M2 internship in

IA-based automated detection and behavior analysis among piglets

Position type : M2 research internship. Possibility of continuing with a thesis.

Starting date : beginning 2024.
Non-European citizen: a 2-month delay before starting is required to obtain security approval.

Duration : 4 to 6 months

Research team: Linkmedia, INRIA-IRISA Rennes, FRANCE

Gratification : according the legislation (around 500 euros per month

Application deadline : end of January 2023

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Keywords : Animal welfare, Artificial Intelligence, Computer Vision, Automated Behavior Analysis, Action Recognition, Animal Pose Estimation, CNN, Transformers, LSTM.

About the center

The Inria Centre at Rennes University is one of Inria's eight centers and has more than thirty research teams. The Inria Centre is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

Context

The proposed subject is part of the PEPR project WAIT4 on animal welfare, which goal is to use Artificial Intelligence and new technologies for tracking key indicator traits in animals facing challenges of the agro-ecological transition. Animal welfare is a key agro-ecological process to be optimized for livestock production. Automated behavior analysis (ABA, also called computational ethology) is the use of technology to detect and observe the behavior of animals in ways that require minimal human labor. Play behaviour is considered an indicator of animal welfare in young pigs. However, as play behaviour events are short-lasting and occur sporadically, continuous monitoring is necessary. We could use standard video cameras,

available in most modern farms, to monitor livestock. However, most computer vision algorithms perform poorly on this task, primarily because, (i) animals bred in farms look identical, lacking any obvious spatial signature, (ii) none of the existing trackers are robust for long duration, and (iii) real-world conditions such as changing illumination, frequent occlusion, varying camera angles, and sizes of the animals make it hard for models to generalize.

Mission

Given a set of annotated video recordings of piglets provided by INRAE. the objective is to measure the social interactions and the occurrence of fights vs positive social contacts between piglets before and after weaning to assess emotional states of piglets. There are currently several methods for performing pose detection for animals, learned from different corpora, as well as for performing action recognition, using for example CNNs feature coupled with LSTMs. The goal of this internship is to evaluate some of these methods on the provided corpus. This will require implementing methods and adapting them (possibly through transfer learning).

Activities

- Develop or adapt sota algorithms for group-housed pigs to perform :
    - animal pose estimation
    - instance level segmentation,
    - tracking
    - action recognition
- Evaluate the performances
- Results analysis to pinpoint difficulties of both the dataset and the methods

Skills

- Master in Computer Sciences, with proficiency in python and its libraries for deep learning
- General background in computer vision and machine learning
- Understanding of deep learning methodologies and techniques;
- Proficiency in data handling, particularly in video processing

Bibliography

1. Automatic detection of locomotor play in young pigs: A proof of concept, Mona L.V. Larsen, Meiqing Wang, Sam Willems, Dong Liu, Tomas Norton, Biosystems Engineering, Volume 229, 2023, Pages 154-166

2. The quest to develop automated systems for monitoring animal behavior, Janice M. Siegford, Juan P. Steibel, Junjie Han, Madonna Benjamin, Tami Brown-Brandl, Joao R.R. Dórea, Daniel Morris, Tomas Norton, Eric Psota, Guilherme J.M. Rosa, Applied Animal Behaviour Science, Volume 265, 2023.

3. Barriers to computer vision applications in pig production facilities Li, J., Green-Miller, A.R., Hu, X., Lucic, A., Mohan, M.M., Dilger, R.N., Condotta, I.C., Aldridge, B., Hart, J.M., Ahuja, N., 2022. Comput. Electron. Agric. 20

4. Automated Behavior Recognition and Tracking of Group-Housed Pigs with an Improved DeepSORT Method. Shuqin Tu and al. Agriculture 2022, 12, 1907

5. Automated detection and analysis of social behaviors among preweaning piglets using key point-based spatial and temporal features. Gan, H., Ou, M., Huang, E., Xu, C., Li, S., Li, J., Liu, K., & Xue, Y. (2021). Computers and Electronics in Agriculture, 188, 106357

6. Livestock Monitoring with Transformer, BMVC, 2021

7. Automated video behavior recognition of pigs using two-stream convolutional networks. Zhang, K., Li, D., Huang, J., Chen, Y., 2020. Sensors 20

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs