

Silent Herdsman; Automatic Classification of Eating and Ruminating in Cattle using a Collar Mounted Accelerometer

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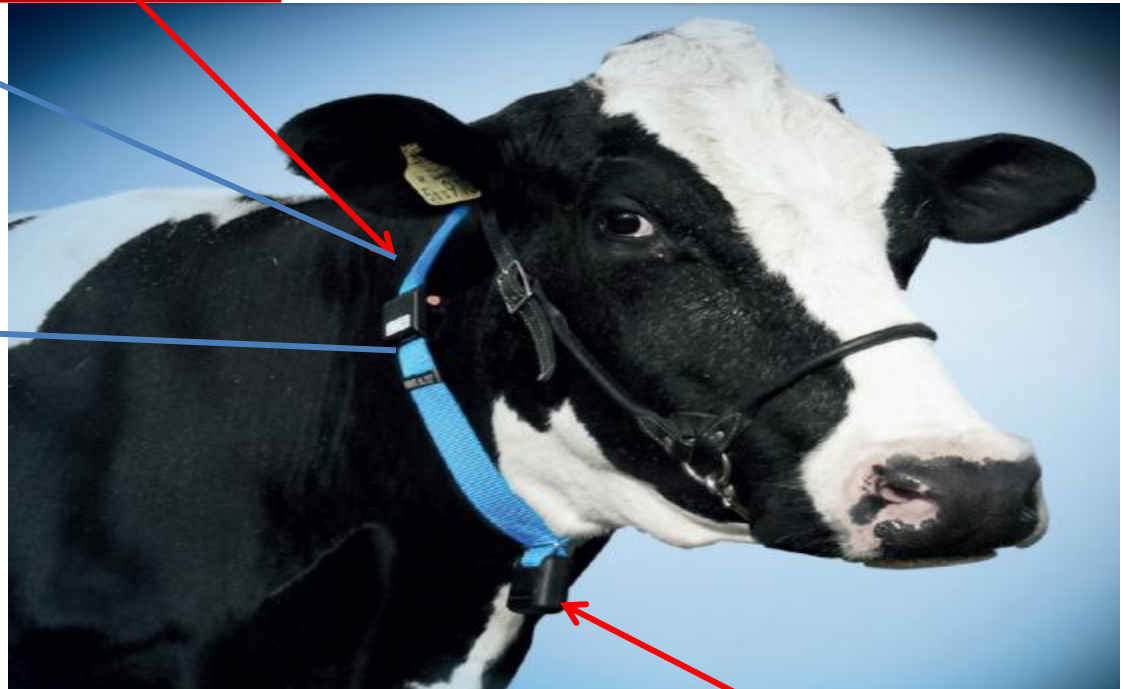
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Neck Mounted Collar

Location for
collar sensor



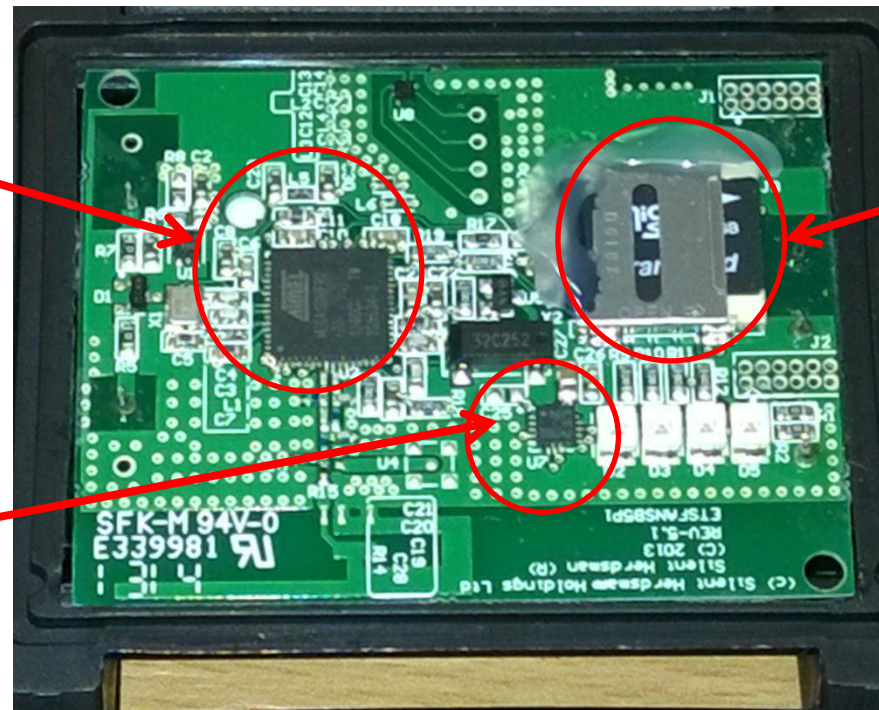
Weight

Data Gathering Collar

Radio
Microprocessor

SD Card

Accelerometer



Detecting Illness

- Activity
 - sick cows tend to be less active
- Eating
 - sick cows tend to eat less
- Rumination
 - sick cows tend to ruminate less
 - they also eat less

Truthing Data

- *Hoko* Feeder
 - time stamps only give indication that cows head is in the feeder
- Video analysis is good but open to interpretation and very labour intensive
- Need another sensor that give alignment with collar.....

A close-up photograph of a dark-colored horse's head. The horse is wearing a green woven halter. Attached to the side of the halter is a black, rectangular electronic identification tag. The tag has a small, circular, gold-colored sensor or antenna on its front face. The horse's eye is partially visible on the right side of the frame. The background is slightly blurred, showing a green surface.

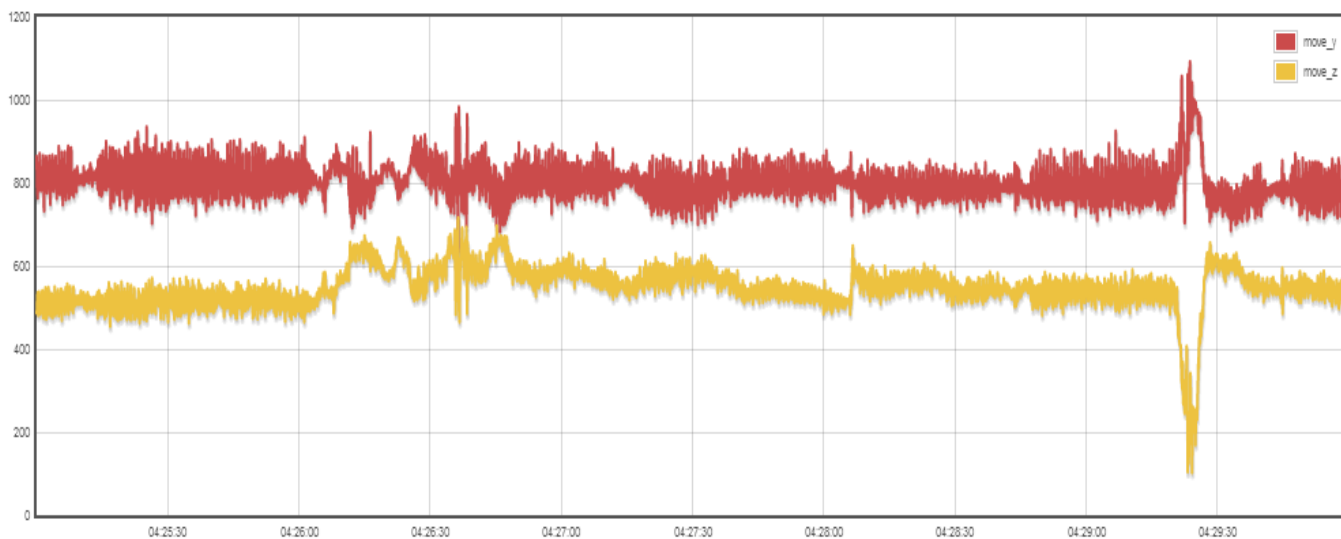


Raw 3-axis Accelerometer Output

Grazing Timeseries

Date From: To:

Time From: To:



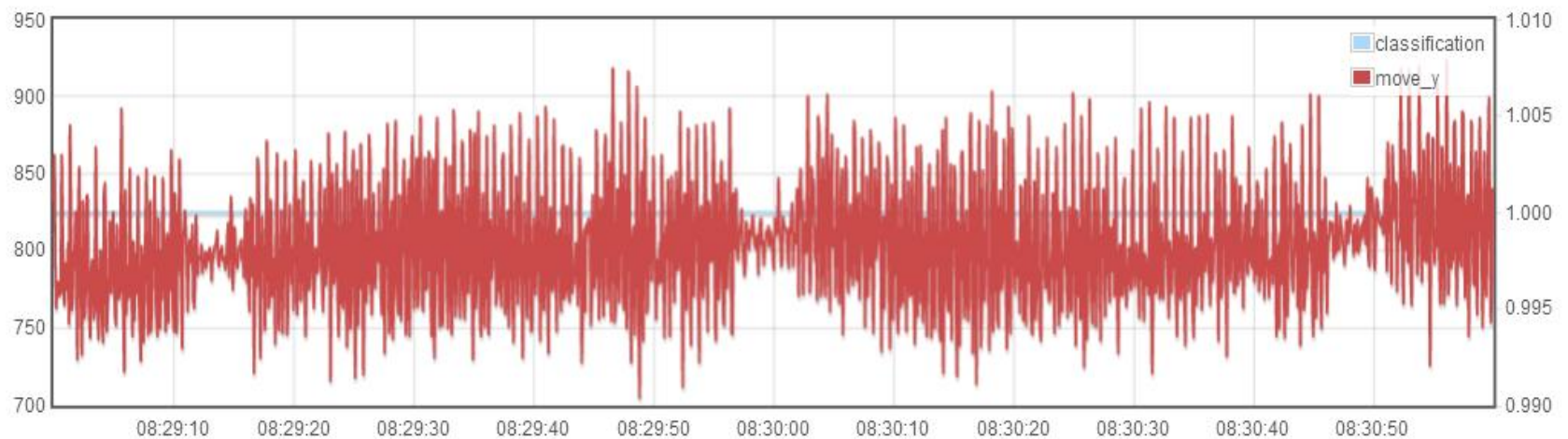
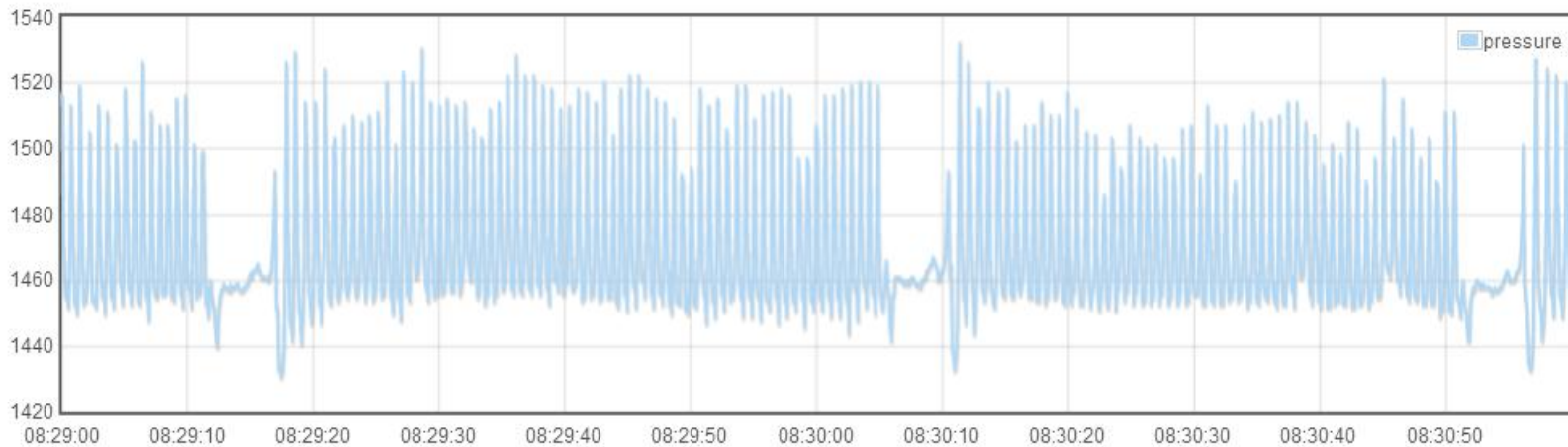
Choices:

