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Towards an automated assessment of pig behaviours on farm

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Tail biting and aggression in finishing pigs are injurious behaviours affecting health and welfare of pigs as well as productivity of the farms. In the PIGWATCH European project (ERANET Anihwa), INRA and CEA are working on development of an automated technique, based on the use of sensors and machine learning algorithms, to detect injurious behaviours or abnormal patterns of activity. A wireless ear tag was developed, including a triaxial accelerometer and an Android application for data recording, processing and alert sending to the farmer on his smartphone when injurious behaviours are detected. Pigs were housed in groups of 8 on solid floor covered daily with fresh straw. Twelve pigs, i.e. 4 per group, were fitted with these ear tags. Their activity was recorded with the sensors during a period of two months. Their behaviour was analysed using video records on selected days. They were subjected to straw deprivation followed by food restriction in order to stimulate injurious behaviours or changes in the behavioural pattern of activity. In a first step, 24 hours of video records were analysed and synchronized with signals from sensors for each pig. Relevant mathematical features were extracted from signals to predict various pig's behaviours and notably, discriminate injurious behaviours from normal activity. These features were used in machine learning algorithms to build a model, able to automatically predict pig's behaviours and detect injurious ones. Regarding 'marked' fights (>3 aggressive acts within 10 s), the model has a sensitivity of 42% and a specificity of 62%. This model has been implemented in an Android App and will be assessed in farms in Germany, notably in terms of true and false alerts. We will get the feedback from farmers on the usefulness and how to improve the system ergonomic. As a third step, the whole database collected at INRA is currently processed with this model to predict other pig's behaviours (e.g. resting, feeding) and assess individual and nycthemeral variations.

Considerations in the conversion of automatically generated behavioural data to useful information

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The application of the 'Smart Farming' concept in the livestock areas of agricultural production requires a closing of the knowledge gap in methodology between data collection and generation of meaningful information and insights in real time, to fulfil its potential to improve or maintain animal welfare and performance. In order to create a management tool that is as effective as a decision made by a person conducting visual monitoring, the sensor technology must be able to identify a change, compare to a previously set standard value, and decide on the correct action if sufficiently different from that standard value. Currently, at the most rudimentary level, real time data recording and real-time management of different types of data (from animals, their feed consumption, atmosphere in the shed) can be analysed in real-time to flag critical values which are important for animal well-being decision-making. The major issue is to learn from this multiplicity of data and convert it to information that may be used, e.g. to create and develop appropriate livestock management tools for the farmer. Firstly, the data may be generated in very large volumes at very frequent time points. The compilation of data into manageable and meaningful sets is necessary. Secondly, data may be retrieved from different sources, e.g. sensors, weather, geo-location. A case in point may be described by cow grazing behaviour data recorded through an accelerometer and pedometer together with cow localization (by triangulation). Finally, data may be generated in different formats, such as images or high resolution spatial maps of e.g. temperature. Relevant questions include what is the optimum frequency of data recording for different subjects/activities, degree of summary and possible integration of the data, relation/comparison to the developed standard, and feed into a decision support tool. New considerations and technologies are required for management and analysis of such data.