

AI FLANDERS
BUILDING OUR DIGITAL FUTURE

AI VLAANDEREN
BOUWEN AAN JE DIGITALE TOEKOMST

Vlaams AI Onderzoeksprogramma Flanders AI Research Program

September 2022

Prof. Dr. Ir. Bart De Moor, ESAT-STADIUS, KU Leuven

.AGORIA

vo
ka
Vlaams
netwerk voor
ondernemingen

siris
giving industry by technology

imec
embracing a better life

FLANDERS
MAKE

VIB

vito

VUB
VRIJE
UNIVERSITEIT
BRUSSEL

KU LEUVEN

U
Universiteit
Antwerpen

**UNIVERSITEIT
GENT**

UHASSELT
UNIVERSITEIT
HASSELT

**AGENTSCHAP
INNOVEREN &
ONDERNEMEN**

**DEPARTEMENT
ECONOMIE,
WETENSCHAP &
INNOVATIE**

**Vlaamse
overheid**

PUBLIC



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



Flanders AI Program

Program Structure with 3 pillars, funded by the Flemish Government

1 FLANDERS AI RESEARCH PROGRAM

Start: July, 1st 2019

2 FLANDERS AI IMPLEMENTATION PROGRAM

3 FLANDERS AI SUPPORTING ACTIVITIES:
ETHICS, EDUCATION AND TRAINING

Yearly budget of
PROGRAM

12 Mio €

15 Mio €

5 Mio €

 Knowledge Centre
Data & Society

Flanders AI Academy

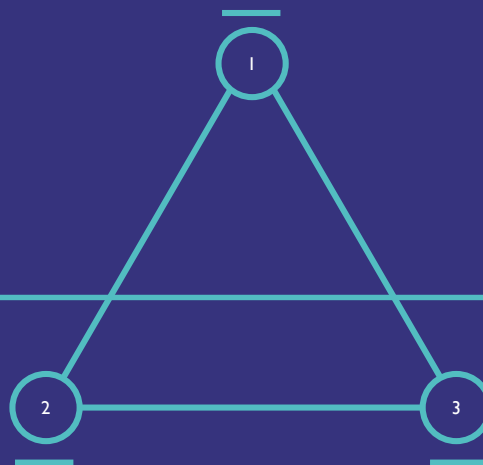
The 'triple helix-model'

Consortium partners AI Research Program

UNIVERSITIES



KNOWLEDGE CENTERS



5 (STRATEGIC) RESEARCH CENTERS



Flanders AI Research Program

Challenge-Based Research with Demand-Driven Impact



RESEARCH CHALLENGES

AI-DRIVEN DATA
SCIENCE



AI IN THE EDGE



MULTI-AGENT
COLLABORATIVE AI



HUMAN-LIKE AI



Internationally recognized challenge-based research

ADOPTION OF AI

RESEARCH &
TECHNOLOGY UPTAKE

COLLABORATIVE
RESEARCH

FOCUS DOMAINS and USE CASES



HEALTH



INDUSTRY 4.0



GOVERNMENT

&



CITIZENS

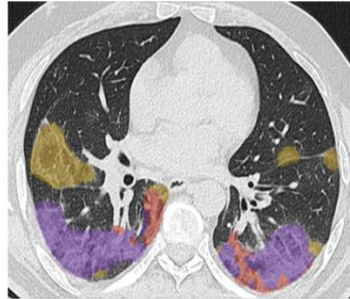
PROOFS-OF-CONCEPTS (POCs)

Demonstrators use and drive new
research

AI Applications in Healthcare and Industry 4.0



Precision medicine



Clinical decision support



Monitoring and treatment



MANUFACTURING



ENERGY



AGRICULTURE



LOGISTICS

Selected Applications AI in Health in Flanders AI Research Program

**PRECISION MEDICINE
IMPROVING PERSONAL
PATIENT TREATMENT
+ BIOMARKERS**

**CLINICAL DECISION SUPPORT
DIAGNOSIS & PATIENT
MONITORING WITH WEARABLES**

**HOSPITAL
TREATMENT
DECISIONS**

**HEALTH
DATA
MGMT**

Single Cell
Technologies

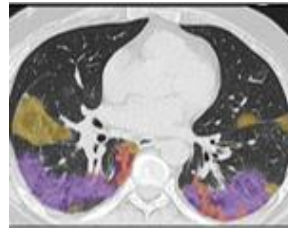
Multiple
Sclerosis

Medical Imaging
*Radiation
Oncology and
Radiology*

Epileptic
Seizure
Detection

Prediction of
Length of Stay
in Hospitals

Personal
Health Data
Management



Selected Applications in Industry 4.0

SMART MACHINES

SMART FACTORIES

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
	Control of machine Fleet		AI-Assisted Operator
	Optimisation of manufacturing processes	Optimisation of flexible production lines	AI system (AGV) assisted by Operator



