PhD position

DigitWelfare. A hybrid modelling approach to characterize dairy goat's activity profiles associated with welfare

WORKING ENVIRONMENT AND ACTIVITIES

Today, we all want animal production systems that are more respectful to animal welfare. Animal welfare is defined as a positive mental and physical state achieved by satisfaction of the animal's physiological and behavioural needs according to its own perception of the situation (ANSES, 2018). Moreover, the agroecological transition of livestock farming integrates the concept of one welfare, where the interdependence between the welfare of animals, wellbeing of farmers and environmental protection is highlighted as part of this transition. To respond to these expectations, continuous objective measures of welfare state at the individual animal scale are needed. However, animal welfare is a multicriteria concept with different animal indicators combining behaviour, health, and aspects of peperformance and physiology. Such indicators are increasingly measurable with lower cost and less human effort thanks to PLF (Precision Livestock Farming) technology.

The objective of this thesis is to improve our ability to assess welfare by developing a pipeline for collection of heterogenous PLF (Precision Livestock Farming) data of performance and activity of dairy goats and develop a modelling approach (combination of supervised machine learning algorithm and dynamic model of perturbed production performance). This will allow us to (1) determine the activity profiles associated with different husbandry practices considered in this project, and (2) to develop a multi-variable machine learning algorithm combined with dynamic model of goats' performance considering behavioural and performance data, to detect deviations in the behavioural data in relation to perturbations of performance. The originality of our approach lies in the combining of the perturbed model of performance and a supervised machine learning algorithm. In particular, the following methods will be used: random forests (scikit-learn), gradient boosting with decision trees (xgboost, catboost, lightgbm), neural networks (tensorflow, keras). This project will break new ground in the characterization of activity profiles, and develop a novel modelling approach to detect deviations in these profiles. These deviations are potential signs of health and welfare problems.

This interdisciplinary thesis will benefit from the expertise of supervisors in data analytics, Artificial Intellegence, biology of robustness, and animal behaviour. This project will provide a rich research environment for the PhD candidate because it is associated with a number of projects and researcher networks in which the supervisorial team is implicated. The successful candidate will have the possibility to participate in the meetings and seminars of these networks. After the three years of the thesis, the PhD is expected to obtain a solid experience in interdisciplinary research. The PhD student will acquire knowledge on what are the different types of modelling approaches and how the combination of such

approaches enables valuable inferences to be extracted from existing data, in particular PLF data. She/he will be able to develop machine learning and concept driven models. From an animal science point of view, the PhD candidate will become familiar with animal welfare concept and its influence on production sustainability. Most of all, she/he will gain the necessary tools and interdisciplinary experience to be able to handle such projects in the future as researcher or engineer.

The successful candidate will be integrated in the MoSAR team (systemic Modelling Applied to Ruminants) and the dynamic of doctoral school ABIES (Paris-Saclay university and AgroParisTech). She/he will have the possibility to follow graduate courses (English and French) of INRAE, Paris-Saclay university and AgroParisTech.

TRAINING AND SKILLS REQUIRED

- MSC (or diplôme d'ingenieur) in computer science, statistics, applied mathematics
- Knowledge on Python/R programming language
- Knowledge and experiences on the machine learning and modelling projects (Neural network, Random Forest, ...)
- Experience in the domain of biology is advantageous
- High interest in animal welfare and behaviour
- Excellent communication skills to interact with a multi-disciplinary team.

↘ Reception modalities

- Unit: MoSAR
- Postal code + city: 75005, Paris
- Type of contract: doctoral
- Duration of the contract: 36 months
- Starting date: October 2022

↘ How to apply

To postulate, please send your CV, motivation letter (using the format provided in attached), recommendations and the name of your references (scientists) to

Masoomeh.Taghipoor@inrae.fr

Joon.kwon@inrae.fr

X Deadline:10/05/2022
After a first selection, an oral presentation in front of the doctoral school jury is expected (from 13th to 15th of June 2022).

Candidature thèse ABIES - Lettre de motivation
ABIES PhD application – Motivation letter
(deux pages maximum - Police Arial 11)
(maximum 2 pages – font Arial 11)

Informations Générales :
General information:

NOM, Prénom : NAME, surname:	
Titre du projet de thèse: PhD Project Title	
Directeur(s) de thèse PhD Supervisor(s)	
Laboratoire d'accueil Host Laboratory	

- **Quelles sont vos motivations pour réaliser une thèse? Quelle est la place de la thèse dans votre projet professionnel ?**

What motivates you to do a PhD? What is the role/importance of the PhD in your career plan?

…

- **Pourquoi avez vous choisi de candidater sur <u>ce</u> sujet de thèse plus spécifiquement ? Quels sont ses atouts pour votre projet professionnel ?**

Why have you chosen to apply for <u>this</u> PhD project? What are its advantages for your career plan?

…

- **Quels points forts du laboratoire d'accueil et de l'école doctorale ABIES souhaitez vous mettre en avant pour la réalisation de la thèse?**

In your opinion what are the strengths of the host laboratory and the Doctoral School ABIES which will enable you to complete this PhD?

…

- **Quelles sont vos compétences acquises que vous mobiliserez au service de la thèse ?**

What are the skills that you have acquired that you will use for this PhD?

…

- **Quelles sont les compétences qui seront à acquérir dans le cadre de la thèse?**

What are the skills which need to be acquired during this PhD?

…

- **Quelles sont pour vous les qualités nécessaires à la réalisation d'une thèse et plus spécifiquement pour la réalisation de la thèse pour laquelle vous êtes candidat(e)? Pouvez vous sur un exemple de votre propre expérience illustrer ces qualités?**

What do you think are the qualities necessary in order to complete a PhD and more specifically the PhD which you are applying for? Can you illustrate these qualities with an example drawn from your personal experience?

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