AI FLANDERS

Challenge-Based Research with Demand-Driven Impact

Sabine Demey, Director Flanders AI Research Program

TRAIL, September 8th, 2020

PUBLIC

AI Flanders

Impulse program by the Flemish Government, started in 2019

1. TOP RESEARCH
2. IMPLEMENTATION IN INDUSTRY
3. ETHICS, EDUCATION AND TRAINING

> Ensuring Flanders' leadership and attractiveness for future investments in AI technology and applications
>
> by focusing on selected AI disciplines
> that are strategically important for Flanders
> and in which Flanders has internationally recognized leadership

AI Flanders

Program Structure as Approved by the Flemish Government

1 TOP RESEARCH

2 IMPLEMENTATION IN INDUSTRY

1. Funded R&D projects (research institutes, universities + companies)
2. Awareness creation, digital transformation trajectories, etc...
3. Digitaletoekomst.be – targeted at companies
    1. Also cybersecurity program

3 ETHICS, EDUCATION AND TRAINING

1. Knowledge center data & society
2. "Flemish AI academy"

The ‘triple helix-model’

UNIVERSITIES

VRIJE UNIVERSITEIT BRUSSEL

KU LEUVEN

Universiteit Antwerpen

UNIVERSITEIT GENT

UHASSELT
KNOWLEDGE IN ACTION

STRATEGIC RESEARCH CENTERS

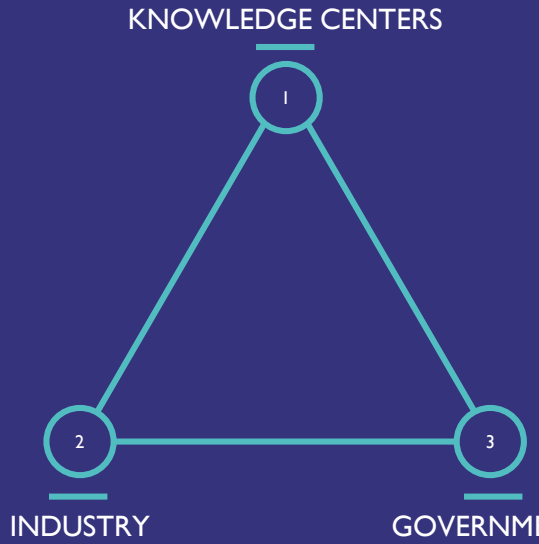
imec
embracing a better life

FLANDERS MAKE

VIB

vito

sirris
driving industry by technology



.AGORIA

Vlaams netwerk van ondernemingen

sirris
driving industry by technology

AGENTSCHAP INNOVEREN & ONDERNEMEN

DEPARTEMENT ECONOMIE WETENSCHAP & INNOVATIE

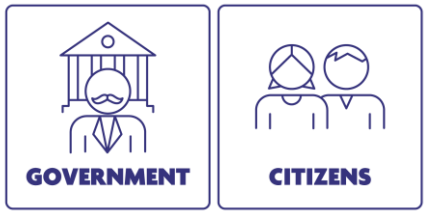
AI Flanders Research Program

1 TOP RESEARCH

3 Domains in Focus of the Flanders AI Research Program







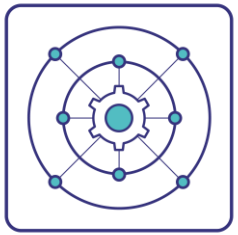
Challenge-Based Research with Demand-Driven Impact

