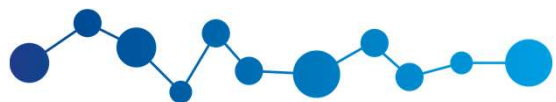


# Unlocking the Future of Big Data



May 15<sup>th</sup>, 2024



**FutureData4EU**

Training Future Big Data Experts for Europe



ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA



UNIVERSITÀ  
CATTOLICA  
del Sacro Cuore



Università  
degli Studi  
di Ferrara



UNIMORE  
UNIVERSITÀ DEGLI STUDI DI  
MODENA E REGGIO EMILIA



UNIVERSITÀ  
DI PARMA



POLITECNICO  
MILANO 1863

# Unlocking the Future of Big Data - Summary

- General overview of the Thematic Area
- List of the Doctoral Positions and Universities involved in the thematic area Enabling Technologies
- Sub Areas of Research to be developed during the project
- Contacts

## Overview of the Thematic Area

*The objective of the enabling technology thematic area is to target the intersection of big data, artificial intelligence, and foundational and applied research.*

*The goal is to move the frontier of foundational and applied research in a wide set of scientific domains by empowering data-driven and big-data approaches as well as advancing the capabilities of cutting-edge artificial intelligence and big-data techniques.*

*With more details, the domain and methods proposed are:*

- Combining symbolic and sub-symbolic AI techniques to analyze multimodal, diverse, big, and noisy data in a transparent, fair, robust, and sustainable way.*
- Investigate applications of big data, machine learning, high-performance computing in fundamental physics and data collected by the LHC accelerator at CERN.*
- AI-powered real-time processing workflows for or extracting insights from Big Data in particle and astroparticle physics experiments*
- Data-driven models of brain circuits for advanced digital twins of single-cell resolved models of brain structures.*
- (Big) Data-driven mathematical and computational models for medical practice and modelling*

# List of the Doctoral Positions and Universities involved Health (11 total)

3

UNIBO

- Big data and statistical theory for enhanced inferences in domain sciences
- Enhancing Dermatologic Interventions through Big Data-Driven Understanding of Placebo Effects
- Data driven determination of statistical properties of proteins

2

UNIFE

- Evolutionary perspective on health and medicine through the lens of paleogenomics
- AI-Based Perioperative Guidance Tool for Vitreoretinal Surgery

2

UNIMORE

- Big-data from single-cell multiomics in somatic stem cells for clinical application
- AI-based neurobiological phenotyping of patients with expansion repeats and brain disorders

4

UNIPR

- Computer-Aided Drug Design
- Illuminating dark gene targets
- Implementation of artificial intelligence algorithms in the sonographic assessment of fetal anatomy
- Multiomic Approach and Big Data Integration to Identify Predictive Signatures for the Response to Immunotherapy in Solid Tumors

# List of the Doctoral Positions and Universities involved Culture, Creativity and inclusive Society (9 total)

6

UNIBO

- Architecture: Critical Theory and Practice in the Age of AI
- Enhancing cultural heritage with generative AI and Big Data
- Normative Reasoning and Fairness in Explainable AI for an Inclusive Society
- Data Analytics and AI for supporting legislative assistance at WIPO: a neuro-symbolic approach
- Large Language Models for a personalised access to large cultural data
- Generative Artificial Intelligence and Creativity

1

UNIFE

- Exploring Lithic Tool Evolution: Big Data & Morphometrics in Prehistorical Archaeology

2

UNIMORE

- Training academic language skills in the age of AI
- Big Data Analysis and Practical Reasoning for Religious Conflict Resolution



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# List of the Doctoral Positions and Universities involved **Civil Security for Society (3 total)**

**1**

**UNIBO**

— Prevention and management of natural disasters through big data: EU law avenues

**1**

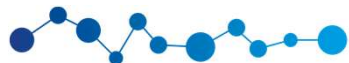
**UNIFE**

— Enhancing Risk Prevention in Society: Advanced Mathematical Methods and Computer Science Techniques

**1**

**UNIPR**

— Design of off-shore structure through Physically Based and Data-Driven Models



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# List of the Doctoral Positions and Universities involved

## Digital, Industry, Space (5 total)

1

UNIFE

— Data mining for space borne astrophysical and cosmological observations

2

UNIMORE

— Big Data Analysis for Industrial Diagnostic

— Deep learning for renal pathology prognosis prediction

1

UNIPR

— Spin Systems for Quantum Technologies

1

POLIMI

— Artificial Intelligence to support manufacturing

# List of the Doctoral Positions and Universities involved Climate, Energy, Mobility (9 total)

3

UNIBO

- Systems for the operation of power distribution networks in the presence of communities of electricity producers and consumers
- Combining Machine Learning and Computational Chemistry to explore the chemical space of functional materials
- Numerical downscaling at the local microscale for the evaluation of climate change adaptation and mitigation measures

2

UNIMORE

- Data Science for Sustainable Mobility
- Exploitation of big data for climate, energy and mobility

2

POLIMI

- Electric vehicles: Infrastructure system and charging strategies based on Renewable Energy Sources
- The role of digital data in interpreting complex urban phenomena and supporting mobility-related policies

1

UNIFE

- Satellite insights: Socio-economic data for Sustainable Development

1

UNIPR

- Beyond Deterministic Models for Sustainable Energy Management in Home, Industry and Transportation



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# List of the Doctoral Positions and Universities involved Food, Bioeconomy, Natural resources, Agriculture and Environment (10 total)

4

UNIBO

- Edge Artificial Intelligence for underwater habitats characterization
- Animal Biodiversity Big Data Integration
- Environmental effects on calcification and accumulation of pollutants in marine calcifiers
- Big data for Water-Food-Energy-Sustainable Agriculture Nexus

2

UNIPR

- Smart Analysis of Agricultural IoT Data
- Mapping consumers' trends and boosting sustainable food choices

2

UNICATT

- Agrisystem
- Agrisystem

1

UNIMORE

- Innovative organic farming through the management and conservation of soil microbiota

1

UNIFE

- Enhancing Dermatologic Interventions through Big Data-Driven Understanding of Placebo Effects



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# List of the Doctoral Positions and Universities involved Enabling Technologies (6 total)

3

UNIBO

- Mathematical Modelling for Medical Practice
- Computational Approaches in (Big) Data-driven Medical Modeling
- Big Data handling in Next-generation Particle and Astroparticle Physics Experiments

2

UNIFE

- Neuro-symbolic artificial intelligence for big data
- Methodologies and technologies of data science and data analytics

1

UNIMORE

- Data-driven modeling of brain circuits for advanced digital twins

## Sub Areas of Research to be developed during the project

*Develop mathematical models for studying neurodegenerative diseases, particularly Alzheimer's, using big data and a multidisciplinary approach.*

*Investigate integrating physical forward models and prior models to solve numerical problems in imaging sciences.*

*Study the convergence, stability, and generalization of learning algorithms in large structured datasets, focusing on neural networks and medical images.*

*Create energy-aware algorithms to reduce computational resources and provide real-time results in biological and epidemiology applications.*

*Combining Large-Language Model with probabilistic logic reasoning*

*Analyzing large knowledge graphs to learn interpretable and accurate models to perform completion and triple classification*

*Investigate applications of big data, machine learning, high-performance computing in fundamental physics and data collected by the LHC accelerator at CERN.*

*Develop AI-powered real-time processing workflows for or extracting insights from Big Data in particle and astroparticle physics experiments*

*Develop Data-driven models of brain circuits for advanced digital twins of single-cell resolved models of brain structures.*

## Contacts

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