Applications in Government & Citizens

PUBLIC
EMPLOYMENT
SERVICES

PERSONAL DATA

Challenges

1. Ethical & Trustworthy
AI, Privacy, Bias &
Fairness
2. Personalization
3. Intuitive interactions

CONVERSATIONAL
AGENTS

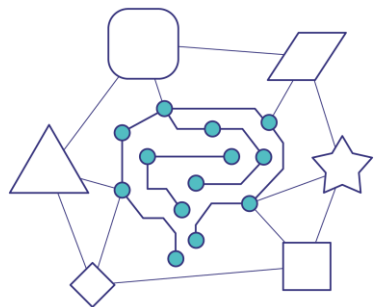
RECOMMENDER
SYSTEMS



Flanders AI Research Program

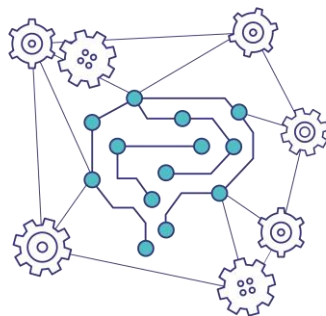
4 Research Challenges

AI-DRIVEN DATA SCIENCE



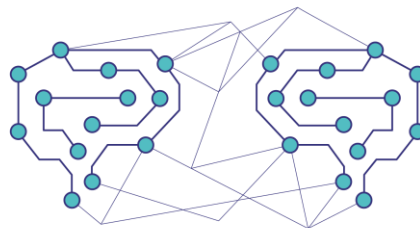
*Making Data Science
Hybrid, Automated,
Trusted and Actionable*

AI IN THE EDGE



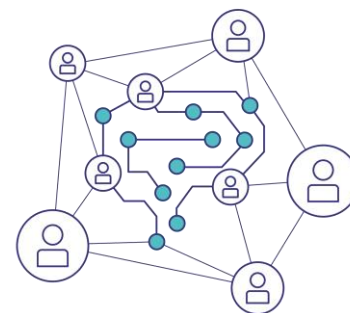
*Real-Time and
Power-Efficient AI
in the Edge*

MULTI-AGENT COLLABORATIVE AI



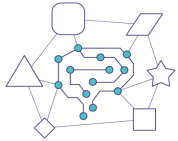
*Interact Autonomously
with other Decision-
Making Entities*

HUMAN-LIKE AI



*Communicate and
Collaborate
Seamlessly with
Humans*

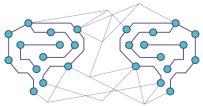
Four challenges



"AI-driven Data Science: Unlocking the value of data in a trusted and automated manner, supporting complex decision making and providing new insights that will empower individuals and society in generating major advances in healthcare, education, industry 4.0, energy systems and more."



"AI in the Edge: Improving edge device environments through the co-optimisation between power efficient AI processors and advanced machine learning tasks with as purpose to increase the real-time performance, reliable low-latency communication, power-efficient processing and data security."



"Multi-Agent Collaborative AI: Creating flexible coordination mechanisms for autonomous decision-making entities, allowing to adapt to changing environments, to interact flawlessly with humans, and to exchange privacy-sensitive data, in this way leveraging the power of AI in a highly connected and rapidly changing world."



"Human-like AI: Towards more natural, interactive, personalized, and human-inspired AI systems. Seamless interaction between humans and AI in Multi-modal perception, Multi-modal instruction, Personalized interaction and responses, Complex control: navigation, reasoning, etc."

Flanders AI Research Program



Sabine Demey
Program Director Flanders AI Research
imec



Jo De Boeck
Executive Representative imec

AI-driven Data Science



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ESAT, KULeuven



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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

Making Data Science Hybrid, Automated, Trusted and Actionable

Challenge I AI-driven Data Science



Making Data Science Hybrid, Automated, Trusted and Actionable

Challenge I AI-driven Data Science



1. AI-assisted Data-Acquisition and Pre-Processing
2. Integrating Learning and Reasoning
3. AI-Assisted Data Exploration
4. Automated Learning
5. Trustworthy and Explainable AI
6. Decision Support Systems