CHALLENGE BASED RESEARCH



RESEARCH CHALLENGES

WITH DEMAND-DRIVEN IMPACT

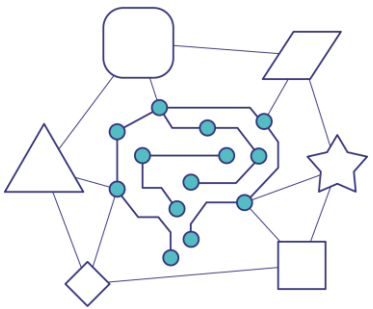


FOCUS DOMAINS and USE CASES

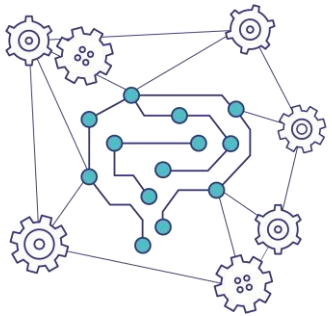
Flanders AI Research Program

4 Research Challenges

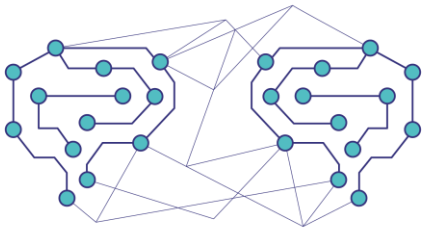
AI-DRIVEN DATA SCIENCE



