MLG
MACHINE LEARNING GROUP

ENABLING TECHNOLOGIES FOR THE ENERGY TRANSITION

ULB UNIVERSITÉ LIBRE DE BRUXELLES

ULB

- Founded in 1834
- Research excellence: **4 Nobel Prizes, 1 Fields Medal, 3 Wolf Prizes.**
- Active in **150+ European projects**, including 49 ERC grants.
- ULB provides **institutional support for European grants**: proposal setup, incentives, and grant writing assistance.

ULB MLG MACHINE LEARNING GROUP

MACHINE LEARNING GROUP

- **Established 20+ years ago**; team of 5 PIs and 20+ members (PhDs, postdocs, affiliates).
- Core member of:
  - **TRAIL AI Institute** (Wallonia-Brussels AI initiative)
  - **FARI – AI for the Common Good Institute.** (VUB & ULB)
  - **IB²** - Interuniversity Institute of Bioinformatics. (VUB & ULB)
  - **CAIRNE** - The Confederation of Laboratories for Artificial Intelligence Research in Europe.
- Key player in the Belgian AI and Data Science ecosystem.

KEY TEAM MEMBERS

Prof. Gianluca Bontempi

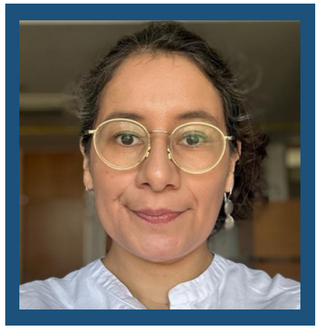
Co-head of MLG

- Former TRAIL president, Senior IEEE member, associate editor at Int. J. of Forecasting.
- +250 papers, 24,700+ citations, h-index 67, €7M+ in grants.
- Expertise: **forecasting, scalable analytics, causal inference, digital twins, and energy prediction.**

Prof. Tom Lenaerts

Co-head of MLG

- Director of FARI, affiliated with VUB and UC Berkeley's CHAI. Editorial board of ACM AI Letters and Adaptive Behavior. Member of ELLIS and Global Partnership on AI.
- +170 publications, 7,400+ citations, h-index 41, €5M+ in grants
- Expertise: predictive medicine, **optimization, multi-agent systems, decision-making, cooperation**, and computational biology.



Dr. Natalia García - Colín

Research & Innovation Lead

- Former modeling & product design lead in the financial industry (London, Brussels).
- **Leads collaboration building and research grant development.**

KEY AREAS OF EXPERTISE

ML & AI FOR

- **Forecasting and time series prediction**
- **Scalable analytics and big data mining**
- **Optimization**
- **Causal inference and computational statistics**
- **Anomaly detection**
- **Multi-agent systems, and collective intelligence**
- **Game theory, decision-making models**
- Bioinformatics

PAST APPLICATIONS

Energy, finance, neuroscience, traffic, fraud detection, cybersecurity, predictive medicine and **digital twins**.

