BOVINOSE: Pheromone-based sensor system for detecting estrus in dairy cows

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The BOVINOSE project (www.bovinose.eu) aims to develop an "electronic nose" to detect estrus in a dairy cow, and thus to determine the optimal timing of artificial insemination. The physical principle is based on detection of sex pheromones that are secreted by the cow, exclusively during estrus. These pheromones are the natural olfactory signal for the bull that the cow is in heat. This technology aims to help the dairy farmers in the EU, the vast majority being micro-enterprises run as family businesses.

INTRODUCTION

To control the calving interval, and therefore to optimize milk production and maximize offspring in dairy cattle, *artificial insemination* is widely used.

- **Farmers detect around 35%-60% of the heats (=estrus).**
- **Estrus detection is not always easy.**
- **Skills of the person performing the detection are relevant.**
- **Using a real bull may be impractical (costly, dangerous).**

Improving the success rate will significantly increase a dairy farmer's profitability.

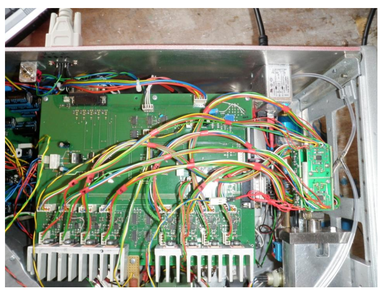
ELECTRONIC NOSE

• Acetic acid and propionic acid were identified as volatile sex pheromone components.
• Bull is able to detect these and gives a sexual response. (Sankar et.al., 2008).

Electronic nose specific to these pheromones:
• Sensor array of 8 sensors.
• Optimized to detect sex pheromones.
• Reduced sensitivities for other gasses (selectivity).
• Each sensor different sensitivity and selectivity.
• Single sensor is insufficient →array.

•Array signal → self learning pattern recognizer → estrus detection

Prototype device: to demonstrate feasibility of recognizing estrus in real feces. Miniaturization for practical use of later concern.



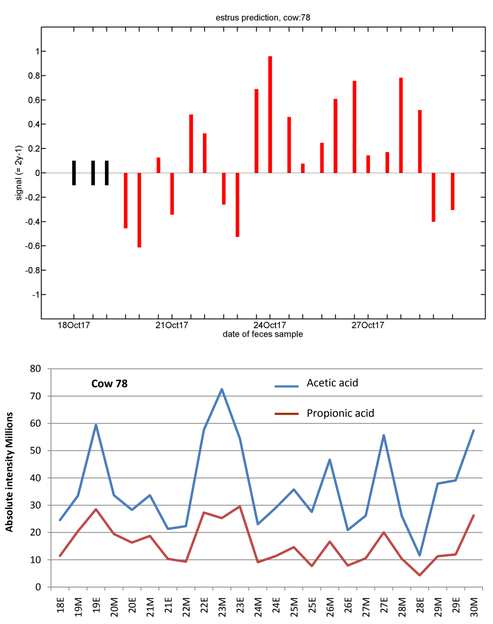
PATTERN RECOGNITION

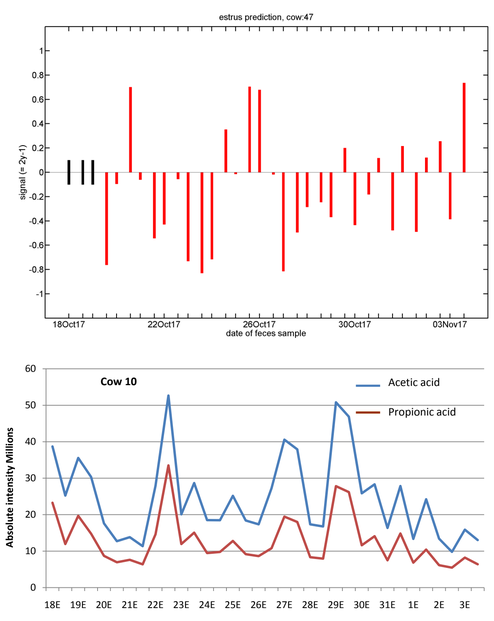
We applied self learning pattern recognition techniques for
1: Array signal → pheromones content
- objective measure as ground truth (Gas Chromatography, GC).

2: Array signal → estrus detection
- project objective, but target is result of a subjective decision by a farmer or a veterinarian.

ESTRUS PREDICTION

• Leave-one-cow-out training and test procedure for estrus prediction.
• Total of 10 cows.
• Training considered only on non-pregnant state.
• Variability between cows → needs calibration per cow.
• Prediction accuracy : 0.5-1 day compared to human observation.
• Untypical hidden estrus: still problematic.





Cow	Heat detection and insemination date(s) + remarks
78	24/10
47	Possibly seen on 21-10. Treated 27-10. Scan on 5-11 showed that heat on 27-10 was missed.

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- **Aveskamp, The Netherlands**

Web: www.bovinose.eu

SEVENTH FRAMEWORK PROGRAMME