Funded by the European Union

Marie Skłodowska-Curie Actions

Green Field Data

Exceptional
36-months Double Degree PhD Scholarship

Phd in Computer Science

Position-A

Optimized IoRT network for enhanced data quality supporting precision farming

EU Recruiting institutions	Aarhus University, Electrical and Computer Engineering (ECE), Aarhus, Denmark (18 Months), Supervisor: Clause Aage Grøn Sørensen University Clermont Auvergne, Clermont-Ferrand, France (18 Months), Supervisor: Gerard Chalhoub
Keywords	Data Science, ML & AI, Digital Agriculture, Remote Sensing (IoT and IoRT), Data quality, IoRT Network performance, Hybrid communication system

Exceptional benefits at a glance

- ***International PhD training excellence (here)***
- ***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 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 A
Optimized IoRT network for enhanced data quality of IoRT cereals production practices

Context: Wireless communication systems are being used in many application fields. They offer a flexible solution for maintaining connectivity between connected devices. The focus of this PhD thesis is the use of wireless communications in the application of agricultural mobile robots in Precision Farming [1,2]. In such applications, robots need to be supervised during their missions on the field, and in some situations, they also need to be remotely controlled by a human operator. These robots continuously collect data and send it to a human operator who ensures that robots execute the right tasks with the collected data [3]. The decisions made by the operator depend on the quality of data collected by the robots and from all the other available sensors deployed on the field. In this regard, the communication system needs to provide the best quality of communication to make sure that all the required data are received with the needed quality. For example, the requested definition of the collected images should answer the needs of the operator to decide the exact action to take [4]. Even though there has been a lot of progress in telecommunication systems in the past 10 years, wireless communications are still prone to performance degradation depending on the current network conditions. For example, the presence of obstacles or high levels of interference might render the communication link unstable, which has a severe impact on the quality of experience of the operator [5]. Indeed, requiring high-level quality of data during the interval of performance degradation will make the system unresponsive and will further degrade the performance [6].

Objectives: In this PhD, we will tackle the issue of real-time monitoring of the state of the network to explain the quality of data the operator receives. Data quality could be explained by differentiating between low and high-quality images on resolution, compression artifacts, or other factors. Once the monitoring system is in place, we will work on prediction algorithms, based on machine learning, that allow the system to anticipate performance degradation and inform the operator in real-time to make adjustments to acquire the right quality of data that the communication system can provide. We will also explore the use of hybrid communication systems, a solution known for enhancing the robustness of communications, to ensure minimum quality of communication at all times. For hybrid systems (e.g., cellular and Wi-Fi), the switching mechanism from one system to another will be implemented based on real-time monitoring. All the mentioned objectives can be listed as follow:

1. Provide precision agriculture methods for irrigation and robotized wedding (spraying and

mechanical) operations of cereals production (Task 4.2)
2. Allow real-time monitoring of the state of the network (Task 1.1)
3. Predict the quality of the network with ML (Task 1.2)
4. Provide feedback to the operator about the quality of data in order to make adjustments to current communication system capacity (Task 3.1).

These objectives will be achieved using the following work planning to grant their feasibility.

Work plan:

1. State of art study [Duration: months 0-6]
2. Develop and blue-print of a system to monitor network quality in real-time and anticipate performance degradation. [Duration: months 6-12]
3. Calibration and Validation of the developed model by simulation and real-time monitoring of the state of the network using a dedicated robot. [Duration: months 12-15]
4. Develop a prediction model to anticipate the quality of the network based on Machine learning techniques. [Duration: months 14-20]
5. Calibration and Validation of the prediction model by simulation. [Duration: months 20-23]
6. Develop novel methods for identifying data that can be summarized, without quality loss, and transmit only summaries to the next level of the architecture. [Duration: months 22-28]
7. Develop a user-friendly and interactive user interface dedicated to farmers to interact with the monitoring system. [Duration: months 27-33]

Expected Results

1. A system to monitor network quality in real-time and anticipate performance degradation,
2. Use hybrid communication systems (e.g. cellular and Wi-Fi) to ensure a minimum level of service.
3. Develop novel methods for identifying data that can be summarized, without quality loss, and transmit only summaries to the next level of the architecture.
4. Develop a user-friendly and interactive user interface dedicated to farmers to interact with the monitoring system.
5. Improve usage of resources for cereals fields.