- ☐ move_x
- ☒ move_y
- ☒ move_z

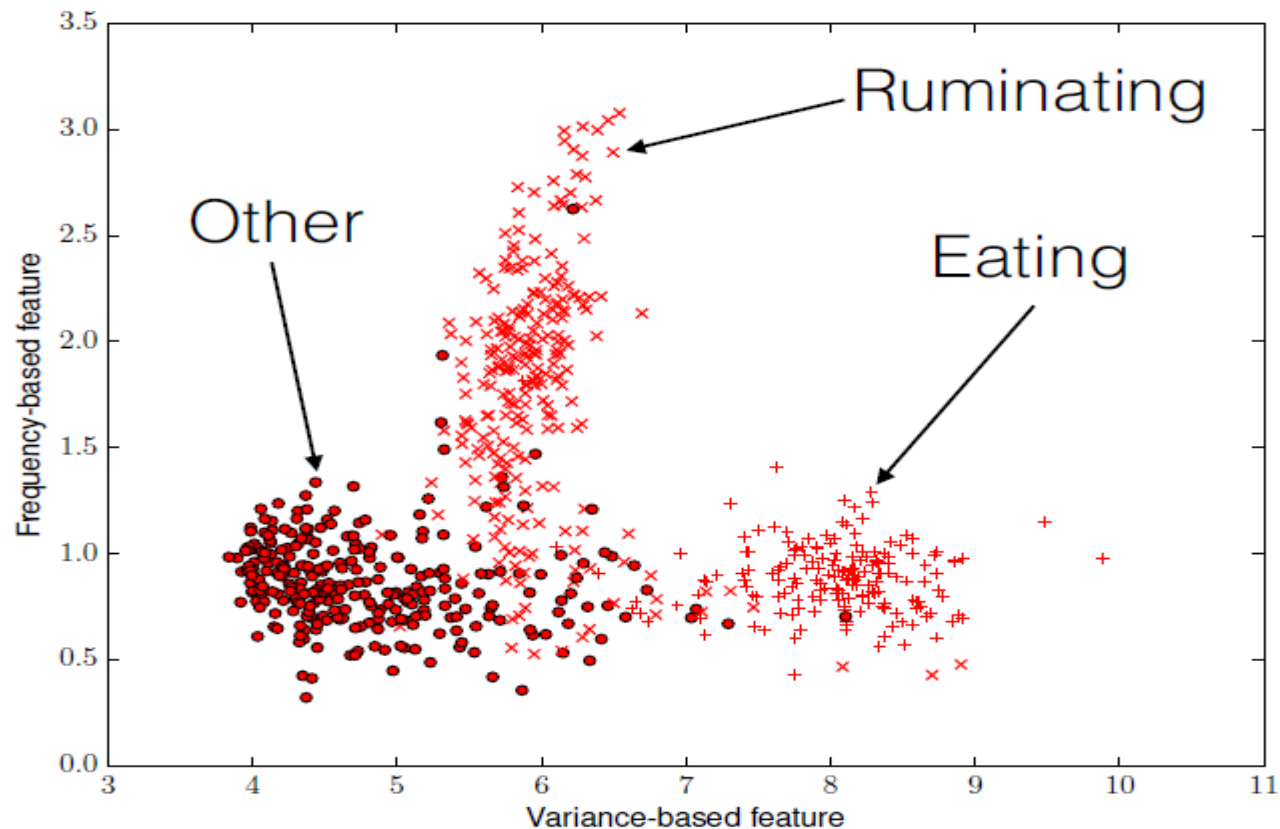
Feature Extraction

- Features relate to energy expended by cow in carrying out different functions
- Signals are small but recoverable

