

## SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

**Action number: 15134**

**STSM title: Image Analysis for behavior and health in pigs**

**STSM start and end date: 16/09/2019 to 27/09/2019**

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### PURPOSE OF THE STSM:

Tail biting is, an abnormal behavior of pigs and is a major welfare and economic issue for pig farming. The problem is evident in pig farming industry since the 50's, although it is widely believed that it became more severe by adoption of more intensive production systems. Tail biting outbreaks are difficult to predict and even more challenging to understand as even in one facility where the same managerial practises are implemented, tail biting is sporadic.

The idea of Precision Livestock Farming (PLF) is to use real-time monitoring of animals and their living environment through sensors and send warnings to the farmer to help him make the appropriate management changes to resolve the problem. This is a complex procedure that requires field data and labelling techniques in order to develop real time algorithms that generate reliable and easy to interpret results. An early detection system of tail biting through the use of PLF could be of outmost importance in adressing the problem as tail biting outbreaks escalate too quickly with devastating consequences for the farmer and the animals.

The objectives of this STSM can be summarized as following:

For the beneficiary (a) to be trained and acquire new knowledge and skills on PLF techniques and image/video analysis in order to do a better assessment of tail biting and health problems in pigs.

(b) To be introduced to PLF technologies/techniques (e.g. what are PLF technologies, how do sensors work, how to develop a PLF application etc.)

(c) To acquire knowledge about video analysis and labelling techniques to potentially

identify early warning signals for tailbiting/health problems.

For the institutions involved, to establish a new network of researchers in the field of animal behaviour observation for welfare assessment and to discover opportunities for further collaboration in common projects.

#### **DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS**

The first meeting with the researchers of the M3-BIORES group at KU Leuven, Belgium was introductory. At the briefing with the supervisor the main goals of the STSM protocol were discussed. More specifically, the two main goals of the mission were specified:

- a) Introduction to the concept of Precision Livestock Farming and how it can help in providing solutions for challenges that farmers are facing.
- b) Acquire knowledge of specific software used for the labelling of behavioral variables and software for image and video analysis in order to develop an algorithm that can be used in PLF applications.

On the first day of the STSM I was given a small tour around the Lab and got to know the researchers working there in order to get an overview of the projects going on currently at M3-BIORES.

In order to have an introduction to PLF I read related articles provided to me by the host institution (M3-BIORES, KU Leuven, Belgium). Moreover, I also took a two-hour introductory lecture on PLF that was given in the faculty for the new students by Dr. Eric Vranken.

Labelling is the procedure that allows the researcher to identify and classify any behavioral variable that is considered in his ethogram. Training in applying the labelling procedure and using the software was carried out with the help of the lab personnel. Labelling is an important first step in the development of an algorithm which will be used at the core of any software developed for automatic real time monitoring of livestock. I was trained in two different kinds of labelling software. One software is called ELAN (Version 5.7) 2019. Nijmegen: Max Planck Institute for Psycholinguistics, and the other software is called Solomon Coder (Version 19.08.02).

After the installation of the software and learning the basic operations we had another meeting where we discussed about a possible project in the context of my PhD. Based upon video recordings from Greek pig farms we set up the main hypothesis that a real time monitoring system could give the activity index of pigs used to set the alarm for the farmer in cases of tail-biting.

The second week of my stay was used in order to better familiarize with the software and the techniques of labelling and image analysis. Labelling a video for behavior analysis is the manual observation and indexing of videos frame by frame for the behavioral variables you are working on

and is very labor-intensive and time consuming. Also, I tested a lot of different videos in order to make appropriate adjustments to the activity index algorithm and to learn how to change the outputs that were produced.

Also, a one-day visit was scheduled in an experimental poultry farm where there is currently an ongoing project on automated tracking of poultry behavior with the use of 2-D and depth sensor (3-D) cameras. I had the chance to see and learn the methodology they apply, the algorithms they use and the actual setup of these experiments and that gave me valuable knowledge to be used in my forthcoming experiment.

#### DESCRIPTION OF THE MAIN RESULTS OBTAINED

During this STSM I was introduced to PLF technologies and acquired new skills in image and video analysis for behavioral observations. Training in labelling is fundamental in order to have the extraction of the appropriate kind of data out of labelling the videos. During my PhD I will collect and use these data in order to make behavioral correlations with tail biting. The use of two different labelling software gave the opportunity to better understand and adapt every software template according to my research interest.

I also had the chance to learn more about the Soundtalks system, a commercially available PLF approach based on sound (cough) real time monitoring of pigs.. The system was developed here in the University and is a good example of how PLF technology can help farmers to intervene early when there are respiratory problems in their farm thanks to alerts sent to their phone in real-time.

Moreover, i met PhD and Post-Doc researchers from the field of bioengineering and make connections and exchange ideas for further collaboration. This exchange of ideas between a veterinarian and a bioengineer is of crucial importance in order to understand how to better deliver the right PLF solution approach to farmer problems and respectively to animal problems. Additionally, a meeting was set up with other PhD students working on automated tracking of animals where we discussed about the specifications of the equipment that we are going to use and also how to best address problems that would probably arise from the implementation of sensitive electronic sensors in a harsh environment (High temperature, flies, spiders, etc..) as the one in a commercial farm.

Furthermore, returning home after this STSM I will have the opportunity to share all this newly acquired knowledge and skills with fellow researchers doing video recordings for behavioral observations. Above all as I participate in educational programmes of Greek pig farmers that are organized by the Ministry of Rural Development and Food, I will have the opportunity to

demonstrate them the advantages of using PLF techniques in their farm in order to be more economically viable and competitive in a continuously changing pig industry.

**FUTURE COLLABORATIONS (if applicable)**

The mutual collaboration between Veterinary Research Institute and M3-BIORES (KU Leuven, Belgium) will continue after the end of this STSM. As the new skills that I acquired through my stay will be used in order to set a small group study. The analysis of the data from this study will be done in collaboration with the Host Institute and will be used so that we can adjust accordingly the activity index algorithm that we already have established during my STSM. I believe that the work which has been started is going to lead to the development of more common projects in the future and possible publications.