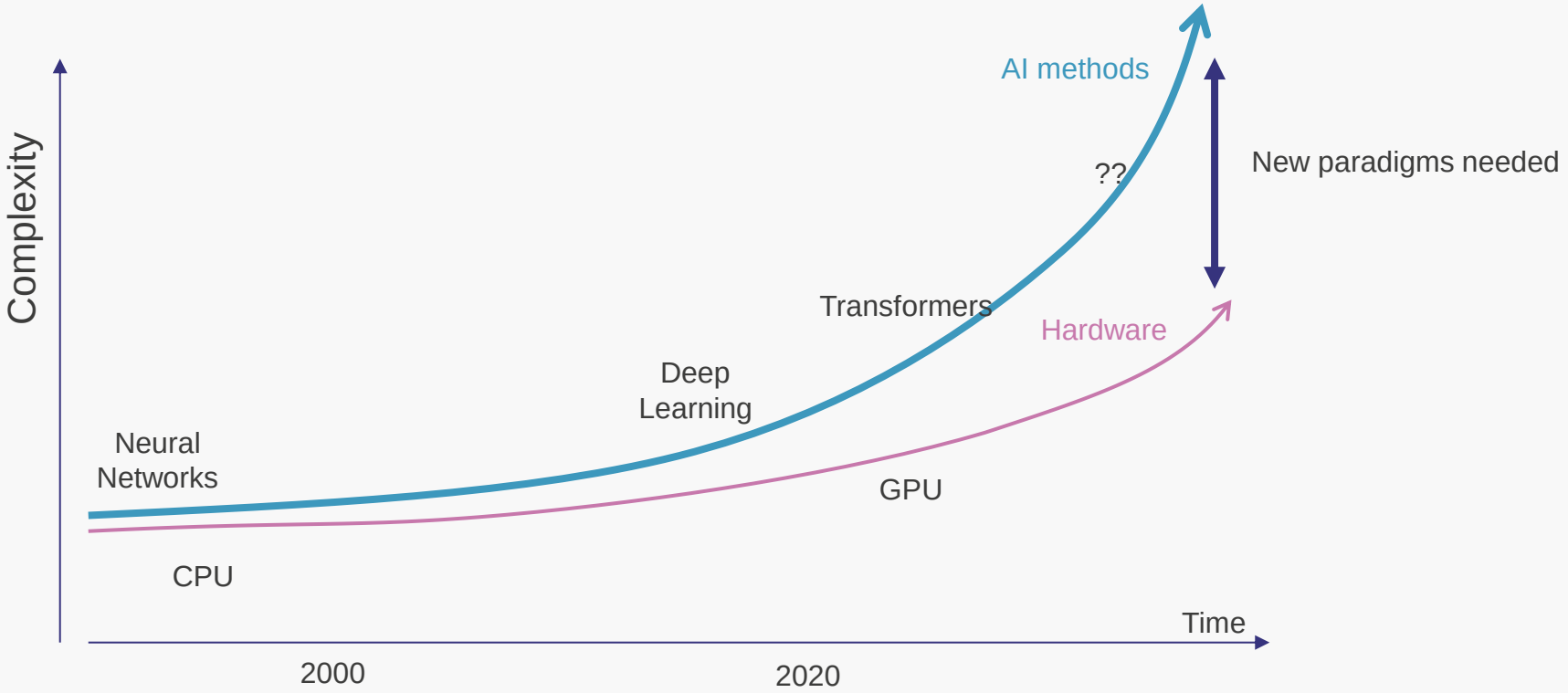
imec

Flanders AI Research Program

Artificial Intelligence Vlaanderen/Flanders



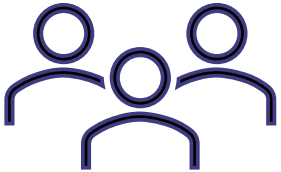
The exponentially increasing complexity of AI requires new paradigms



The exponentially increasing potential value creation with AI requires strategic choices

AI is an indispensable technology
in creating value, in creating a sustainable future

