ecosystem integrating two consent management tools as “pilots” and the conditions for their interoperability between each other or with the future tools to come. The goal of this communication will be to describe the solution proposed in this project.

This solution is based on a shared typology of data and data processing as well as on the specifications of the consent message content, a prerequisite for considering the interoperability of the ecosystem. It is also based on a router, which provides unified access to consent management tools (using API). In particular, it provides the farmer (beneficiary) with an exhaustive view of his/her consents (which can be distributed on several consent managers), meeting farmers' expectations for transparency. It is also the point where a data provider can check whether the consent required to provide data exists, without needing to know which consent management system is concerned. As part of the project, we compare two existing consent management tools based on different approaches involving a trusted third party for one and Blockchain technology for the other.

In this project, the stakeholders want to demonstrate to agricultural professional organizations the benefits and feasibility of a consent management ecosystem with several use cases. By strengthening the confidence of farmers to share their data, the project will allow the emergence of new knowledge and new services. It promotes open innovation, i.e. the emergence of agricultural applications coupled with farmers' data from any data source or connected object, to avoid the risk of innovation concentration, but also the creation of knowledge through the analysis of massive farms data, in a chain of trust.

A case study on prediction of sensitivity of tomato sepals to fungal infection using hyperspectral imaging

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Tomato quality is dependent on growing conditions and chain conditions like humidity and temperature, as well as crop handling during harvest and post-harvest processes (transport, packaging, storage etc.). Like many other perishable fruits and vegetables, it is highly prone to post-harvest losses, reaching up to 30% in some developing countries. Tomato is known to be highly susceptible to pathogenic fungi, such as Penicillium, Aspergillus and Mucor, which tend to attack crops with high moisture and nutrient content. Tomato tissue cell damage can occur due to changes in environmental conditions as well as damage during product handling. Such damage creates potential entrance for fungal spores which, given appropriate germination conditions, may infect stem, calyx, sepals etc.

This work focuses on the sensitivity of sepals to fungal infection. In addition to the physical damage to the calyx, the calyx can also be physiological strong or weak, which is likely influenced by various growing conditions like radiation during fruit set and fruit growth, relative humidity during cultivation, more vegetative or generative growing crops, plant density and nutritional level of the crop. In case of presence of fungal spores and favorable fungal growing conditions, it is hypothesized that there is a correlation between weakness of the calyx (prior to fungal infection) and eventual fungal infection and/or the severity of infection.

Early sepal cell damage or weakness of calyx, is not visible to the naked eye, and, to our knowledge, no method exists for detecting this automatically prior to the infection. Hyperspectral imaging (HSI), especially in the Near-Infrared (NIR) range, has been shown to be sensitive to certain types of cell damage, such as bruises, but has not been demonstrated for the cell damage on the sepal tips and for early detection of weak sepals. As one of the novelty of this work, we investigate HSI to capture the sepal cell damage and weakness.

To investigate the hypothesis, an experimental procedure was designed wherein hyperspectral images were acquired from several batches of tomatoes (from multiple origins, 1 cultivar) prior to visible evidence of fungal infection, potentially capturing the cell damage. The tomatoes were then introduced to conditions stimulating for fungal germination for multiple days. On the final day of the experiment, tomatoes are imaged (normal colour images) for gathering visual evidence of fungal severity for each sepal.

Finally the first results are reported where a machine learning based approach – Random forest regression – was used to find a correlation between the spectral information from the first day of the experiment, and the fungal severity on the last day. Each sepal is described by the mean and standard deviation of its hyperspectral pixels values. 10-fold and group fold cross validation methods were used to evaluate the model performance. In reported experiments, groups correspond to different tomato origins. Predicted fungal severity correlated well with ground truth estimates with Pearson correlation of 0.73 and 0.66, and a high proportion of the variance explained with R2 score of 0.52 and 0.43 for 10-fold cross validation and group cross validation, respectively.

Use of a 3D imaging device to model the complete shape of dairy cattle and measure new morphological phenotypes

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Monitoring of body weight variation, body condition and/or morphological changes allows optimal management of animal health, production and reproduction performance. However, due to implementation difficulties (handling, time consumption, investments), this type of monitoring is not very common within commercial farms. The development of three-dimensional imaging technologies is an interesting solution to meet these needs. The purpose of this study was to develop, test and validate a device (Morpho3D) offering the possibility of recording and analysing complete 3D forms of dairy cattle. To evaluate the performance of this tool, manual measurements were performed on 30 Holstein dairy cows: height at withers (HG), chest circumference (TP), chest depth (PP), hip width (LH), buttock width (LF) and ischium width (LI). They were compared to those measured from the Morpho3D device. Correlations between Morpho3D measurements and manual measurements were 0.89 for PP, 0.80 for LH, 0.78 for TP, 0.76 for LF, 0.63 for LI and 0.62 for HG. For the Morpho3D system, the repeatability standard deviation ranged from 0.34 to 1.89 (coefficient of variation (CV) from 0.26 to 9.81) and the reproducibility standard deviation ranged from 0.55 to 5.87 (CV from 0.94 to 7.34). These values are close to those obtained with manual measurements. This new device offers the possibility of measuring new phenotypes such as the total volume of the animal or the body surface and thus offers new opportunities for new researches and studies.