Vision-based artificial intelligence and social network analysis for early prediction of disease from cattle behaviours and interactions

Supervisory team:
Lead supervisors: Prof Andrew Dowsey (University of Bristol), Dr Mark Hansen (University of the West of England; UWE)
Dr Suzanne Held (University of Bristol), Prof Melvyn Smith (University of the West of England; UWE)

Collaborators: Mr Duncan Forbes (Agri-EPI Centre)

Host institution: University of Bristol, University of the West of England; UWE
Submit applications for this project to the University of Bristol

Project description:

Social network data now gives us unprecedented means to research human and animal behaviour, and recently has shown much value in the early prediction of mental health disorders and degenerative disease. Human behaviour in the general environment is extremely complex, so there is much potential in investigating more structured animal environments where we have found evidence that social activity subtly changes even under mild (subclinical) infection (https://doi.org/10.3168/jds.2020-20047).

This PhD project is aimed at developing vision-based artificial intelligence(AI) techniques to build dynamic social networks to understand changes in social dynamics associated with early and chronic subclinical disease in cows. Through a long-term study of the complete 185-head herd at our John Oldacre Centre for Sustainability and Welfare in Dairy Production, network constructs associated with changes in animal health would provide key information on aspects of animal welfare, health, and sustainable production, and could eventually be translated back to monitor structured environments in the human domain (e.g. schools, care homes).

This studentship will combine and extend our AI methods and the underlying behavioural science to develop a system that identifies and tracks the movements of individuals, and then detects and classifies social interactions and their initiator. It builds on previous work in our labs, where we have developed new AI methodology that can individually identify and track Holstein-Friesian cows with high accuracy (https://arxiv.org/abs/2006.09205), as well as demonstrating that facial recognition in livestock is achievable (https://doi.org/10.1016/j.compind.2018.02.016), thus potentially unlocking the ability to automatically detect grooming and/or the aggressive nature of social interactions.

The PhD would suit either a computational student interested in social networks and behaviour, or someone with biosciences expertise who wishes to build up artificial intelligence skills – in either case a tailored training package will be developed to suit. The student will learn the key facets of health-relevant behaviour assessment and use this and cutting edge AI and social network analysis to build and apply the system across the studentship timeline. The student will be based 50%/50% at two leading, geographically close institutes – Bristol Robotics Laboratory at the University of West of England with Dr Mark Hansen and Professor Melvyn Smith, and Bristol Veterinary School & Visual Information Laboratory at the University of Bristol, with data scientist Professor Andrew Dowsey, behavioural scientist Dr Suzanne Held, computer vision expert Dr Tilo Burghardt and Animal Welfare and Behaviour Group Lead Professor Mike Mendl.

*Please note: This project in collaboration with the University of Bristol and the University of the West of England (UWE) is subject to a **joint degree award**. Successful applicants will be registered at both these institutions, and graduates will be awarded a joint degree from these two institutions upon successful completion of the PhD programme.*