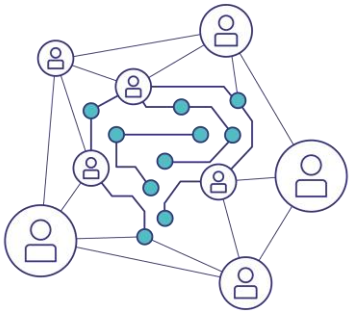
AI IN THE EDGE



MULTI-AGENT COLLABORATIVE AI



HUMAN-LIKE AI



Challenge-Based Research with Demand-Driven Impact

CHALLENGE BASED RESEARCH

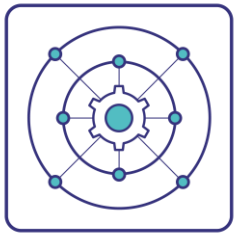


RESEARCH CHALLENGES



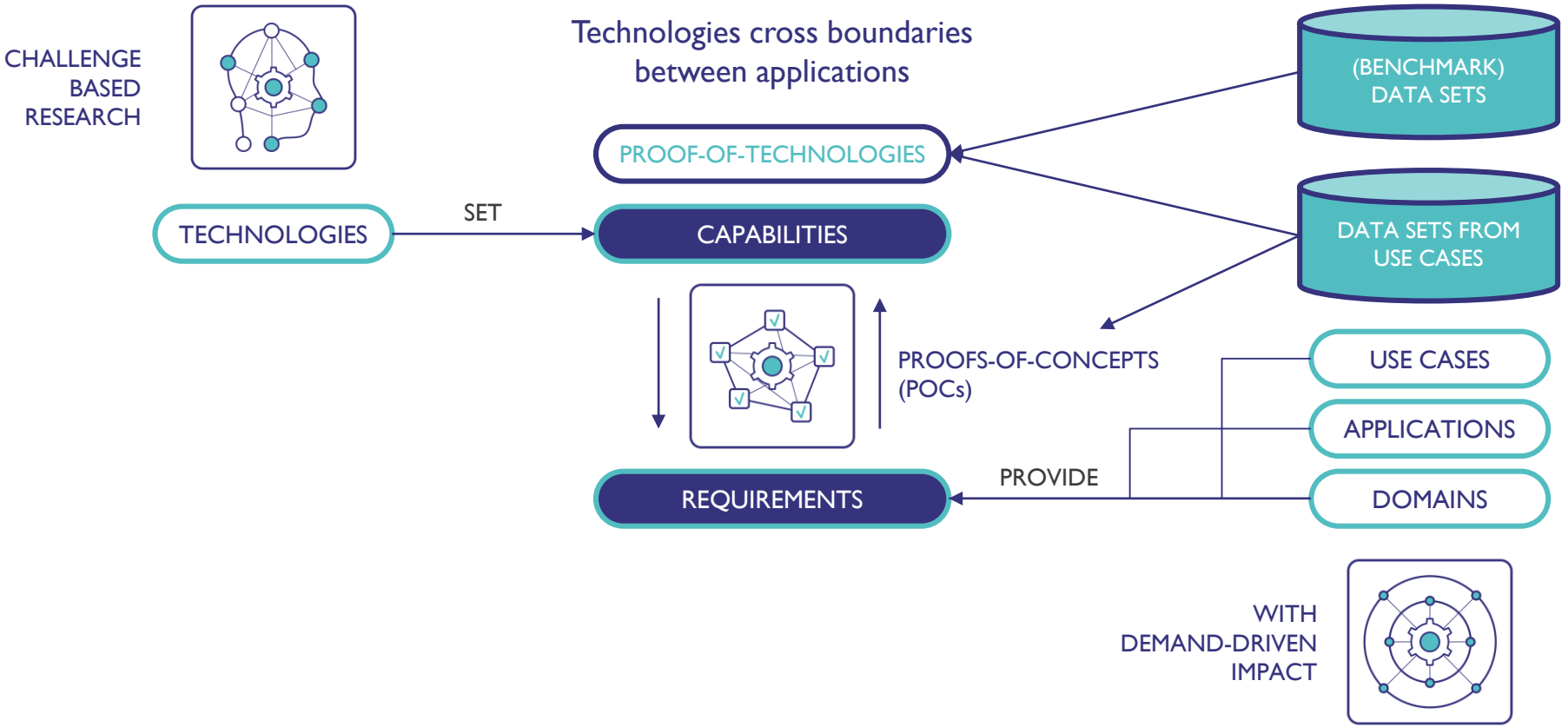
PROOFS-OF-CONCEPTS (POCS)

