Funded by the European Union

Marie Skłodowska-Curie Actions

Green Field Data

Exceptional
36-months Double Degree PhD Scholarship

PhD in Agriculture, Environment and Bioenergy from UniMI
and PhD in Computer Science from ULB

Position-D

Human-Centric Digital Twins for Monitoring Robotized Biostimulant Application Practices

EU Recruiting institutions	University of Milan, Dept. of Agricultural and Environmental Sciences - Production, Landscape, Agroenergy, Italy (18 Months), Supervisor: R. Oberti Université Libre de Bruxelles, Dept. of Computer and Decision Eng., Data Science and Engineering lab, Belgium (18 Months), Supervisor: D. Sacharidis
Keywords	Agri-robots, multi-modal sensing, explainable AI, Vision-Language-Action models

Exceptional benefits at a glance

- ***International PhD training excellence***
- ***Renowned supervisors & top-tier labs***
- ***Interdisciplinary & multi sectoral research***
- ***Competitive MSCA salary & allowances***
- ***Global academic & industrial network***
- ***Non-academic secondments***

Salary

	Living Allowance	Mobility Allowance*	Family Allowance**
Gross amount	**EUR 5325**	**EUR 710**	**EUR 660**

Long Term leave allowance (if applicable)

Special needs allowance (if applicable)

*private mobility-related costs (e.g. travel and accommodation costs), not their professional costs under the action

**doctoral candidate has or acquires family obligations during the action duration, i.e. persons linked to him/her by (i) marriage, or (ii) a relationship with equivalent status to a marriage recognised by the legislation of the country or region where this relationship was formalised; or (iii) dependent children who are actually being maintained by the researcher, the family allowance must be paid to him/her as well

GreenFieldData Project at a Glance

GreenFieldData: "IoRT Data management and analysis for Sustainable Agriculture" is a project funded under the action HORIZON Marie Sklodowska-Curie Action (MSCA) Joint Doctoral Network. **GreenFieldData** will train a new generation of researchers able to tackle digital and green transition challenges using a human-centric approach to ensure the robustness and relevance of the solutions responding to the specific needs of the EU market in a context of climate change and increasing socio-economic constraints. At a policy level, **GreenFieldData** outcomes will feed in directly to the aims of the HE Strategic Plan 2025-2027, EU Partnership Agriculture of Data and Digital EU Program. **GreenFieldData** proposes a high-level interdisciplinary, inter-sectoral and international (triple 'i') research project and training network on new IoRT (Internet of Robotic Things) based solutions for sustainable agriculture. **GreenFieldData** will mobilize 14 Doctoral Candidates (DCs) enrolled in Double Degree Doctorate programmes with 12 academic main beneficiary partners, across 7 EU countries. Moreover, 21 non-academic associated partners, and 3 academic associated partners will provide support to the DCs. The partners form a high quality network, where Academic partners have previous research collaborations as outlined in a common vision paper. The ambitious project will provide the DCs with a unique toolbox of cutting-edge knowledge, tools and strategies which will boost their employability and benefit the next generation operational workforce (researchers, Digital Technologies (DTs) and agricultural stakeholders). The project results will also benefit EU innovation as the human-centric IoT devices & robotics, and data-based solutions tailored to EU context will enable the agricultural sector to assess and mitigate the impacts of climate change, and define new sustainable low input practices, thus increasing resilience and competitiveness.

PhD Position D – Human-Centric Digital Twins for Monitoring Robotized Biostimulant Application

Context: Agriculture is undergoing a major transformation driven by robotics, sensing technologies, and artificial intelligence (AI). Modern farms are gradually adopting autonomous robots capable of precision monitoring and management tasks (planting, weeding, spraying etc), supported by IoT-enabled sensor networks that generate continuous streams of environmental and crop-related data. These developments enable the creation of digital representations of crops and their environments, that can simulate growth, predict problems, and guide targeted interventions for improved sustainability and productivity.