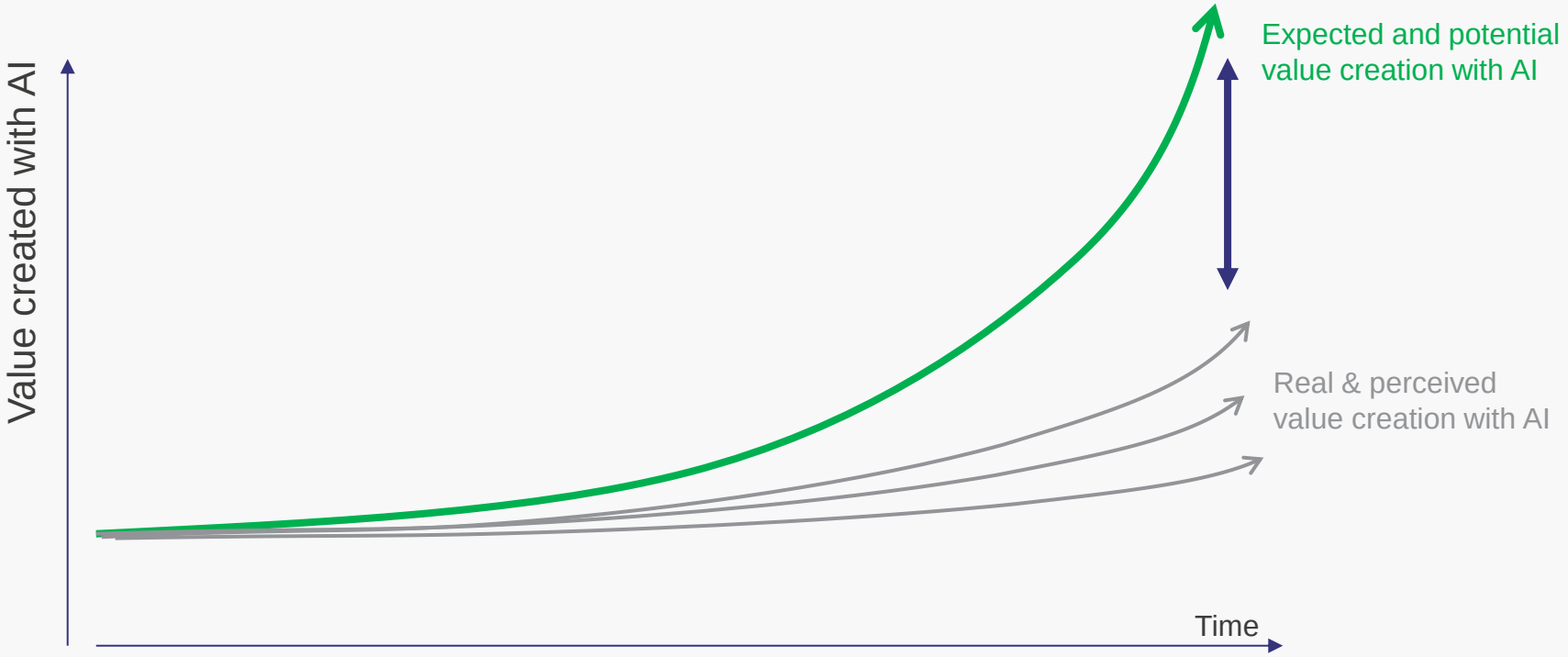
Economic



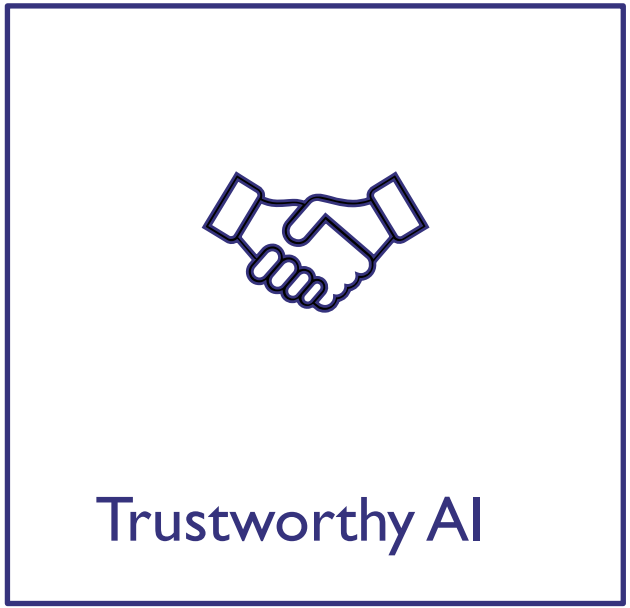
Social

Environmental

The exponentially increasing potential value creation with AI requires strategic choices



