PRACTICE ABSTRACT

Feasibility of using drone and cow tracker sensor technology in beef systems

Problem

In extensive cattle production systems, farmers often lack actual information on the status of their cattle herd concerning resilience and/or efficiency.

Solution

Novel technologies such as drones and cow tracking sensors could help farmers by providing precise information of their cattle.
Noldus developed a new outdoor tracking system using a single neck-mounted sensor to collect triaxial accelerometer and GPS location data (Figure 1). Cow sensor data can be recorded and visualized continuously and in real-time with TrackLab software. It is used to generate data that can serve as input to classify cow behaviour.
Drones are complementary to the cow tracker sensor technology because even if they only provide information for a very short period of time, they do it at the herd level rather than at the individual cow level. Drones fly for 20 minutes and then provide information on the number of cattle, their location, and individual characteristics such as height, volume and weight.

Outcome

Wageningen Research (WR) has shown that drone imagery combined with deep learning techniques and 3D analysis can provide useful information. Detecting cows in the field reached accuracies >95%, whereas detecting cows in fields without shade reached higher accuracies (99.9%) than in shaded fields (97.3%). Identifying Holstein cows reached an accuracy of 91% for cows in a small herd, having a distinct coat pattern. The characterization of cows into standing, grazing, and lying, caused no difficulties separating grazing from lying, but separating grazing and standing is challenging. The current machine learning algorithms can predict lying and standing with an accuracy between 0.82 and 0.95. The eating and rumination behaviours can be predicted with an accuracy between 0.85 to 0.99 with human annotation as reference. Noldus developed new collar mounted cow tracker sensors and combined this with the new TrackLab software to generate activity and behaviour parameters as input for proxies for resilience and efficiency.

Practical recommendations

- The current Noldus cow tracker sensor is limited to use in extensive beef cattle systems due to the limited battery life time of 4-5 days when sensor data is sampled at high frequency. Drones have limitations as well due to battery endurance and good weather conditions that are needed.
- Information collected by drones is often not real-time, so this has to be processed when the drone is back at the farm, so on-board processing in the drone is recommended for future. Noldus makes it possible to continuously measure what the individual cows with cow tracker sensors are doing in real-time; however, it is still limited to a set of cows.
- At the moment, identifying individual cows is only possible if they have a unique pattern, such as Holstein cows.

On-farm application

The results suggest that camera-mounted drones along with cow tracker sensor technology are promising new tools for monitoring cattle activity and behaviour traits that can be used as input for proxies for cattle resilience and efficiency assessment in extensive rearing systems.

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Further reading

Kamphuis, C., Ouweltjes, W., Poppe, H. W. M., Mücher, C. A., & de Haas, Y. (2021). How can cow-individual sensor data, national data and drone images improve our understanding of resilience

Noldus TrackLab Livestock research https://www.noldus.com/tracklab/livestock-research

Resources

https://youtu.be/chOMSGIXrWI

Figure 1 EBEE fixed wing drone & Noldus Cow tracker sensor

GenTORE has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 727213. The information contained in this communication only reflects the view of the authors.

"GENomic management Tools to Optimize Resilience and Efficiency - GenTORE" is an H2020 project which aims to develop innovative genome-enabled selection and management tools to empower farmers to optimize cattle resilience and efficiency in different and changing environments.