

PhD Project Advertisement

Project title: *AI Powered Multi-modal Approaches for Animal Behaviour Analysis and Welfare Monitoring using Unannotated Data*

Project No: FBS25-35-Dutta-sq

Lead supervisor: Dr Anjan Dutta, Surrey Institute for People-centred AI / School of Veterinary Medicine, University of Surrey

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Co-supervisors:

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Project description: As the global population grows, so does the demand for affordable, high-quality meat, while consumers increasingly emphasise animal welfare. Meeting this demand requires optimal animal care, which is labour-intensive and prone to human error when reliant solely on manual observation. Artificial Intelligence (AI) offers a transformative solution by automating the monitoring of livestock health and behaviour. Using tools such as computer vision and machine learning, AI can identify health issues, generate insights for better management, and support sustainable and ethical meat production.

Currently, many machine learning models for animal behaviour are restricted to specific species and tasks, such as identifying behaviours like tail and ear biting in pigs. These models depend on large, annotated datasets, which are scarce and expensive to create in farm settings. Although unannotated data, such as videos, accelerometer, and microphone recordings, is available for cattle and other farm animals, it remains underutilised due to the lack of labels and annotations. This project aims to address these challenges by utilising advanced AI tools, including large language models (LLMs) and vision-language models (VLMs). These multi-modal foundation models, trained on billions of texts and text-image pairs, demonstrate strong generalisation to unseen data, enabling behaviour and health pattern predictions without requiring time-intensive data labelling. By incorporating contextual learning, where environmental factors are considered, this approach offers new opportunities for scalable and cost-effective behaviour monitoring in farm animals.

The student will work on four interconnected objectives during their studentship. They will first explore the integration of multiple sensors, such as video and accelerometers, to enhance behaviour recognition using unlabelled data. Building on this, they will develop a cost-effective, camera-only model to predict behaviours such as feeding and resting, making advanced monitoring accessible to farms with limited resources. The third objective involves creating a linguistic projection system to translate observed behaviours into “action sentences,” enabling LLMs to interpret and analyse complex actions. Finally, the student will develop an actor-agnostic model capable of recognising both known and unknown behaviours across diverse species, facilitating real-time monitoring.

By combining AI innovation with practical applications, this project aims to revolutionise animal health monitoring, making it more efficient, accessible, and ethical. The work has the potential to support sustainable farming practices and address the growing demand for ethically sourced, high-quality meat.

Training opportunities: The student will benefit from their supervisors' association with three key initiatives: the Institute for Global Food Security (IGFS) at Queen's University Belfast, and the Institute for People-Centred AI (PAI) and Veterinary Health and Innovation Engine (VHIVE) at the University of Surrey. These initiatives drive advancements in digital and data analytics tools to enhance animal welfare, providing the student with access to cutting-edge developments. The student will undertake a three-month placement at Queen's University Belfast, based at IGFS, with access to state-of-the-art animal health and welfare research facilities. Depending on their background, they may attend MSc modules in Data Analytics or AI. These placements offer opportunities to explore advanced AI approaches under

expert guidance. The student will also attend summer schools and conferences in artificial intelligence, animal health, or biosciences, depending on their background. Additionally, they will benefit from university workshops and webinars to improve writing and presentation skills.

Project supervision style: We offer a structured supervision plan that includes the following activities:

1. **Lead Supervisor Meetings:** Weekly one-to-one meetings with the lead supervisor to discuss progress, address challenges, and refine research objectives. Feedback on drafts will be provided accordingly.
2. **Supervisory Team Meetings:** Monthly meetings with the full supervisory team to review progress, align research with project goals, and integrate interdisciplinary perspectives. These meetings will mostly be in virtual formats.
3. **Lab Group Meetings:** Participation in fortnightly lab group meetings at PAI to foster peer learning, share updates, and gain exposure to related research.
4. **Placement Meetings:** During the 3 to 4 months placement at QUB, weekly check-ins with QUB supervisors will ensure focused guidance on animal health and welfare.
5. **Six-month Reviews:** Formal reviews at the end of every six months to assess progress, set milestones, and outline next steps.

Student profile: The project requires essential skills in programming and a strong foundation in mathematics, particularly in areas such as linear algebra, statistics, and probability. Prior knowledge of machine learning or artificial intelligence concepts, as well as experience with coding in Python or similar programming languages, would be highly beneficial for candidates. An interest in working on multi-disciplinary projects and a passion for animal welfare are important for engaging fully with the project's objectives.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2024/25 this is £19,237 (£21,237 at Brunel University) 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.

These are opt-in processes.

Our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the [FoodBioSystems website](#).