PhD Project Advertisement

Project No/title: FBS2026 52 Moraru Ia / *Multi-Modal Computer Vision for Automated Insect Species Identification in Agricultural Monitoring Systems*

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Co-supervisors:

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Project Details

Agricultural pests cause over $220 billion in global crop losses annually, making early detection vital for food security. Current monitoring relies heavily on slow manual inspections or automated cameras that frequently struggle to identify small insects or distinguish between similar-looking species.

This PhD project aims to revolutionize pest insect surveys for biodiversity and integrated pest monitoring/management by developing an advanced automated system that combines high-resolution, multi-angle imaging with Artificial Intelligence. Unlike standard solutions, this research focuses on a "human-in-the-loop" approach: the AI will automatically identify distinct pests while intelligently flagging uncertain or complex cases for expert verification. By merging novel computer vision hardware with smart collaboration between AI and human experts, this project seeks to achieve over 95% identification accuracy, delivering a scalable and reliable tool to protect global agriculture.

Research aims: To investigate how multi-modal imaging can be integrated for robust insect identification. To determine if uncertainty-aware AI can intelligently cluster ambiguous specimens and seeks to optimize human-AI collaboration strategies, maximizing identification accuracy while minimizing expert verification workload in agricultural settings.

What you will do: The student will undertake an interdisciplinary research programme combining hardware engineering, computer vision, and field science:

- System Development: Designing and integrating multi-modal imaging hardware (active cameras) capable of focus stacking and super-resolution to capture high-fidelity insect data.
- AI Modelling: Developing deep learning architectures (e.g., YOLO, InsectNet) with a specific focus on uncertainty quantification and clustering algorithms to group morphologically similar species.
- Workflow Optimization: Creating "human-in-the-loop" interfaces that allow the AI to intelligently flag uncertain specimens for expert verification, maximizing efficiency.
- Field Validation: Help deploy prototypes in real-world agricultural settings with industry partners to benchmark performance against traditional monitoring methods.




References:

1. Bjerge, K., Mann, H. M., & Høye, T. T. (2022). Real-time insect tracking and monitoring with computer vision and deep learning. Remote Sensing in Ecology and Conservation, 8(3), 315-327.
2. Yu, K., Xu, W., Zhang, C., Dai, Z., Ding, J., Yue, Y., ... & Wu, Y. (2023). ITFNet-API: Image and Text Based Multi-Scale Cross-Modal Feature Fusion Network for Agricultural Pest Identification.

Student profile

Essential for project: A background in data science or AI.
Desirable for project: A background in entomology, pest science would be beneficial. Interest in engineering and conservation could help.
All FoodBioSystems applicants: An upper 2nd class degree (or equivalent) in a subject relevant to the project. Candidates with a lower class of Bachelors degree, but merit or above at Masters level will also be considered**.** Demonstrable skills in problem-solving, team-working, communication and time management.

Training

Project specific training opportunities: The student will gain a comprehensive interdisciplinary skill set spanning computer science and conservation. Technical training in machine vision, planning theory, and human-in-the-loop AI will be offered at the University of Lincoln, supported by attendance at a specialist summer school (e.g., BMVA). Entomological training, including species identification and sampling, will be provided by the Allerton Project. Crucially, the student will benefit from time working at the Allerton Project. Working alongside a dedicated agri-environmental research team, they will receive 'on-the-job' training in experimental field design, trap positioning, safety protocols, and high-quality data collection. This combination of academic rigour and practical field experience ensures the student is fully equipped to deliver real-world automated monitoring solutions.

FoodBioSystems training opportunities: Throughout their studentship, all FoodBioSystems doctoral researchers participate in cohort training that covers four key themes: food systems, big data (data analytics and modelling), business, and research fundamentals. All doctoral researchers complete a placement: either project-related with a non-academic (CASE) partner, or unrelated to the project and outside the academic environment (PIPS). Details of training are available on the DTP website: https://research.reading.ac.uk/foodbiosystems/training/.

Project supervision style

The student will meet with lead supervisor Dr Moraru 1:1 weekly to monitor progress and provide support. Once a month the wider supervision team will meet (Dr Moraru, Dr Coutts, Dr Santer and Dr Asiri or Dr Bussell from the Allerton trust), to provide a wider range of perspectives and expertise. At different times through the project supervision from the wider team will be more intensive. When the student is placed at Game & Wildlife Conservation Trust's Allerton Farm research and demonstration site (approx 1 month) Dr Asiri will provide weekly supervision and be on hand day to day, to help the student develop the entomology and field sampling skills they need.

Stipend (Salary)

FoodBioSystems DTP students receive an annual tax-free stipend (salary) that is paid in instalments throughout the year. For 2025/26 this is £20,780 and it will increase slightly each year at rate set by UKRI.

Equity Diversity and Inclusion

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher (DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- Guaranteed interview and applicant mentoring schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups who also meet academic eligibility criteria and the student profile essential for the project.

These are opt-in processes**.**
Our studentships can be offered to home students on a part-time basis, and studentship end date and stipend payments will be amended to reflect the part-time registration. The minimum registration for DTP funded part-time students is 0.5 FTE (studying an average of 20 hours per week over 8 years). We regret that part time registration is not available to international students due to complexities of visa restrictions.

Funding note

We welcome applications from candidates with Home/ROI fees and international fees status. This studentship is funded by UKRI and covers stipend, fees at Home/ROI rate, and research costs. The host university will not charge UKRI funded international students the difference between Home/ROI fees and international fees.
Costs that must be found from other sources or met by the individual student include: visa fees, healthcare surcharge, relocation costs and guarantor services.
For up to date information on funding eligibility, studentship rates and part-time registration, please visit the FoodBioSystems website.