WITH DEMAND-DRIVEN IMPACT



FOCUS DOMAINS and USE CASES

Challenge-Based Research with Demand-Driven Impact



Flanders AI Research



Sabine Demey
Program Director Flanders AI Research
imec

AI-driven Data Science



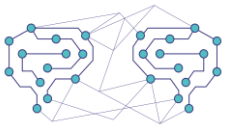


Prof. Bart De Moor
ESAT, KULeuven



Prof. Piet Demeester
IDLab, Ghent University-imec

Multi-agent Collaborative AI





Ann Nowé
Professor AI Lab, VUB

AI in the Edge





Mieke De Ketelaere
Program Director AI, imec

Human-Like AI





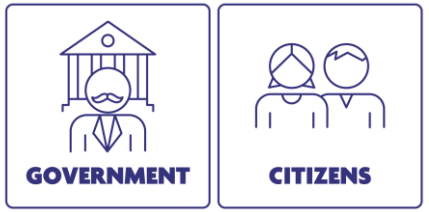
Prof. Steven Latré
IDLab, University of Antwerp
- imec

DEMAND from Focus Domains, Applications, Use Cases

3 Domains in Focus of the Flanders AI Research Program

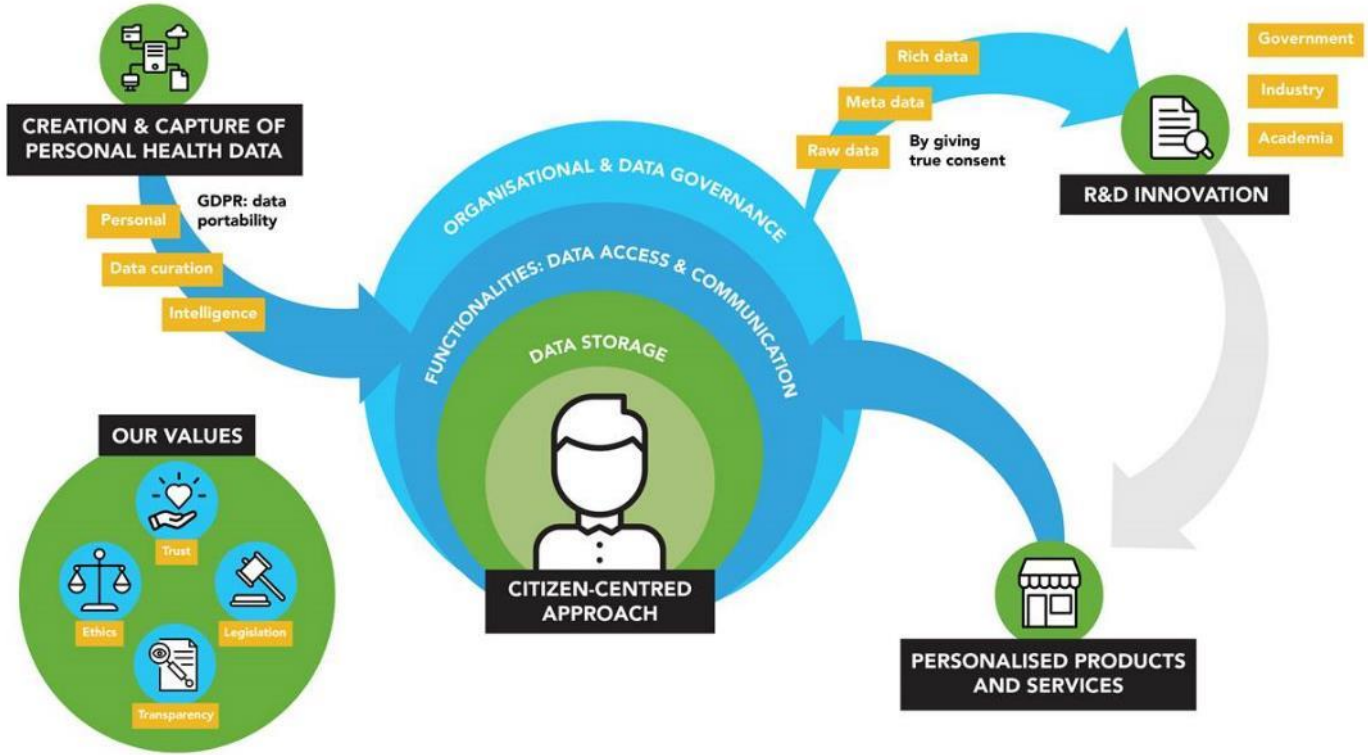






Exchanging Data and Knowledge in a Healthcare Setting

Distributed data intelligence with decentralized personal data vaults



GOVERNMENT

CITIZENS

vito

Bart Buelens

Selected Applications in Health

PRECISION MEDICINE		CLINICAL DECISION SUPPORT		HOSPITAL DECISION SUPPORT
Single Cell Technologies	Multiple Sclerosis	Epilepsy	Medical Imaging *Radiation Oncology and Radiology*	Hospital Treatment Decisions
Visualisation of single cell data & Segmentation of 3D electron microscopy images	Improve MS treatment	Automated detection of epileptic seizures	Segmentation & classification for radiation oncology and radiology	Prediction of length of stay in hospitals



Selected Applications in Industry 4.0

SMART MACHINES	SMART FACTORIES	SMART ENERGY
Smart Monitoring	Smart Control	Smart Industrial Spaces
Prognostic Health Management of industrial machines, power-efficient anomaly detection, preventive maintenance	Low-latency control of robots	Control of cooperating robots/robot arms	People Detection & Tracking	Forecasting congestions in a low voltage distribution grid
	Control of machine Fleet		AI-Assisted Operator	
	Optimisation of manufacturing processes	Optimisation of flexible production lines	AI system (AGV) assisted by Operator	