Real-Time and Power-Efficient AI in the Edge

Challenge 2 AI in the Edge



Real-Time and Power-Efficient AI in the Edge

Challenge 2 AI in the Edge



1. Edge Learning
2. Sensor Fusion
3. Extreme Edge Hardware

Interact Autonomously with other Decision-Making Entities

Challenge 3 Multi-agent Collaborative AI



Interact Autonomously with other Decision-Making Entities

Challenge 3 Multi-agent Collaborative AI



1. Multi-Agent Control Systems
2. Human Agents
3. Distributed Data Intelligence

Communicate and Collaborate Seamlessly with Humans

Challenge 4 Human-Like AI



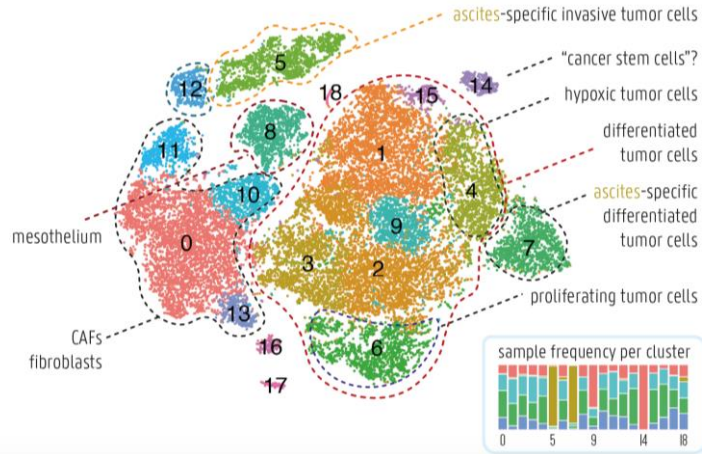
Communicate and Collaborate Seamlessly with Humans

Challenge 4 Human-Like AI



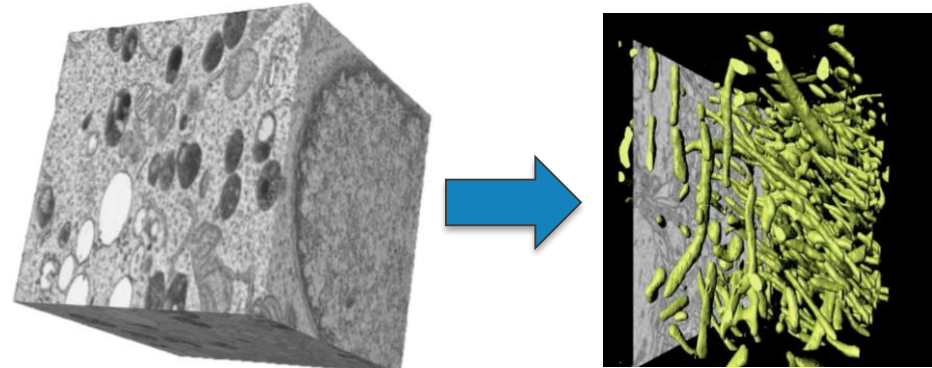
1. Audio-Visual Perception and Multimodal Representations
2. Conversational Agents
3. Interaction, Personalisation and Recommendation
4. Cognitive Architectures and Human-Like Learning

Single-cell “omics”



- **Interactive** visual analytics
- **Structure learning** (clusters, cell type hierarchies, cell developmental trajectories)
- Incorporation of **prior biological background knowledge**

3D electron microscopy



1 Dataset: 100 to 2000 slides (5 to 380 GB)

- **Automated segmentation** of cell organelles
- Very **few labeled** data (costly labels)
- Active learning, weakly supervised learning, transfer learning
- **Interpretability**

Rapid response to COVID-19 challenge

VIB COVID-19 RESPONSE - UZ Gent/VIB/UGent Inflammation Research Center

About IRC/VIB | single-cell.be | Contact

DATA PORTAL | DISEASE BIOLOGY | CLINICAL TESTING | THERAPEUTICS

COVID study

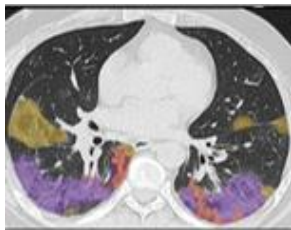
STUDY

This study aims to gain more insight in the immunological characteristics of SARS-CoV2 infection. Samples have been collected from patients with a high clinical suspicion of