Among the promising innovations for sustainable crop management are biostimulants, i.e., natural substances or microorganisms that favour nutrient uptake, increase tolerance to stress conditions (nutrient deficiency, draught, soil salinity etc.), improve yield and quality traits of produce. However, their effective use is still under scrutiny depending on a complex interplay of factors such as crop development stage, management practices, plant stress intensity, etc. Integrating multimodal data (pedoclimatic and plant development time series, imagery, and other sensor information) is key to understanding and optimizing these dependencies.

Integrating robotic sensing with AI-driven modelling can substantially improve decision-making in biostimulant applications, optimizing treatment timing, dosage, and spatial distribution. This integration relies on high-quality, comprehensive data, the ability to perform near real-time analyses, and preserving human oversight and interpretability throughout the process. Vision-Language-Action (VLA) models which can seamlessly link a robot's sensory inputs to its actions through a textual interface, offer considerable potential in achieving these goals.

Nonetheless, while AI models can extract valuable insights from complex datasets, their internal reasoning often remains opaque to end-users. For AI-based systems to be trusted and effectively adopted by agronomists and farmers, they must be explainable, interactive, and human-centric, with end-users having the possibility to understand the rationale behind recommendations and of exploring "what-if" scenarios to support informed and transparent decision-making.

Objectives: This PhD aims to integrate multimodal advanced plant sensing, robotic monitoring and actuation, and augmented crop modelling within an explainable framework for monitoring and optimizing biostimulant application practices in vegetable crops, under real-world stress conditions. Case studies will focus on biostimulant treatments applied to a crop under varying levels of relevant abiotic stress factors,

such as drought, salinity, and nutrient deficiencies.

The research will combine greenhouse/field crop sensing, explainable AI, and simulation within a closed-loop system in which sensing, analysis, and action are seamlessly interconnected under human supervision. The specific objectives are as follows:

1. Refine and augment plant development models for the selected vegetable crops case study using advanced sensing techniques.
2. Develop and deploy a robust phenotyping system integrating 3D and hyperspectral image analysis with air and soil microclimate data for accurate crop monitoring, including automated detection and correction of problematic sensor data (e.g., noise, misalignment) using lightweight AI models suitable for robotic platforms.
3. Integrate the multi-sensor phenotyping system on robotic platforms for early detection of stress conditions and for characterization of plant responses to biostimulant treatments.
4. Quantify and model the effects of biostimulant applications and integrate these parameters into the crop development model.
5. Design explainable decision-support tools for plant treatment recommendations, ensuring human-in-the-loop control, transparency, and trust.

Work plan:

1. Review of the state of the art [months 0–6]
2. Development and integration of the multi-sensor phenotyping system on the UniMI robotic platform to collect multimodal data for improving crop development models under different abiotic stress levels and biostimulant treatments [months 6–18]
3. Construction of a simplified model for the selected vegetable crop to capture plant growth, forecast potential issues, and recommend optimized biostimulant treatment strategies based on the continuously updated robotic data [months 18–30]
4. Implementation of explainable AI methods to interpret and validate predictions and recommendations, ensuring transparency and user interaction [months 24–33]

Expected Results

1. Crop phenotyping metrics derived from robotic multimodal sensing for detecting abiotic stress conditions (drought, salinity, nutrient deficiencies) and assessing crop recovery levels under biostimulant treatments.
2. A reliable prototype AI-based system for the selected vegetable crop, modelling plant development and responses to biostimulant treatments (efficacy threshold, timing etc.).
3. Integration of explainability approaches providing interpretable and transparent recommendations for agronomists and farmers, ensuring human-in-the-loop control and trust.

References

[1] Kawaharazuka, K., Oh, J., Yamada, J., Posner, I., & Zhu, Y. (2025). Vision-language-action models for robotics: A review towards real-world applications. IEEE Access.

[2] Molnar, C. (2020). Interpretable Machine Learning. Lulu.com.

[3] Giannopoulos, G., & Sacharidis, D. (2025). Responsible AI. In Human-Centered AI: An Illustrated Scientific Quest (pp. 619-644). Cham: Springer Nature Switzerland.

[4] Kavouras, L., et al. (2024). GLANCE: Global Actions in a Nutshell for Counterfactual Explainability. AAAI 2025.