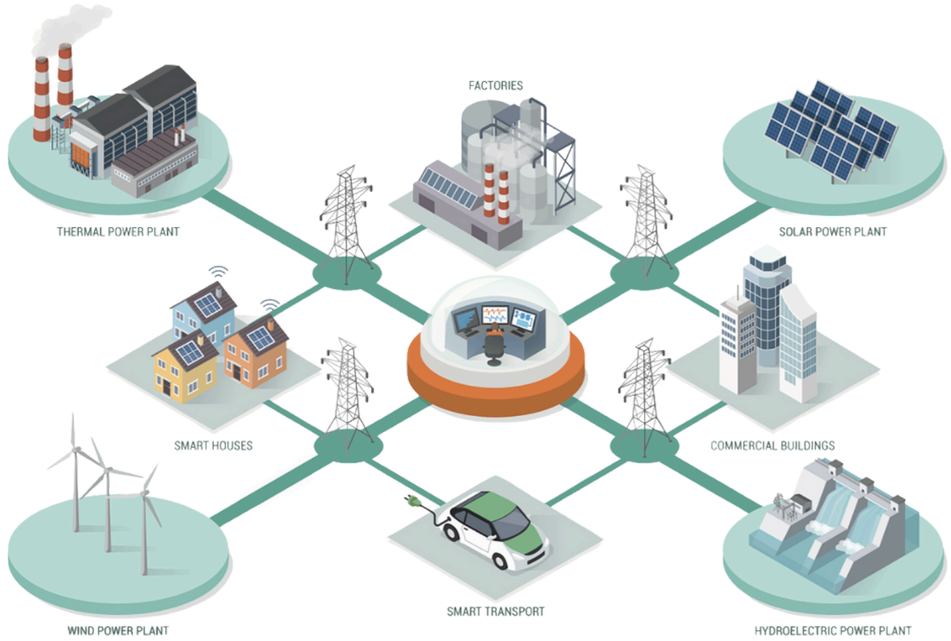
CURRENT INTERESTS

AI for societal impact: safety, health, **energy systems, smart grids, and virtual power plants.**

ULB MLG MACHINE LEARNING GROUP

ENABLING TECHNOLOGIES FOR A "SUSTAINABLE, SECURE, AND COMPETITIVE ENERGY SUPPLY"

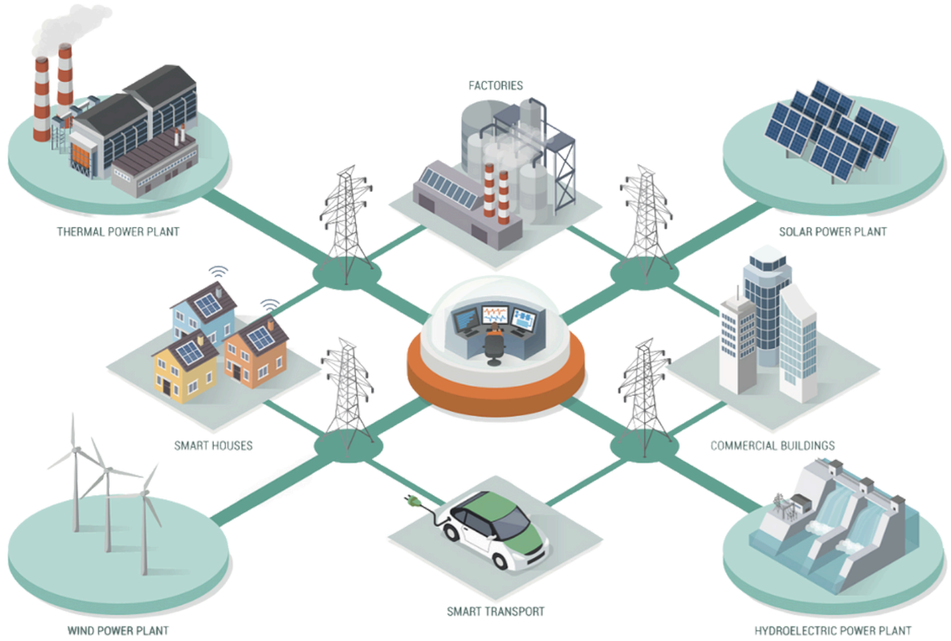
- **Renewable Energy Forecasting**
  - AI-driven models for wind/solar generation.
- **Energy Load Prediction**
  - Adaptive demand forecasting systems.
- **Grid Optimization**
  - Dynamic line rating and intelligent control.
- **Transfer Learning for Smart Grids**
  - Cost-effective monitoring with fewer sensors.
- **Energy Storage Optimization**
  - AI strategies for battery use and grid integration.