Value creation at scale requires trust in AI



Ethics guidelines for trustworthy AI are defined by the EC

Trustworthy AI

1. human agency and oversight
2. technical robustness and safety
3. privacy and data governance
4. transparency
5. diversity, non-discrimination and fairness
6. environmental and societal well-being and
7. accountability

Value creation at scale requires trustworthy and resource-efficient AI

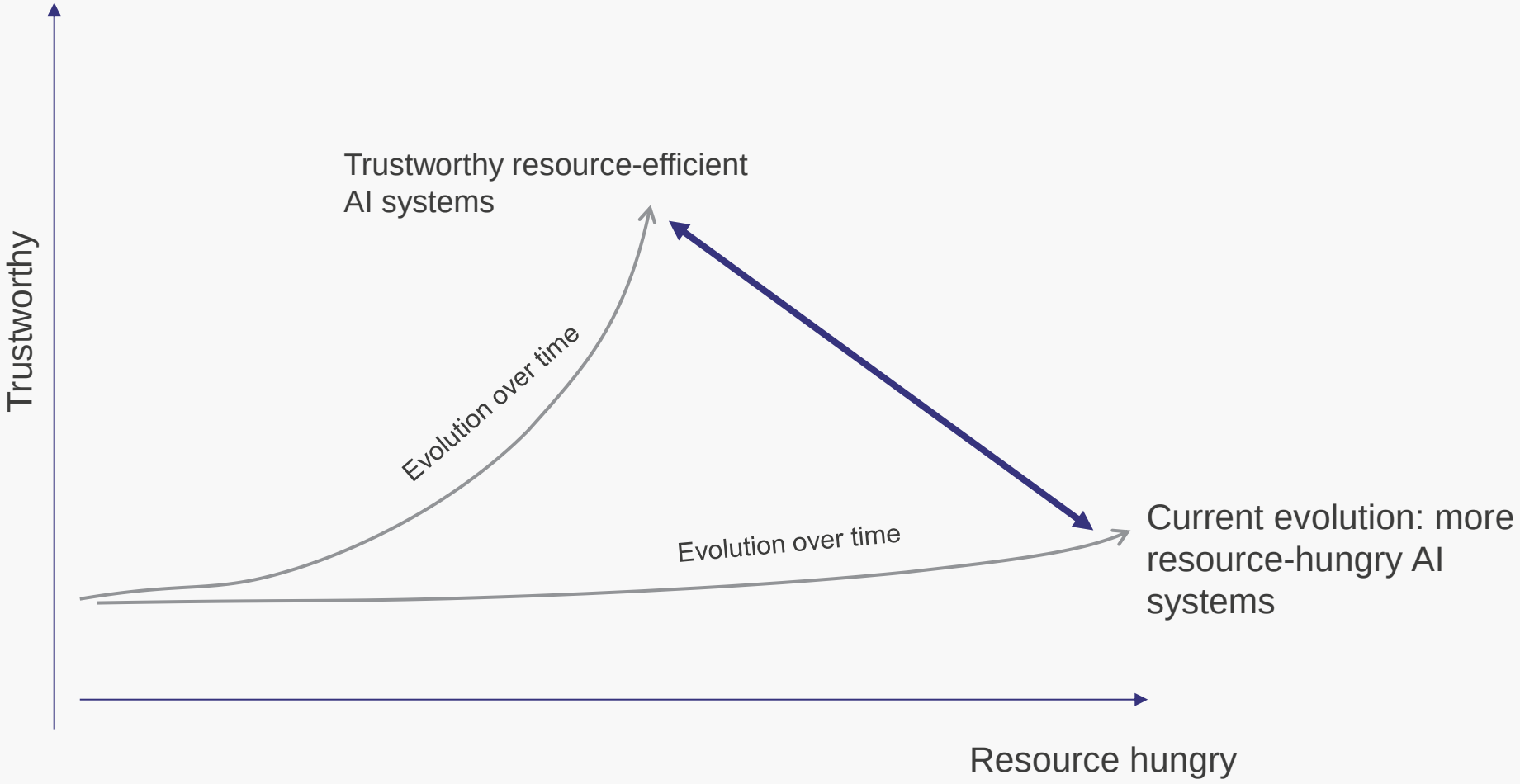
Trustworthy AI

Resource-efficient AI

Value creation at scale requires **affordable access to** trustworthy and resource-efficient AI

Trustworthy AI

Resource-efficient AI


Trustworthy
Trustworthy resource-efficient
AI systems
Evolution over time
Evolution over time
Current evolution: more
resource-hungry AI
systems
Resource hungry

Creating trustworthy and resource-efficient AI requires co-optimization of technologies over the full technology stack

APPLICATIONS and AI SYSTEMS

COMPUTE, DATA, KNOWLEDGE INFRASTRUCTURE

AI TECHNOLOGY

COMPUTE HARDWARE

Creating trustworthy and resource-efficient AI requires co-optimization of technologies over the full technology stack

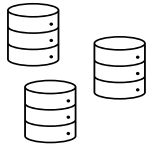
APPLICATIONS and AI SYSTEMS

Industry, Health & pharma, Mobility, Energy transition, Science …

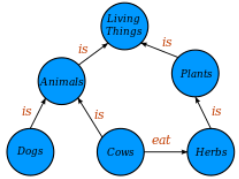