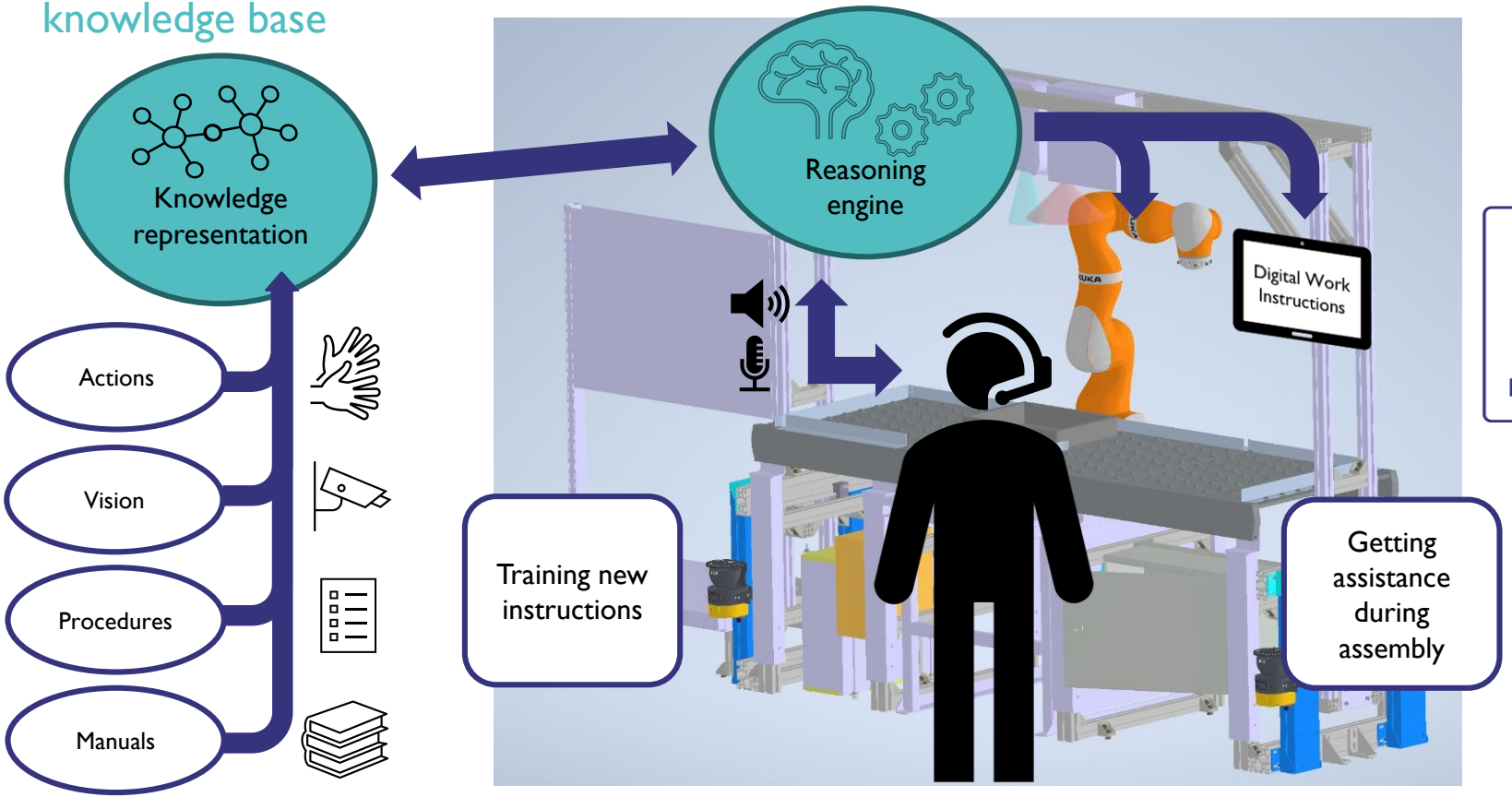
Common Concept: Smart Spaces

CONVERSATIONAL AGENTS

RECOMMENDER SYSTEMS

AI-Assisted Operator

Towards an enhanced operator through seamless interaction with a smart knowledge base



INDUSTRY 4.0

FLANDERS MAKE

Maarten Witters

Intelligent and Instructable AGV

Increasing the autonomy of AGVs to address more complex tasks



"Pick up the red pallet and put it on the truck"

Speech interpretation

Object recognition and referral

Learning of tasks, actions, and navigating

Understanding object relations and context

INDUSTRY 4.0

Increasing the autonomy of AGVs to address new and more complex tasks and allowing adoption in a larger number of agricultural, industrial and logistic settings.