ULB MLG MACHINE LEARNING GROUP

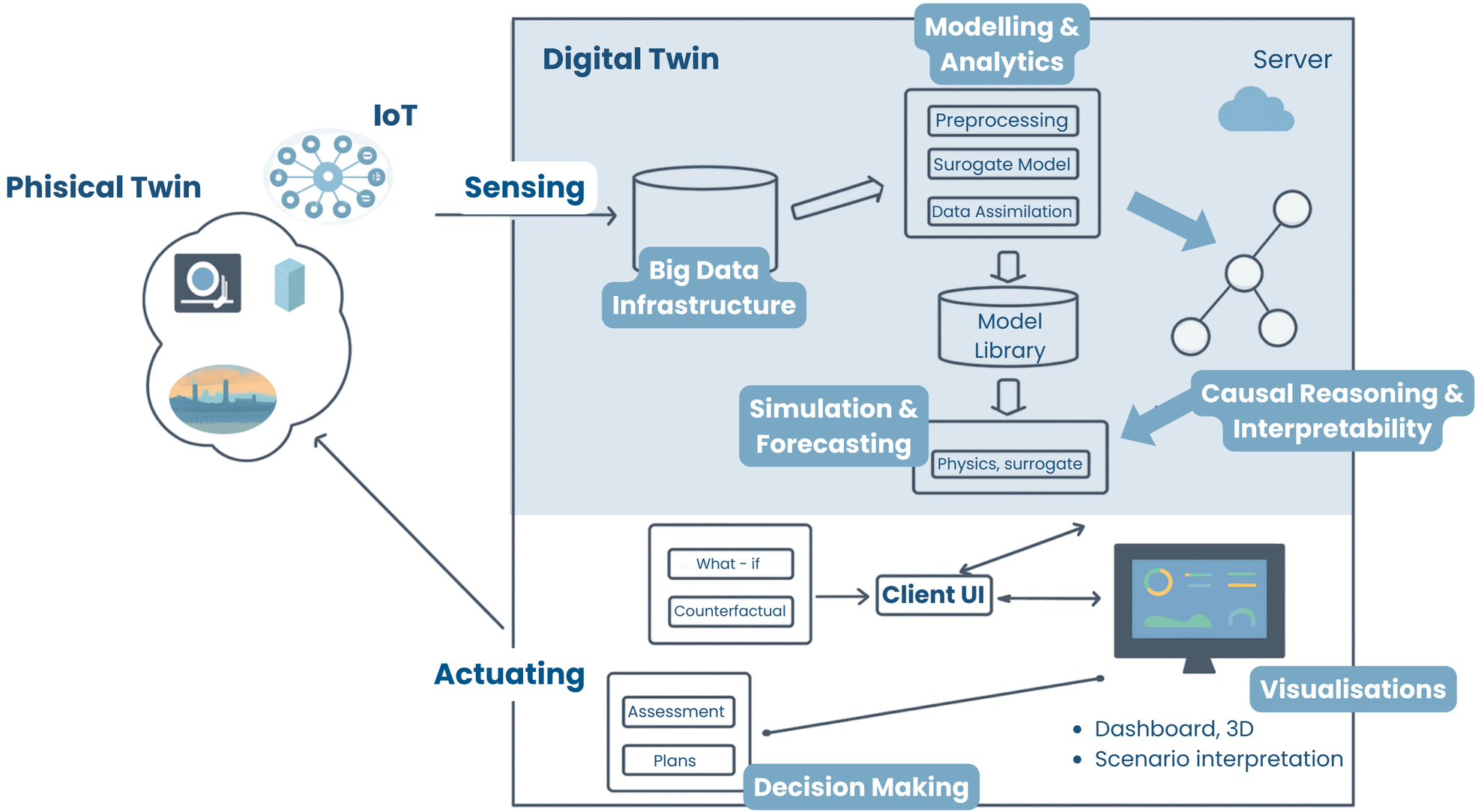
ENABLING TECHNOLOGIES FOR A "SUSTAINABLE, SECURE, AND COMPETITIVE ENERGY SUPPLY"

- **Consumer-Centric Forecasting**
  - Personalized demand prediction.
- **Behavioral & Cooperative Models**
  - Human-AI decision mechanisms for energy sustainability and fairness.
- **Virtual Power Plant Simulation**
  - Forecasting and market participation models.
- **Digital Twin Development**
  - Virtual system-wide simulations for infrastructure optimization.