[5] Fiorani F., Schurr U. (2013). Future Scenarios for Plant Phenotyping. Annu. Rev. Plant Biol. 64:267–91

[6] Murphy K.M., Ludwig E., Gutierrez J., Gehan M.A. (2024). Deep Learning in Image-Based Plant Phenotyping. Annual Review of Plant Biology, 75 : 771 – 795

[7] Cooper J., Propst K., Hirsch C.D. (2025). Current methods and future needs for visible and non-visible detection of plant stress responses. Frontiers in Plant Science, 16: 585413

[8] Oberti R., Caffi T., Calcante A. (2025). Developments in precision crop protection systems. In: Precision agriculture for sustainability 2nd Ed (pp. 501-540). Burleigh Dodds Science Publishing

PRACTICAL INFORMATION

Recruiting and host institutions	• University of Milan, Dept. of Agricultural and Environmental Sciences - Production, Landscape, Agroenergy, Italy (18 Months) (Recruiting institution) • Université Libre de Bruxelles, Dept. of Computer and Decision Eng., Data Science and Engineering lab, Belgium (18 Months)
Doctoral schools	• AAB @ University of Milan, Italy • EPB @ Université Libre de Bruxelles, Belgium
Supervisors	• Pr. Roberto Oberti (University of Milan, Italy) • Pr. Dimitris Sacharidis (Université Libre de Bruxelles, Belgium)
Non-academic mentors	• D. Appert (Neusta, France) • M. Penco (Infosolution, Italy)
Secondments (1 to 6 hosting months)	• Neusta, D. Appert, up to 3 months, on scalable Big Data management architecture for IoRT models based on cloud and robotics expertise acquired through a parallel project to support prototype development • Infosolution, up to 4 months, on autonomous navigation system with the aim of simplifying the interaction between farmers (or non-expert users) and agri-robots for programming field missions
Contact information	• Roberto.Oberti@unimi.it • Dimitris.Sacharidis@ulb.be

RECRUITMENT CRITERIA

General criteria

- MSCA Mobility Rule: Candidates must not have resided or carried out their main activity (work, studies, etc.) in **Italy** for more than 12 months in the 36 months immediately before their date of recruitment.
- All researchers recruited must be doctoral candidates (i.e., not already in possession of a doctoral degree at the date of the recruitment).
- An applicant must have received the equivalent of 300 ECTS with a major in computer science, from which at least 120 ECTS corresponds to a master degree. The master degree must be granted by a university recognized by the International Association of Universities.
- Scientific excellence to fit the PhD project.
- Fluent (oral and written) English skills as the project operates in English language.
- Knowledge of the language of the host countries may be considered a merit.
- Team-mindedness.

Required skills

- Proficiency in Python
- Strong background in machine learning, including multimodal data analysis.
- Familiarity with explainable AI concepts.
- Ability to work effectively across disciplines and within interdisciplinary research groups.
- Ability to work collaboratively in an international, multidisciplinary team.
- Prior experience with sensing or robotic systems, or strong motivation to learn about agricultural robotics and plant sensing platforms.
- Interest in agricultural sustainability or crop production systems (domain-specific knowledge can be developed during the PhD, but curiosity and motivation are essential).

APPLICATION

How to apply?

- **All information is provided here.**

Deadline: **15th April 2026**

Other information

Université Libre de Bruxelles (ULB)

Université Libre de Bruxelles (ULB) is a major public research university in Brussels with a broad international profile and multidisciplinary teaching and research across science, engineering, social sciences and humanities. ULB runs numerous Master and PhD programs in computer science, engineering and data science and hosts many research partnerships with national and European research networks. ULB participates in this project with the *Data Science & Engineering Lab*, which consists of three professors (e.g., E. Zimanyi, D. Sacharidis, M. Sakr) and several researchers working on data management, data engineering, and machine learning within the CoDE umbrella and the Brussels School of Engineering. The teams work on both theoretical and applied problems, related to databases, spatio-temporal data, and responsible AI.