FLANDERS MAKE

Chris Ganseman

Domains and Applications



HEALTH

PRECISION MEDICINE

CLINICAL DECISION SUPPORT

HOSPITAL DECISION SUPPORT

…



INDUSTRY 4.0

SMART MACHINES

SMART FACTORIES

SMART ENERGY

…



GOVERNMENT

PUBLIC EMPLOYMENT SERVICES

…



CITIZENS

PERSONAL DATA

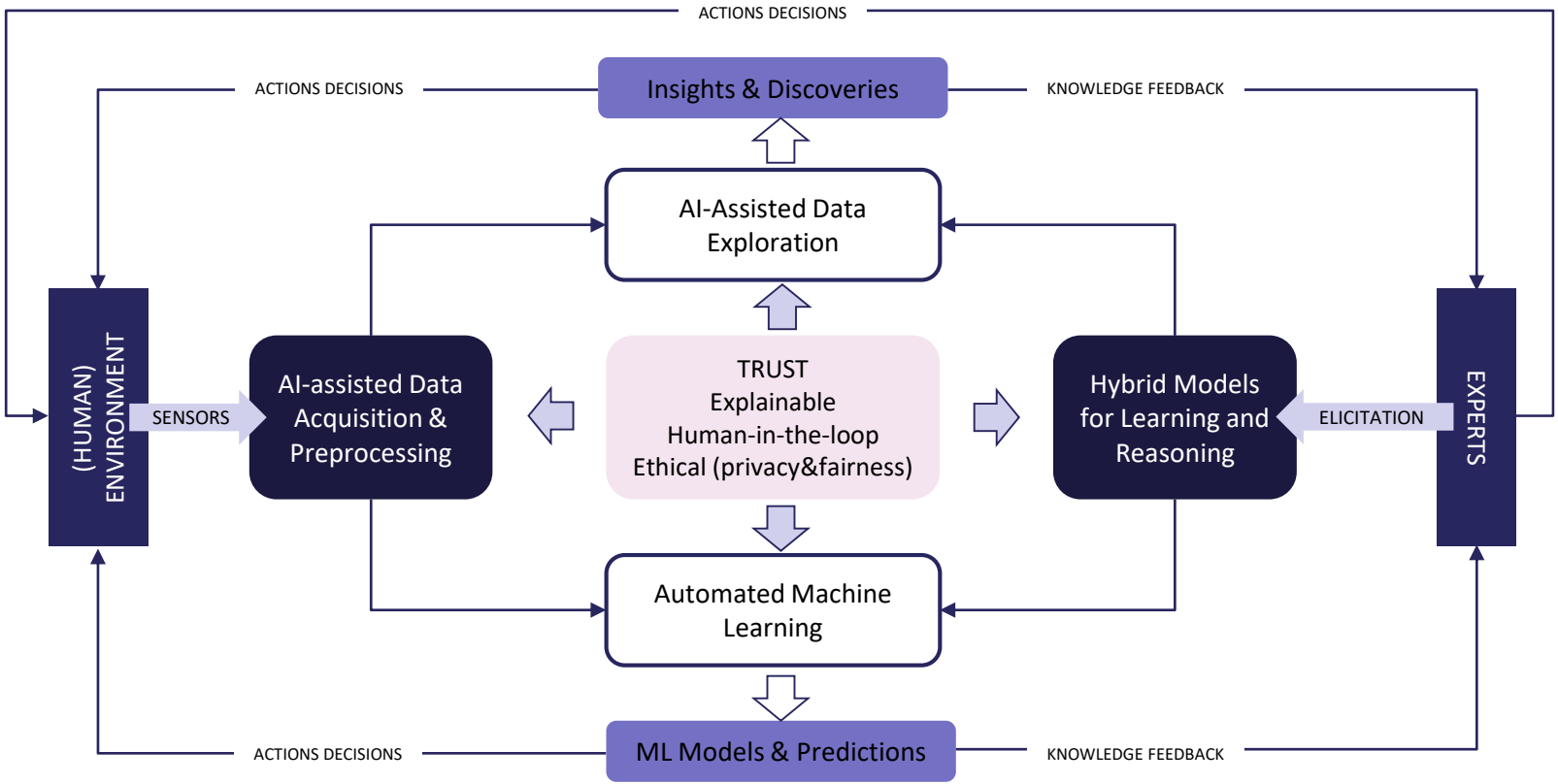
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SMART SPACES

CHALLENGE-BASED RESEARCH

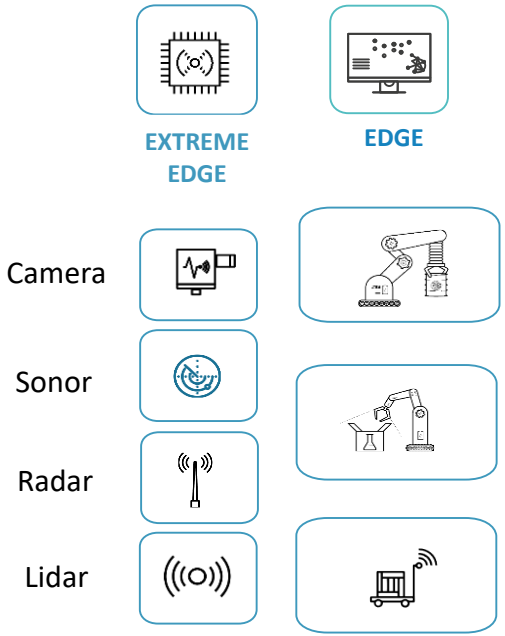
Making Data Science Hybrid, Automated, Trusted and Actionable

