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Individual activity monitoring as a measure of the resilience of group-housed pigs using computer vision

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Modern welfare definitions not only require that the Five Freedoms are met, but animals should also be able to adapt to changes (i.e. resilience) and reach a state that the animals experience as positive. Measuring resilience is challenging since relatively subtle changes in animal behaviour need to be observed 24/7. A computer vision (CV) based tracking algorithm for pigs could potentially measure individual activity. This study investigated a potential CV algorithm for pig detection and tracking for individual activity monitoring in pigs. Pigs were first detected using You Only Look Once v3 (YOLOv3) and were tracked using the Simple Online Real-time Tracking (SORT) algorithm. Two videos recorded in a barren and an enriched environment were used to test the tracking algorithm. Four thousand annotated frames were used to train the detection algorithm. Mean average precisions (mAP) of over 99.9% in the enriched environment and 99.7% in the barren environment were achieved. Intersection over Union (IOU) exceeded 85% in both environments, indicating a good accuracy of the detection algorithm. The tracking algorithm performed better in the enriched environment compared to the barren environment, likely due to the larger space per pig. When false-positive tracks were removed (i.e. tracks not associated with a pig), individual pigs were tracked on average for 22.3 minutes in the barren environment and 57.8 minutes in the enriched environment. Thus, based on a tracking-by-detection algorithm using YOLOv3 and SORT, individual pigs can be tracked automatically in different environments, but manual corrections may be needed to keep track of the same individual throughout the video.