References

[1] Moysiadis, V.; Tsolakis, N.; Katikaridis, D.; Sørensen, C.G.; Pearson, S.; Bochtis, D. Mobile Robotics in Agricultural Operations: A Narrative Review on Planning Aspects. *Appl. Sci.***2020**, *10*, 3453. https://doi.org/10.3390/app10103453

[2] Tomaszewski, L., Kołakowski, R. and Zagórda, M., 2022, June. Application of mobile networks (5G and beyond) in precision agriculture. In *IFIP International Conference on Artificial Intelligence Applications and Innovations* (pp. 71-86). Cham: Springer International Publishing.

[3] R. A. Saeed, G. Tomasi, G. Govindarajan, R. Vidoni and K. D. Von Ellenrieder, "Metrology-aware Path Planning for Agricultural Mobile Robots in Dynamic Environments," *2021 IEEE International Workshop on Metrology for Agriculture and Forestry (MetroAgriFor)*, Trento-Bolzano, Italy, 2021, pp. 448-453, doi: 10.1109/MetroAgriFor52389.2021.9628737.

[4] Barbosa, Gustavo & Silva, Eduardo & Leite, Antonio. (2021). Robust Image-based Visual Servoing for Autonomous Row Crop Following with Wheeled Mobile Robots. 1047-1053. 10.1109/CASE49439.2021.9551667.

[5] Alzate-Mejía, Néstor & Boada, Germán & Amazonas, José. (2022). Verification of performance degradation in a telecommunications system due to the uncertainty of human users in the loop. Cogent Engineering. 9. 10.1080/23311916.2022.2062878.

[6] Ibrahim Sammour, Gerard Chalhoub, Application-Level Data Rate Adaptation in Wi-Fi Networks Using Deep Reinforcement Learning, IEEE VTC, September 2022

PRACTICAL INFORMATION

Recruiting and host institutions	• Aarhus University, Electrical and Computer Engineering (ECE), Aarhus, Denmark (18 Months) (Recruiting institution) • University Clermont Auvergne, Clermont-Ferrand, France (18 Months)
Doctoral schools	• GSTS @ Aarhus University, Aarhus, Denmark • SPI @ University Clermont Auvergne, Clermont-Ferrand, France
Supervisors	• Pr. Claus Aage Grøn Sorensen (Aarhus University, Aarhus, Denmark) • Pr. Gerard Chalhoub (University Clermont Auvergne, France)
Non-academic mentors	• Pr. Lazaros Nalpantidis (DTU University, Denmark) • Laurent GINESTE (The Creative hive, France)
Secondments (1 to 6 hosting months)	• DTU University, Denmark, month 12-15, Testing/validation robotics connectivity. Design and perform connectivity testing/simulation building on previous DTU experiences with robotics and communication. • The Creative hive, France, months 18-20, experiments and evaluation of hybrid communication systems: Select testing methodology and design testing scenarios, conduct testing and record performance for further development in the project.
Contact information	• claus.soerensen@ece.au.dk • gerard.chalhoub@uca.fr

RECRUITMENT CRITERIA

General criteria

- MSCA Mobility Rule: Candidates must not have resided or carried out their main activity (work, studies, etc.) in **Denmark** 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 (English language requirement is comparable to a minimum of TOEFL 83 or IELTS 6.5)
- Knowledge of the language of the host countries may be considered a merit
- Team-mindedness

Required skills

- Advanced software development and programming skills
- Advanced telecom and wireless networking skills
- Advanced data analysis skills
- Familiarity with agricultural domain
- Interdisciplinary work

APPLICATION

How to apply?

- **All information are provided here**

Deadline: **15th April 2026**

Other information

Aarhus University

Aarhus University is a dynamic, modern and highly international university. Since its founding in 1928, it has grown to become a leading public university with international impact and reach across the entire research spectrum. Aarhus is a great place to study and a great place to work. Here are some of the top reasons to come work or study with us.

We are a Top 100 University: AU is consistently ranked as one of the world's top universities. It was ranked number 85 in the latest Shanghai ranking and is among the world's 100 best universities in 17 out of 48 subjects in the latest QS World University Rankings by Subject.

Denmark is a great place to live.

Safe, secure and equal: Denmark is widely cited as one of the world's most liveable places for a variety of reasons. It has the world's highest level of income equality, according to the OECD. Furthermore, Denmark is widely cited as one of the world's most liveable places. And based on the Corruption Transparency Index, Denmark is the least corrupt country in the world. Levels of public trust are high and crime is low.

We're always here for you: AU offers all the practical support and guidance you need to feel at home here. For students, the International Centre offers a full induction and introduction programme as well as professional, friendly support and guidance throughout your time at AU.