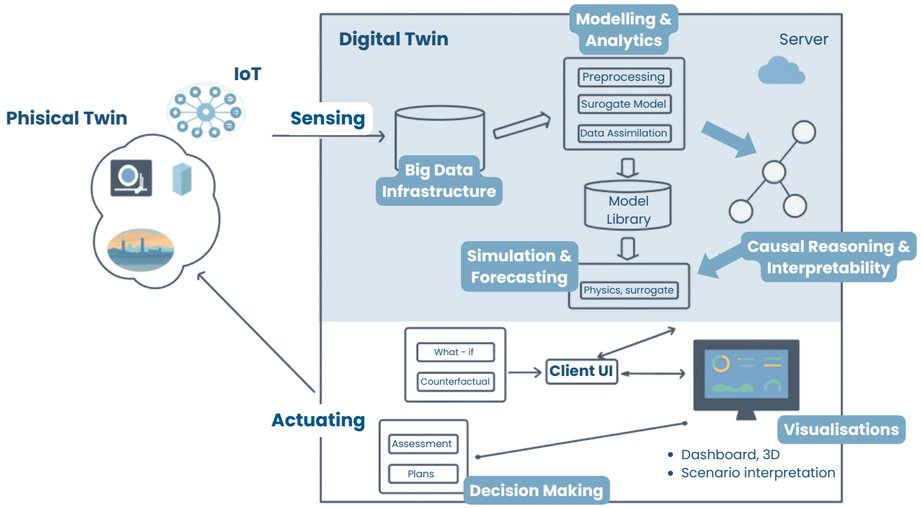
ULB MLG MACHINE LEARNING GROUP

ML FOR DIGITAL TWIN ARCHITECTURE



DT: THEY RAISE SCIENTIFIC QUESTIONS

- **Integration of physical and data-driven models**
  - Data assimilation
  - Physics - based machine learning
  - Surrogate modelling
  - Causal inference and discovery
- **Multi-criteria Optimisation**
- **ML**
  - Transfer learning, active learning
  - Online learning
  - Non-stationarity, Concept drift
- **Data infrastructure**
  - Big data
  - Streaming infrastructure
  - Sequential model updating
- **User interaction**
  - What-if scenarios
  - Dashboarding, visualisation
  - Human -AI interaction / cooperation



ULB MLG MACHINE LEARNING GROUP

RELATED PROJECTS, PAST AND PRESENT

- **NEXUS** - (submitted) Innoviris.
  - **Adaptive energy consumption modulation and demand management.**
- **MultiRoofs** – (2023-2025) INTERREG NWE Co-funded by EU.
  - **Digital twins for sustainable rooftop management.**
- **TORRES/TULIPE** - (2023-2025) Innoviris.
  - **Monitoring and analysis of traffic data at the scale of a large city. Traffic Twin.**
- **COOMEP** – (2024-2025)
  - **Monitoring and modeling household energy consumption, smart coordination of household energy, user-centered energy management, and safeguarding fundamental rights in AI systems.**
- **TRAIL–ARIAC** – (2021-2027) Digital Wallonia4.AI initiative.
  - **Digital twins, and transfer learning** to manage evolving data in dynamic systems, using causal analysis to uncover their fundamental mechanics.
- **WEL-T**
  - **Enhancing DIgital TwinS with scalable and interpretable AI**

ULB MLG MACHINE LEARNING GROUP

COLABORATIONS, PAST AND PRESENT...

VUB

EVERGi RESEARCH GROUP

amU Aix Marseille Université

UNIVERSITÀ DEGLI STUDI DEL SANNIO

Yacq

Sibelga energizing the city

brupower

HORIZON CALLS: “SUSTAINABLE, SECURE, AND COMPETITIVE ENERGY SUPPLY”

- HORIZON-CL5-2026-03-D3-21:
  - **Hybrid AI-Control Framework for a next-generation grid-scale energy storage and system integration**
- HORIZON-CL5-2026-03-D3-23:
  - ***AI-driven forecasting algorithms for Grid and Consumer friendly Energy Sharing – Societal Readiness pilot***
- HORIZON-CL5-2026-11-D3-24:
  - **Data sharing to support the training and development of AI foundation models in the energy sector**
- HORIZON-CL5-2027-02-D3-25:
  - **Large scale operational validation and upscaling of state-of-the-art (Generative) AI tools and models powering a next generation digital energy system**
- HORIZON-CL5-2027-07-D3-26:
  - **Advanced TSO control rooms to enhance grid observability, stability and resilience**
- HORIZON-CL5-2027-07-D3-27:
  - **Advanced Distribution Management Systems (ADSM) for more efficient and flexible distribution grids**
- HORIZON-CL5-2027-07-D3-29:
  - **Community of practice - Data-Driven Decision-Making in Energy**

ULB MLG MACHINE LEARNING GROUP

SEEKING CONSORTIA

Our ideal partners have

- Research complementary.
- Domain knowledge in energy grid technologies, energy contracts, etc.
- Interesting Use Cases.
- Loads of data.
- A nice coffee machine. ;-)

ULB MLG MACHINE LEARNING GROUP

THANKS FOR YOUR ATTENTION, PLEASE CONNECT WITH US FOR FUTURE COLLABORATIONS.

- mlg.ulb.ac.be
- Relevant publications

- tom.lenaerts@ulb.be
- gianluca.bontempi@ulb.be
- natalia.garcia.colin@ulb.be