Multi-modal, multi-agent, high-workloads, edge AI, …

COMPUTE, DATA, KNOWLEDGE INFRASTRUCTURE

Trustworthy Data



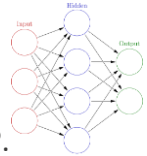
Trustworthy Knowledge



AI TECHNOLOGY

Learning

Neural Networks, Deep Learning, Reinforcement Learning, Transformers, ???.



Neurosymbolic AI
Physics-informed AI, Hybrid AI
Trustworthy AI Agents

Reasoning

COMPUTE HARDWARE

imec

The imec R&D center and tower in Leuven, Belgium.
Photographer: Olivier Matthys/Bloomberg

- Globally, the leading independent R&D center in **nanotechnology** since 1984
- **>5500** international R&D top talents
- **>€3.5B** invested in **leading-edge semiconductor fabs**
- Focus on industry-relevant technology solutions for **health and life sciences**, mobility, industry 4.0, agrifood, smart cities, sustainable energy, etc.
- 2023: € 920M revenue (>70% industry funded) 162 patent applications, 1,300 Web-of-Science publications

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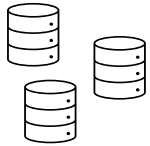
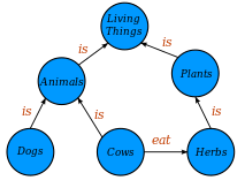


Trustworthy Knowledge



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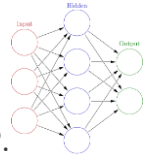

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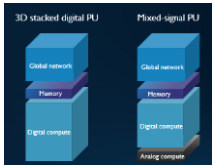
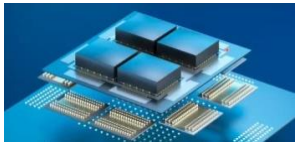
COMPUTE HARDWARE