Halter and Accelerometer



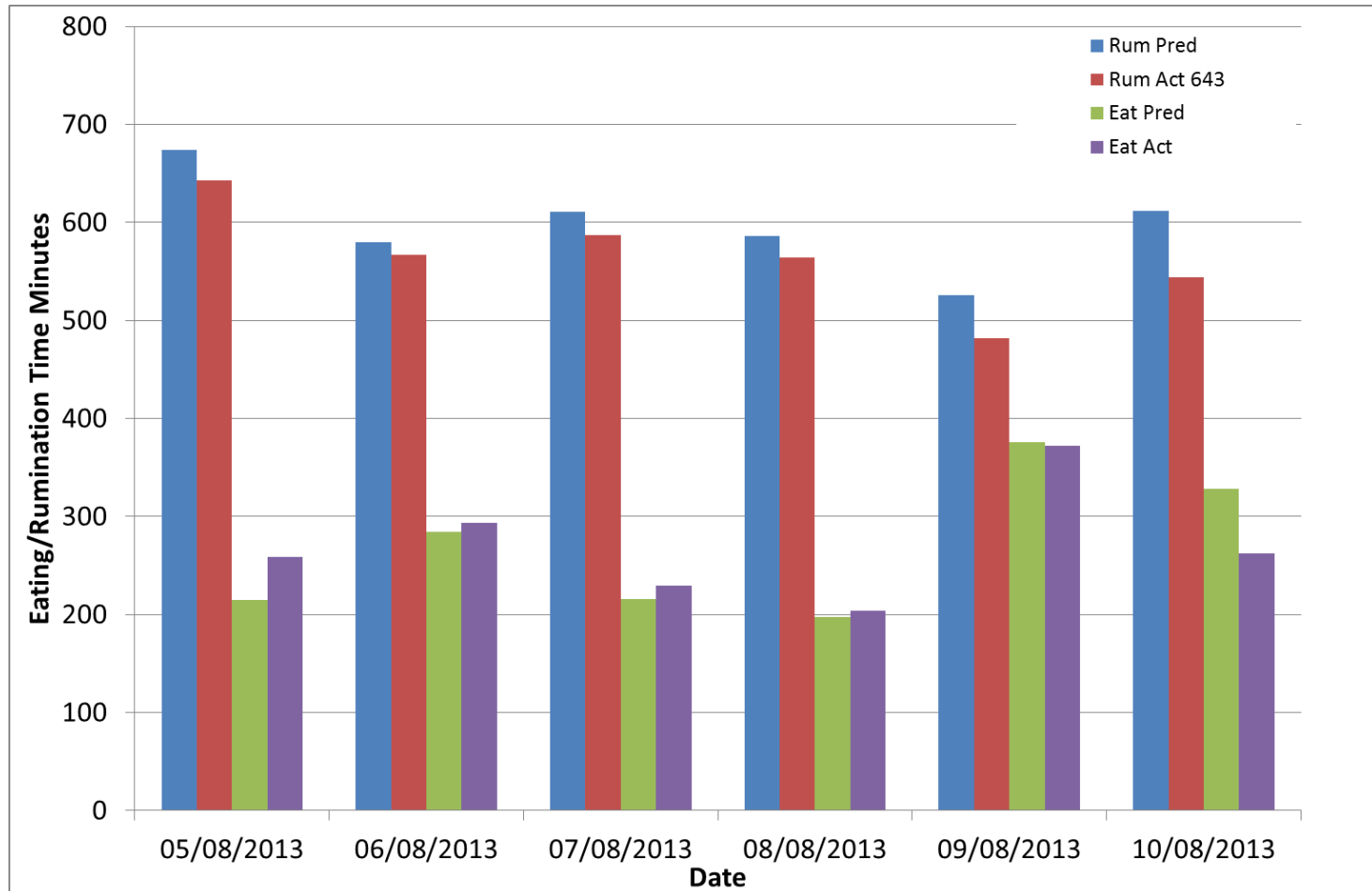
Clustering Procedure



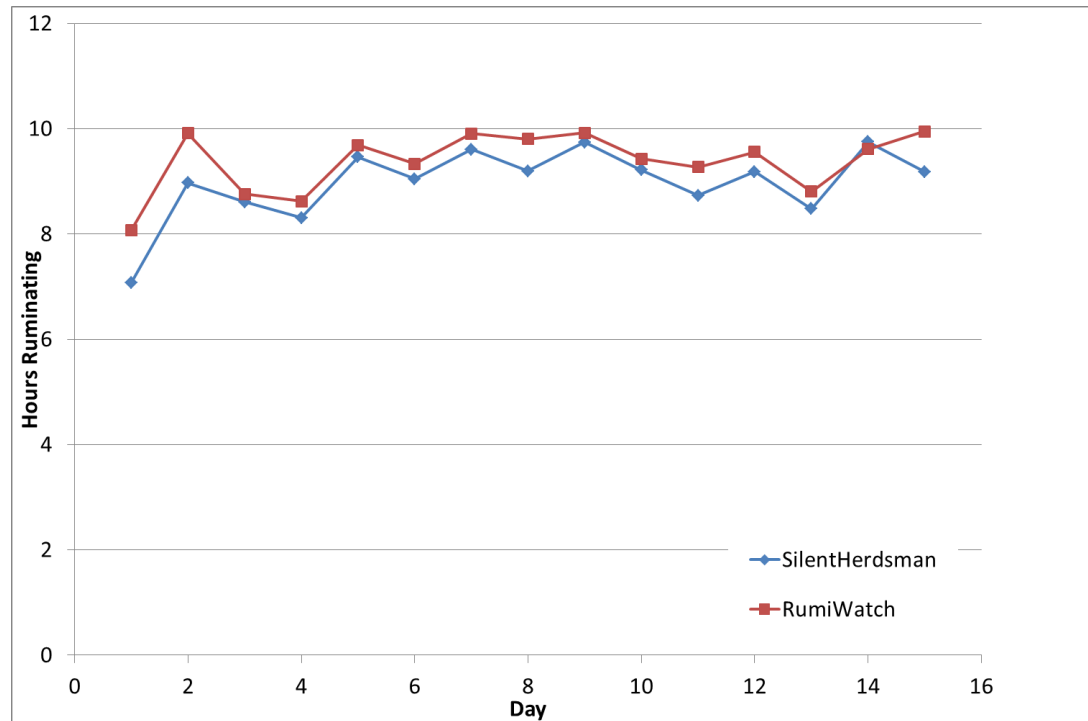
Performance

- Rumination
 - Sensitivity >85%
 - PPV >95%
- Eating
 - Sensitivity >85%
 - PPV >85%