Challenge 1 AI-driven Data Science



Real-Time and Power-Efficient AI in the Edge

Challenge 2 AI in the Edge



1. Inter-device algorithms
   - Sensor fusion – cooperative and resilient
   - Distributed edge & resource-aware Learning, Transfer Learning
   - AI task distribution
   - Adaptive wireless networks
2. Intra-device algorithms
   - Early sensor fusion
   - Adaptive inference
   - On-line edge learning
3. Software tools suite
4. Extreme edge hardware for energy-efficient edge inference and learning
   - Based on design space exploration
   - Work at several levels
     - Circuit level
     - Architecture level
     - System level
     - Application level

Interact Autonomously with other Decision-Making Entities

Challenge 3 Multi-agent Collaborative AI

- **Multi-agent systems (MAS)**
  - AI systems do not live in isolation but are interconnected
    - Interconnectivity gives opportunities for sharing information, and joint learning and optimisations
  - Multi-agent systems are systems in which autonomous decision-making entities (called agents) interact
    - Each agent has its own goals and intentions
    - Many examples in nature: flocks of birds, swarms of bees, ant colonies, biological cells

- **Multi-agent control systems**
  - As agents need to interact with each other, coordination mechanisms are needed
  - Anywhere on the spectrum between cooperative or competitive
  - Agents need to:
    - Adapt rapidly to unpredictably changing environments
    - Be open-ended, so new agents, users and technologies can join at any time



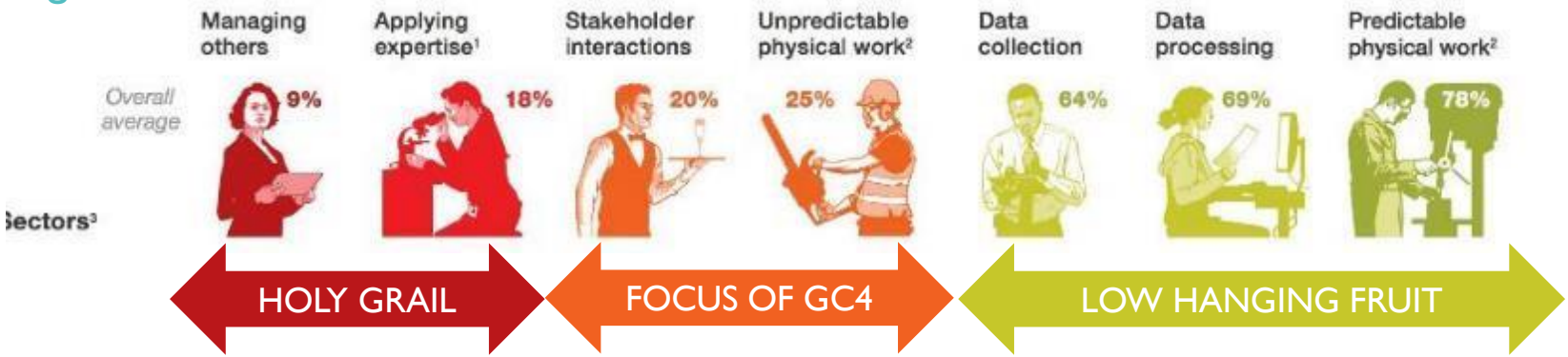
Agents in a smart grid model

- **Multi-agent systems interact with humans**
  - By understanding their intentions and explaining their own behaviour
  - By being accountable and manageable by their creators

- **Handling data in multi-agent environments**
  - People might want to share information, but they want to keep control
  - Sharing information might be conditional and for specific servies only
  - Agents need to adhere to contraints, rules and regulations, even in the absence of central control

Communicate and Collaborate Seamlessly with Humans

Challenge 4 Human-Like AI





INTERACTION WITH THE ENVIRONMENT & HUMAN



UNDERSTANDING OF "WHAT'S GOING ON"

(beyond simple pattern matching)

FAST AND PERSONALIZED ACTIONS

Increase AI Reasoning and Understanding



GETTING A DETAILED UNDERSTANDING OF THE ENVIRONMENT

- Multimodal scene analysis
- Learning context
- Understanding user & environment state and intention





FAST AND COMPLEX LEARNING OF TASKS

- Complex conversations & question answering
- Personalized to the human operator
- Adapt fast with limited training data

Challenge-Based Research with Demand-Driven Impact

Flanders AI Research Program

CHALLENGE
BASED
RESEARCH





PROOFS-OF-CONCEPTS
(POC)

WITH
DEMAND-DRIVEN
IMPACT

