Multi-camera machine vision of a whole cattle herd for assessing the impact of interventions for environmental sustainability

Supervisory team:
Main supervisor: Prof Andrew Dowsey (University of Bristol)
Second supervisor: Dr Daniel Enriquez-Hidalgo (University of Bristol)
Non-academic (CASE) supervisor: Dr Taro Takahashi (Agri-Food and Biosciences Institute)
Dr Suzanne Held (University of Bristol), Dr John Fennell (University of Bristol), Dr Laszlo Talas (University of Bristol)

Collaborators: Prof Siobhan Mullan (University College Dublin)

Host institution: University of Bristol
CASE partner: Agri-Food and Biosciences Institute (AFBI)

Project description:
While dairy farming is receiving increasingly strong competition from plant-based alternatives, it remains an important agricultural option where grass is the most viable crop, such as in substantial areas of the UK as well as a large slice of world landmass. A significant proportion of the global population, particularly in lower/middle income countries, will remain reliant on dairy production for economic and nutritional health. It is therefore essential to achieve sustainable dairy farming both resilient to climate change and to mitigate its high carbon footprint. Artificial intelligence and machine vision can play a major part in realising this goal. The hypothesis we will investigate is that optimising cattle breeding for reduced emissions and/or increased resilience to heat stress will not reduce health or welfare of the animals, whilst having a significant positive impact on environmental sustainability. We have established the John Oldacre Centre for Welfare and Sustainability in Dairy - the world's most intensively monitored longitudinal cattle cohort, underpinned by our world-leading Animal Welfare & Behaviour research community to ensure that high welfare is built upon rather than sacrificed by sustainability [https://doi.org/10.1080/14735903.2021.1957348]. To generate the evidence for our hypothesis, the aim is to harness our multi-camera platform with new machine vision classifiers for tracking the activities and behaviours of our cattle herd 24/7 in order to predict individual-animal sustainability within a life-cycle assessment (LCA) model. This system will be underpinned by our deep learning methods to identify and track individual cows that we have developed [https://doi.org/10.1016/j.compag.2021.106133], together with novel AI methods developed in this studentship to track animals across multiple cameras as well as estimate energy expenditure and welfare-relevant behaviours.

The studentship would suit a computational student interested in environmental sustainability and life-cycle assessment, or someone with those skills who wishes to build up their expertise in AI – in either case a tailored training package will be developed to suit. The student will be based in the data science and animal biometrics groups of Professor Andrew Dowsey, Dr John Fennell and Dr Laszlo Talas located in central Bristol and Bristol Veterinary School (BVS), and with agricultural economist Dr Taro Takahashi at the Agri-Food and Biosciences Institute, Northern Ireland (CASE partner). The student will translate their work at both BVS and AFBI through life-cycle assessment with Dr Takahashi and sustainability expert Dr Daniel Enriquez-Hidalgo, animal bio-scientist Dr Suzanne Held, and Professor of Animal Welfare Siobhan Mullan (University College Dublin).

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.