For researchers and PhD students, Aarhus University offers a full range of services to make your transition to the university as smooth as possible. IAS (International Academic Staff) assists researchers and PhD students from abroad with all practical matters, including visa, residence and work permits, housing services, child care, etc.

Top reasons to study in Aarhus

Our teachers are world-class lecturers: At AU, classes are taught by active researchers in an informal, stimulating atmosphere. All degree programmes are deeply rooted in the latest research and are subject to a rigorous quality assurance programme to ensure they meet the highest global quality standards.

English is our second language: AU offers more than 50 full degree programmes in English at Bachelor's and Master's level. All PhD programmes are in English. And Danes were recently ranked as among the best non-native English speakers in the world on the on the annual English Proficiency Index (EPI), so it's easy for international students to feel at home in Denmark from day 1.

Our student body is diverse and highly international: Around 12 per cent of AU's 36,000 students are internationals – from over 120 countries.

Denmark offers an attractive green card scheme: The green card residence permit granted to international university students in Denmark is valid for an additional six months after completion of the degree, which gives graduates time to look for work in Denmark.

Top reasons to work at AU

We have state-of-the-art research facilities: Aarhus University offers world-class research facilities and laboratories in a wide range of subjects. We have a strong tradition of multidisciplinary research for instance in one of our 42 major research centres.

We offer attractive working conditions: When asked about what they appreciate most about AU, our international staff at AU emphasise favourable working conditions as an important motivation for working at Aarhus University. These include an attractive salary, a generous pension scheme and parental leave benefits. What's more, international academic staff members are eligible for tax breaks in many cases.

We are world champions in work-life balance: Danish workplace culture stresses the importance of work-life balance, and AU is no exception. Researchers enjoy flexible working conditions and a high level of autonomy and self-determination. What's more, the municipality offers a range of high-quality social services that enhance the quality of life for internationals, including free healthcare and subsidised childcare and international schools.

Université Clermont Auvergne (UCA)

Université Clermont Auvergne (UCA) is a public, multidisciplinary research university based in Clermont-Ferrand, France, created in 2017 through the merger of Blaise Pascal University and the University of Auvergne. UCA enrolls around ~30–39k students (including several hundred PhD candidates) and employs over 3,200 staff with more than 1,200 researchers and faculty members; it organizes teaching and research across some 20+ faculties, schools and institutes and 4–5 doctoral schools.

Research structure & major laboratories

- UCA hosts a network of research units and laboratories across many disciplines (fundamental sciences, engineering, life & health sciences, social sciences, management, earth sciences, etc.). Many of these are joint units with national institutes such as CNRS, INRAE, INSERM and others.
- Representative research units and labs (examples): LIMOS (informatics, modelling & optimization), iGReD (genetics & development), ICCF (chemistry), LPCA (physics), LMV / ClerVolc (geosciences/volcanology) and multiple joint units cited in research indexes. UCA's presence is also visible in international research listings (Nature Index).
- UCA coordinates and participates in LabEx / thematic initiatives (e.g., IMobS3 related to sustainable mobility), and hosts joint laboratories with industry and CNRS (for example the recently announced BioDLab in partnership with Michelin and CNRS). These federated structures strengthen multidisciplinary, industry-linked research.

Education & Doctoral training

- UCA offers a broad portfolio: bachelor's, professional degrees, master's, engineering and health programs (over 150 programmes listed), plus 5 doctoral schools supporting ~600–900 doctoral students in different scientific domains. International exchange and English-taught course lists are available for mobility students.

Key support services & innovation ecosystem

- Research support & mobility: UCA takes part in regional EURAXESS services (CSEA) that assist incoming international researchers with administrative and mobility needs.
- Technology transfer & valorisation: Dedicated structures such as UCA Accélérateur, UCA Partner and Clermont Auvergne Innovation support startup creation, industry partnerships and the exploitation of research.
- Student services: Campus life services (housing, scholarships, catering, social assistance) are supported by CROUS and university student services; UCA also provides health, counseling and career services.

Facilities, partnerships & regional role

- UCA is a regional anchor in Auvergne-Rhône-Alpes, collaborating with national research organisations and local industry (e.g., Michelin) and operating multi-site research units. LabEx and federation projects (ClerVolc, IMobS3) emphasize cross-institutional, multidisciplinary research with regional impact.

Practical info / contact (campus)

UCA's main administrative address and a summary of programmes, courses and admission information can be found on the university site and institutional profile documents (www.uca.fr). For prospective students and partners, the English pages list courses taught in English and contact points for international mobility.