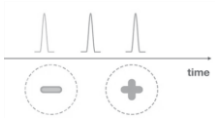


3D & CMOS 2.0

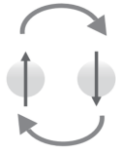


Chiplets
Modular architectures

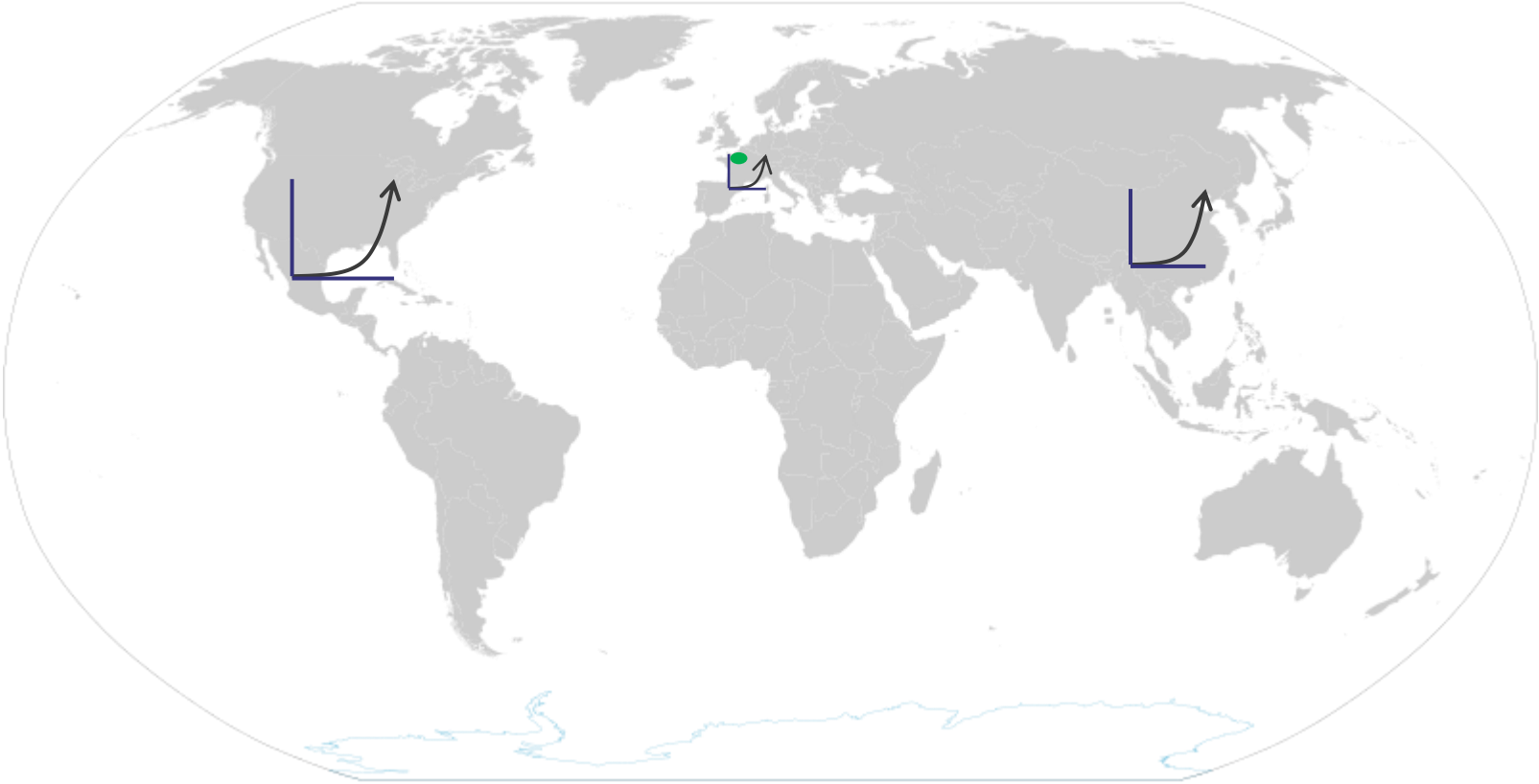
Superconducting digital



Neuromorphic compute



Probabilistic bits



Artificial Intelligence
Vlaanderen/Flanders

Flanders AI Plan for a successful adoption of AI

1

Flanders AI
Research Program

2

Implementation

3

Skills/Training

Ethics & Legal

Knowledge Centre Data & Society

Citizen Projects
Public Outreach

Sabine Demey, imec
Director Flanders AI Research Program

DEPARTMENT OF ECONOMY SCIENCE & INNOVATION
VLAIO

Flanders AI Research Program

One program that brings together a **critical mass** of researchers

40 Research Groups
90 Professors
300+ researchers

Flanders AI Research Day, October 2024

KU LEUVEN · GHENT UNIVERSITY · VUB VRIJE UNIVERSITEIT BRUSSEL · University of Antwerp · UHASSELT · imec · FLANDERS MAKE · VIB · vito · sirris · ILVO