Brussels is an excellent place to live and work

A cosmopolitan capital: Brussels is an international hub for science, technology, arts, and policymaking, hosting the EU institutions, major research organizations, and global companies.

Safe, multicultural, and well connected: The city offers high-quality healthcare, efficient public transport, and easy access to the rest of Europe.

English-friendly environment: Although French is the main local language, English is widely spoken in academia, industry, and daily life.

Top reasons to work at ULB

Research Facilities and Innovation Networks: ULB provides access to extensive research facilities and innovation networks that support high-level work in AI, data engineering, and related fields. Researchers benefit from computing resources, specialized laboratories for AI and data-intensive experimentation, and participation in regional access-to-labs initiatives that connect academic and industry partners. ULB is also a founding member of FARI – AI for the Common Good Institute, a Brussels-based interdisciplinary centre that brings together ULB and VUB experts in artificial intelligence, data governance, and digital policy. Through FARI, ULB researchers gain access to shared infrastructures, applied research programmes, and collaboration pathways with public institutions, companies, and societal stakeholders across Brussels and Europe.

ULB supervisors are active researchers: ULB's academic staff are active researchers who drive cutting-edge work across computer science, data engineering, and AI. Their research expertise directly shapes the university's programmes, ensuring that students engage with the latest scientific developments and methodologies. Teaching is grounded in rigorous quality assurance processes and is closely integrated with research laboratories, creating a strong link between advanced research activity and graduate training.

Attractive working conditions and research support: ULB offers: Structured doctoral training through its doctoral schools. Support for grant applications, EU projects, technology transfer, and industry collaboration. Access to state-of-the-art computing resources, specialized labs, and innovation infrastructures (e.g., Sustain.brussels and access-to-labs networks). Career development workshops, mobility grants, and international exchange opportunities

Participation in major European networks: ULB is a core partner in initiatives such as DEDS (Data Engineering for Data Science) and coordinates the DEAI Erasmus Mundus Joint Master, reflecting a strong focus on responsible AI, data engineering, and end-to-end data lifecycle research and training.

Balanced academic life in a vibrant city: Researchers benefit from flexible working conditions and access to high-quality public services. Brussels's cultural and social life offers rich opportunities outside the lab, combined with excellent transport links and a strong international community

University of Milan (UniMI - Università degli Studi di Milano)

The University of Milan is a major public institution with more than 60,000 enrolled students. Renowned internationally for excellence in research, teaching, and cultural engagement, it combines creativity, innovation, and a strong global outlook. Located in the heart of one of Europe's most dynamic cities, the University is deeply integrated into Milan's academic, scientific, innovation, and cultural ecosystems.

Milan itself is a vibrant international hub, recognised for its culture, creativity, design, and innovation. It offers an ideal environment for international students: multicultural, well connected, and rich in opportunities for internships and collaborative projects with an extensive network of industries and institutions.

With over 130 Bachelor's and Master's degree programmes and 34 PhD programmes, the University of Milan provides an exceptionally broad and interdisciplinary academic offering. Students benefit from programmes designed to address the challenges of a rapidly evolving world, supported by an international environment, global networks, and a thriving cultural scene that makes Milan an inspiring place for study and personal growth.

As the only Italian member of the League of European Research Universities (LERU), the University consistently ranks highly in major international rankings and attracts substantial competitive funding, including numerous European Research Council (ERC) grants, recognising the quality and impact of its multidisciplinary research.

PhD candidates benefit from an active, multidisciplinary research environment, access to state-of-the-art laboratories and research infrastructures, participation in European and international networks, interdisciplinary doctoral schools, and extensive mobility opportunities.

The University welcomes a diverse global community and offers dedicated services and programmes for international students, alongside cultural and social initiatives, inclusion projects, sports activities, and high-quality artistic events throughout the year.

The University of Milan is also a member of the 4EU+ Alliance, a consortium of six leading European research-intensive universities—Paris-Sorbonne, Charles University in Prague, the University of Copenhagen, Heidelberg University, and the University of Warsaw—committed to developing an integrated European higher-education system through mobility, joint programmes, and shared research infrastructures.