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Millimetre-wave radars for the automatic recording of sow postural activity

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The global objective is to analyse the variations in the pattern of activity in a Large White population and estimate associations with piglet survival. The aim of the study is to evaluate the efficiency of millimetre-wave radars based on frequency modulation to monitor the postural activity of lactating sows kept in a crate. The monitoring is performed with two radars operating at a frequency of 122 GHz positioned on a metal structure 35 cm above the crate at two strategic locations: above the head and above the sow's back. The acquisition speed was 20 obs/sec. For validation of the positions predicted from radar sensor data, sow positions were recorded with a digital camera and video records were analysed by observers trained in the same way. Preliminary results were obtained on two sows analysed over a period of 24 h and two other sows over a period of 12 h and using information collected each second. First trials focused on the ability of radars to distinguish three positions: standing (ST), sitting (SI) and lying (LY). The prediction ability was tested with machine learning applied to random forests and deep learning. The model used is derived from VGG16, which is a state of art model to analyse images. Analyses were carried out individually for each sow, using 40% of the beginning of the data base as training data set and the remaining 60% as validation data set. On the validation set, the global statistical sensitivity was 93% (94% for ST and between 80 and 93% for both SI and LY). The 3 positions were also detected by random forest with similar sensitivity but the data coming from the radar have to be preprocessed before. More sows will be monitored for validating the use of millimetre-wave radars as an accurate and non-invasive innovative technology for the study of the sow pattern of activity. The analysis of more sows is in progress and additional behavioural traits of interest might be identified from radar signals.