

PhD position: Development of methods for characterizing the behaviour and social interactions of cattle, for health and welfare assessment, in the context of agro-ecological transition.

Project summary

The 2 structuring elements of the evolution of agricultural systems in the coming years are climate change and the agro-ecological transition. These evolutions will be accompanied by new challenges in the management of animal health and welfare. Sensors embedded on animals can help to meet these challenges by allowing real-time monitoring of behaviours. Dairy cow lameness is an interesting model to support these developments as it is a frequent and relatively painful disease with behavioural repercussions. Among the sensors, 3D accelerometers can be used to finely characterize behaviours. By coupling these accelerometers with proximity sensors, it becomes possible to characterize certain social interactions. The development of a system for detecting specific behaviours at the individual and group levels opens the prospect of a better understanding of the causes and consequences of lameness, as well as improved detection.

A first hypothesis is that lameness is accompanied by changes in the rising and lying behaviours of cattle. One of the objectives of the project will be to finely characterize these rising and lying behaviours using 3D accelerometers and appropriate machine learning methods, to ultimately detect lameness.

A second hypothesis is that lameness has an impact on social interactions between cattle. The other objective of the project will be to characterize the interactions between cattle by combining 3D accelerometers, proximity sensors and machine learning methods, in order to evaluate the consequences of lameness on these interactions.

Main steps

The main steps of the project will be:

1. Data collection in dairy farms.
 - Equipping the cattle with a collar containing the sensors
 - Recording the behaviours of these cattle: rising, lying down, other usual behaviours, interactions; direct observation or video.
 - Labelling of the lameness data with a usual scoring method
2. Evaluation of machine learning methods for the prediction of observed behaviours from sensor data.
 - Accelerometric signal: methods based on segmentation of time series into overlapping windows and application of adapted algorithms, or deep learning methods for identification of specific patterns.
 - Proximity detector: approach to be developed and methods to be identified.
3. Evaluation of associations between behaviours, social interactions and lameness.

Start of the PhD work: September 2023

Candidate profile

- Master's degree in animal science with an interest in animal production/welfare and a specialization in data science, or, Master's degree in data science with an interest in animal production/welfare
- Organizational skills.
- Ability to work in a multidisciplinary environment including animal health and welfare researchers, artificial intelligence researchers, interactions with farmers.
- Good command of French and English.
- Curiosity and taste for research.

Supervision

Hosting research units:

- **UMR BIOEPAR, [PEPS](#)** team – Joint research unit Oniris, INRAE; located at Oniris, Nantes Veterinary School. The unit produces and disseminates knowledge on animal health management and for improving the understanding of the mechanisms of occurrence and spread of transmissible diseases.
- **UMR AgroParisTech / INRAE MIA 518, [LInK](#)** team – The team conducts research on the exploitation of heterogeneous data as well as on the study and use of machine learning methods capable of processing streaming data.

The supervisory team of the thesis is composed of:

Aurélien Madouasse: Associate professor at Oniris, affiliated to UMR BIOEPAR. Research themes: disease detection and evaluation of welfare in cattle.

Antoine Cornuéjols: Professor at AgroParisTech. Research themes: machine learning.

Christine Martin: Associate professor at AgroParisTech. Research themes: machine learning.

Application

Send CV, cover letter, M1 and M2 transcripts by email to aurelien.madouasse@inrae.fr before June 5, 2023.

The selected candidates will be interviewed in the second half of June.

For more information, please contact Aurélien Madouasse (aurelien.madouasse@inrae.fr).