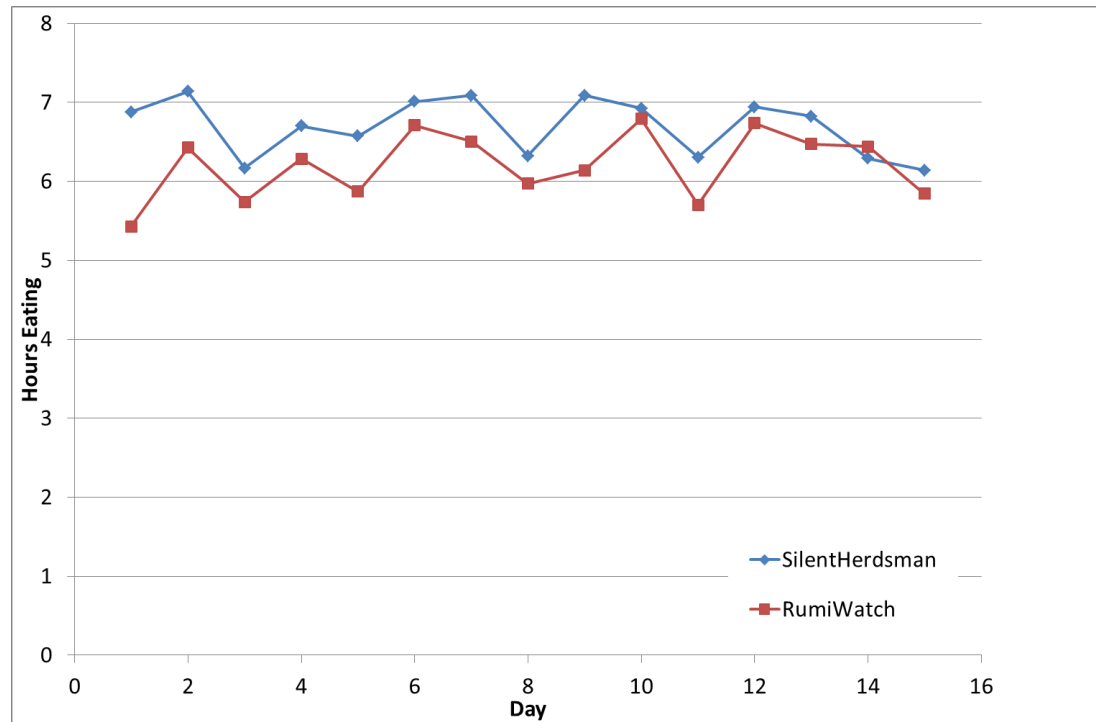
Performance



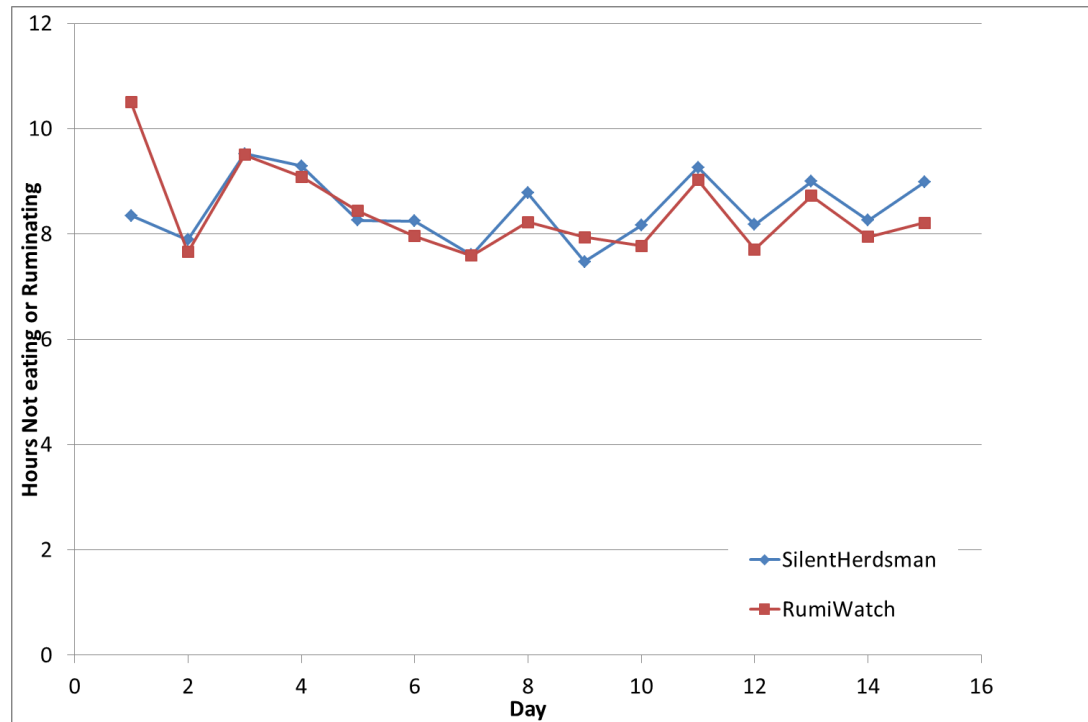
Ruminating



Eating



Other

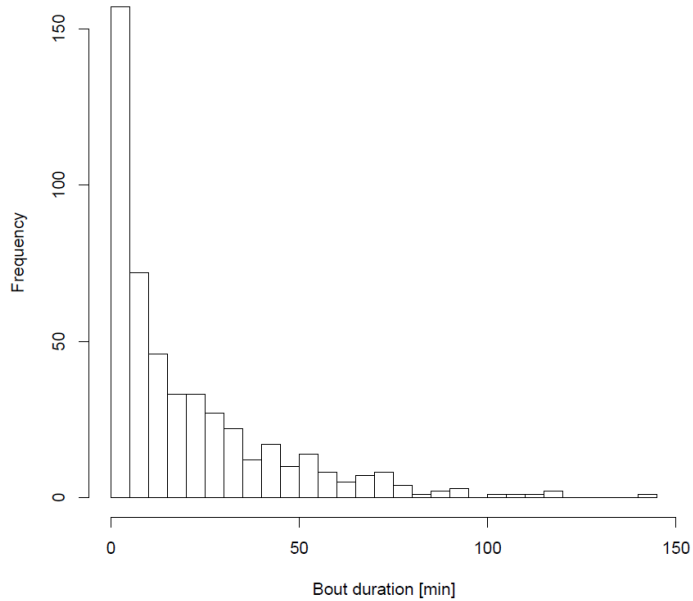


Conclusions

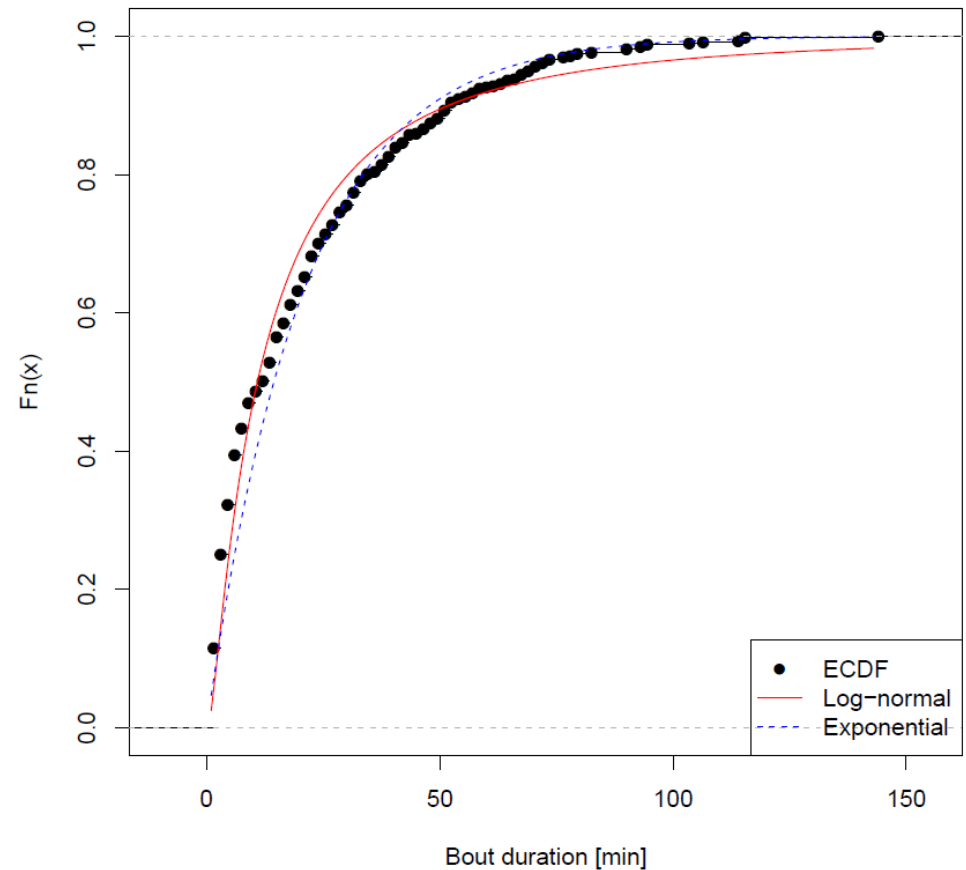
- Multiple behavioural states of individual animals can be derived from the raw data captured by a neck mounted 3-axis accelerometer
 - Heat detection
 - Eating times
 - Rumination times.....other?
- improved classification performance includes temporal behaviour

What next - eating

Histogram of feeding



CDF of feeding



Q-Q plot for feeding