Foto:
KU Leuven
HEALTH

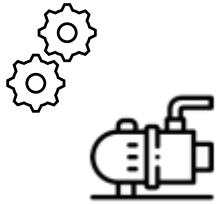

SOCIETY


Foto: Flanders Make
INDUSTRY


PLANET & ENERGY
Foto: VUB

AI is a transversal technology
Applications from multiple domains set expectations for AI technology

APPLICATIONS and AI SYSTEMS

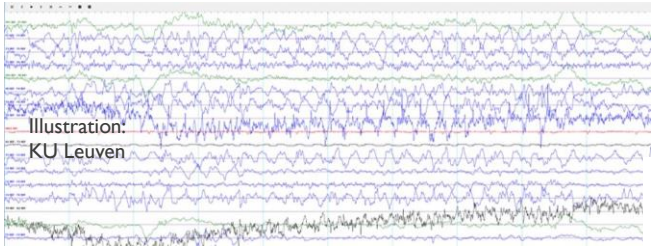


Anomaly detection, preventive maintenance, prognostic health management

Smart grids - faster simulations and predictions of electricity consumption

Epileptic Seizure Detection

AI TECHNOLOGY



AI on time series

Applications from multiple domains set expectations and are testbeds for AI technology and compute hardware

APPLICATIONS

PLANET & ENERGY

INDUSTRY

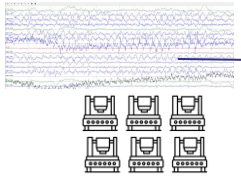
HEALTH

SOCIETY

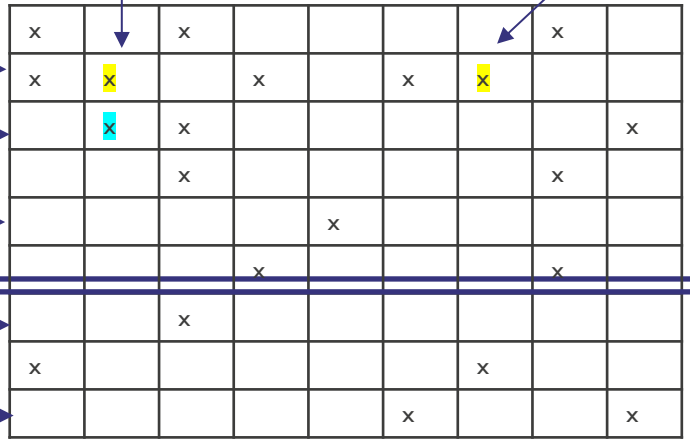
...

...

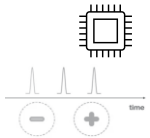
AI TECHNOLOGY



Neuro-symbolic AI



COMPUTE HARDWARE



Flanders AI Research Program supports adoption of AI with generic research and demonstrations in use cases (TRL 2-4)

Generic research challenges

AI-driven data science

*Supporting complex **decision making and actionable insights creation** with powerful and intuitive AI-Driven Data Science*

Situated AI

*Supporting complex **task execution** in a dynamic environment with (semi-)autonomous AI Systems, collaborating in real time with each other and with people*

Focus domains and use cases

HEALTH

INDUSTRY

PLANET & ENERGY

SOCIETY

Ambition
Successful adoption of AI

Uptake of research results in companies and organisations

Ambition to create a **sustainable future** with AI
for the benefit of economy, society, environment

To realise this, there is a need for **trust in AI,**
for **trustworthy** and **resource-efficient AI**

We need to **join forces** by public and private partners

- to tackle **technological challenges** across the **full technology stack**
- to create **resilience** in the **complete AI value chain in Europe** and provide **affordable access** to trustworthy and resource-efficient AI