Harnessing 3D cameras and deep learning for on-the-fly automated body condition and mobility analysis to improve cattle welfare

Supervisory team:
Lead supervisors: Prof Andrew Dowsey (University of Bristol), Prof Melvyn Smith (University of the West of England; UWE)
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Collaborators: Mr Duncan Forbes (Head of Dairy, Agri-EPI Centre)

Host institutions: University of Bristol, University of the West of England (UWE)
Submit applications for this project to the University of Bristol

Project description:

A growing world population and climate change are stressing food availability. High animal welfare and health practices are more important than ever to satisfy societal demands for the livestock sector. The use of precision monitoring instrumentation for dairy cattle is key to optimising production while maintaining animal health. In this PhD project, 3D video technology with the latest Intel cameras will be used to unobtrusively provide stress-free monitoring of incremental changes in individual cow mobility and body condition with the aim of understanding behavioural cues preceding observed lameness to improve cow health, welfare and productivity and hence increase the climate and environmental sustainability of milk production. These traits are currently measured by manual visual assessment, requiring high skill levels and training, but are nevertheless open to the subjectivity of individuals and rarely capture the longitudinally detail needed for novel behaviour research. This will realise a system that can be transplanted into farms without extensive instrumentation, allowing farmers and others in the value chain such as vets, nutritionists and livestock advisers to make use of much more precise, consistent and frequent measurements, creating greater opportunities to improve cow performance and welfare.

The studentship would suit either a mathematical or computational student interested in sustainable food production, or someone with veterinary or 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 animal welfare assessment, and use this and cutting edge AI to build and apply the system across the studentship timeline so we can develop a better understanding of lameness. The student will be based 50%/50% at two leading, geographically close institutes – Bristol Robotics Laboratory at the University of West of England, and Bristol Veterinary School & Visual Information Laboratory at the University of Bristol, and will benefit from a broad cross-disciplinary supervision team, led by Prof Melvyn Smith (Machine Vision) and Prof Andrew Dowsey (One Health Data Science), who have published state-of-the-art work in this area that will be built upon (see https://doi.org/10.1016/j.compind.2018.02.011 , https://arxiv.org/abs/2006.09205, https://www.biorxiv.org/content/10.1101/2020.08.03.234203v2).

Data collection and validation will harness the Bristol Veterinary School's John Oldacre Centre for Sustainability and Welfare in Dairy Production, a new research centre based at our Wyndhurst dairy farm, which will include blanket 24/7 video coverage of all our 185 cows linked to data on production, emissions and veterinary assessments (https://www.bristol.ac.uk/vet-school/research/john-oldacre-centre--farm-research-data-platform).