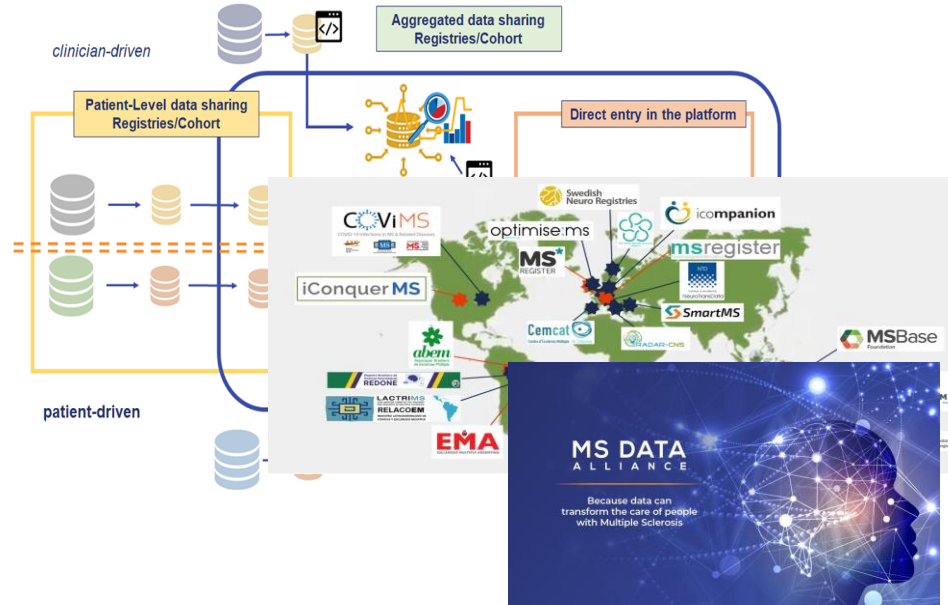
principal investigators

- Linos Vandekerckhove (UGent)
- Yvan Saeyls (UGent)
- Rafika-Pierre Sekaly (Case Western Reserve)

COVID-19 cell Atlas project, clinical trial
<https://www.single-cell.be/covid19/>

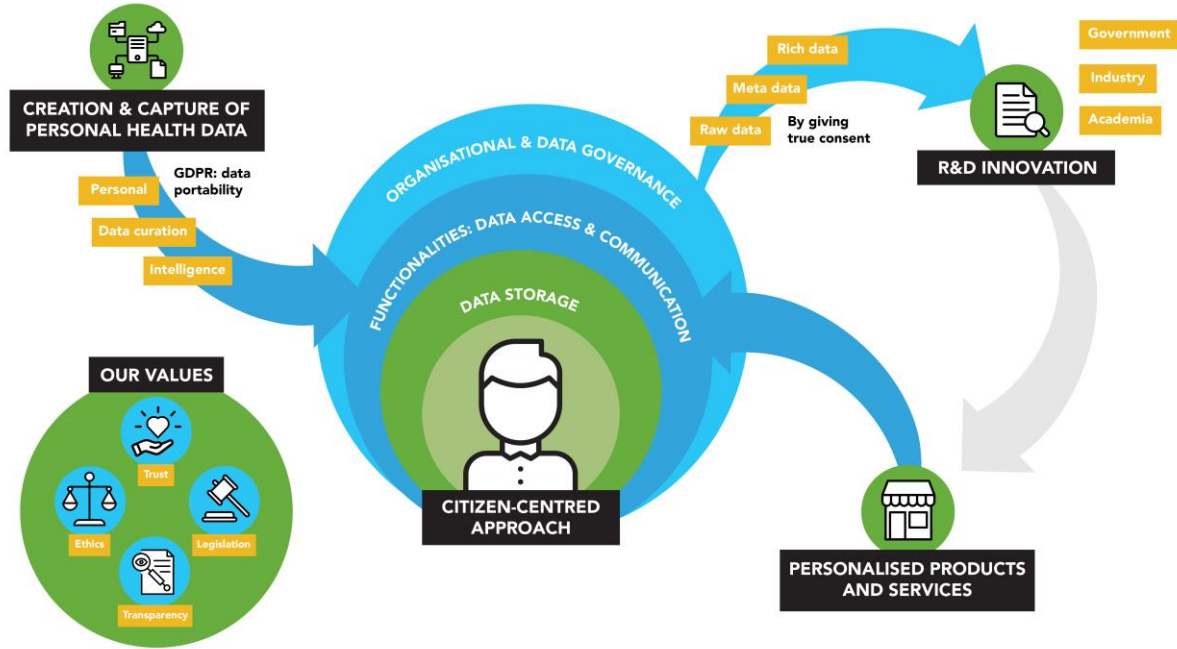


Lung Segmentation



Federated infrastructure with automated data wrangling pipeline

Personal data



- Distributed data intelligence
- Decentralized personal data vaults (in line with principles of Solid)

