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Deep learning-based multiple object tracking for a fixed number of objects in the context of farm animal ethology

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Analysing the behaviour of farm animals is a prerequisite for being able to identify their needs and thus, to ensure animal welfare. In this context, it is of great interest to find out how animals move in their habitat as a function of time, for example, with the objective to make statements about their group behaviour, their foraging behaviour and their use of space. Current approaches of veterinarians working with poultry are based on observations from video cameras, which are manually evaluated to determine the behaviour of the animals. As this procedure is extremely time-consuming, the idea of this project is to support the medical scientists by means of automatically extracted trajectories of all animals in an image sequence. Although there is already extensive research in the field of image-based tracking of pedestrians, there is little research in the domain of tracking farm animals and apparently no approaches addressing the fixed number of tracked animals.

In the frame of this master thesis, the student shall investigate how existing tracking algorithms can be transferred to the domain of farm animals in general and poultry in particular. Thereby, the goal of the applied methodology is to obtain one region proposal for each animal in each of the frames as well as the association of all region proposals of a single animal in the course of the entire image sequence. Thus, as a result, the tracking algorithm delivers one trajectory per observed target which could, for example, be realized by means of the approach presented in (Ali et al., 2022) that was so far investigated for poultry tracking with variable number of trackable objects.

Thus, in addition to the conceptual elaboration, this master thesis also includes a practical component, in which the student shall adapt an existing tracking algorithm to the domain of farm animals. The developed approach is to be tested on image sequences showing pigs (https://homepages.inf.ed.ac.uk/rbf/PIGDATA/) and/or on image sequences showing chicken that is available at the Institute of Photogrammetry and GeoInformation; both data sets are made available to the student. The student's adaptation of a tracking algorithm shall be analysed with respect to the ability of tracking farm animals, whereas the evaluation is carried out using standard evaluation metrics for multiple-object tracking. The evaluation should also include an analysis of failure cases of the methodology in the context of animal tracking and first ideas for potential adaptations to overcome these limitations.

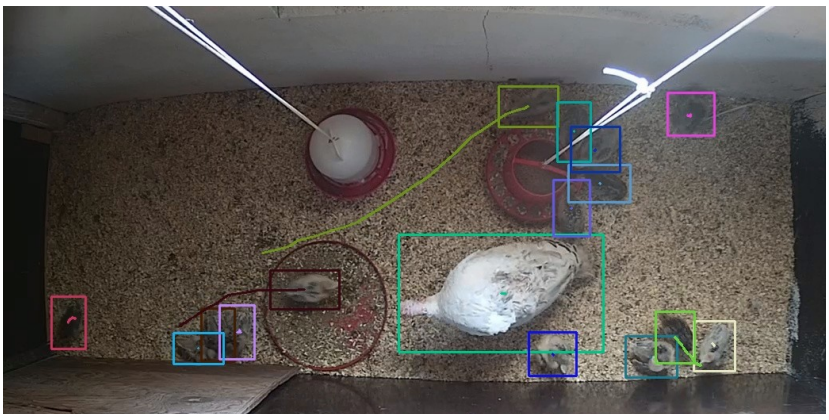

Figure 1: Example illustrating the utilized dataset, where the colored bounding boxes represent the unique IDs of tracked chicks, and the colored lines depict the paths traversed by the chicks.

Ali, R., Dorozynski, M., Stracke, J., and Mehltretter, M.: DEEP LEARNING-BASED TRACKING OF MULTIPLE OBJECTS IN THE CONTEXT OF FARM ANIMAL ETHOLOGY, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLIII-B2-2022, 509–516, https://doi.org/10.5194/isprs-archives-XLIII-B2-2022-509-2022, 2022.

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