



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

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Outline

- Silent Herdsman
- Collar
- Illness
- Algorithm Development Methodology
- Classification
- Performance
- Conclusions

Silent Herdsman Platform

A neck mounted collar technology platform for animals continuously monitoring individual animal's activity and automatically detecting behaviour patterns

Silent Herdsman Platform

**Software
Management
Application**



Remote Connectivity

Base Station



Event



Collar

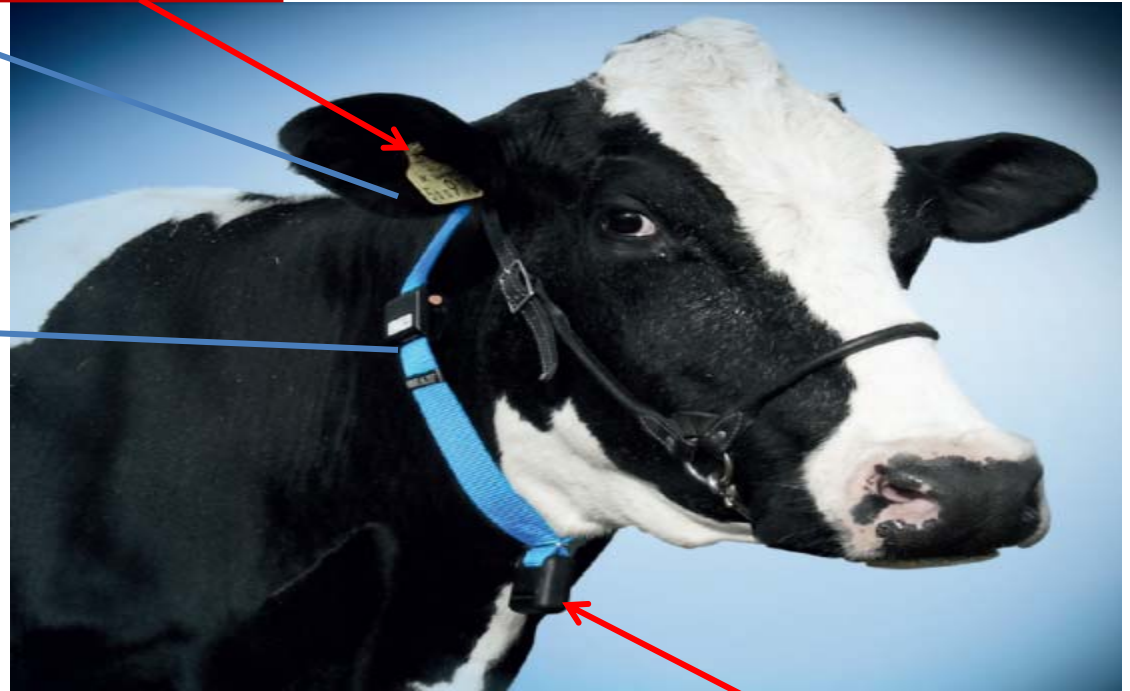
Sensor Platform
Model Outputs
Wireless Transmission



Data Management

Smart Collar

Location for
collar sensor



Weight

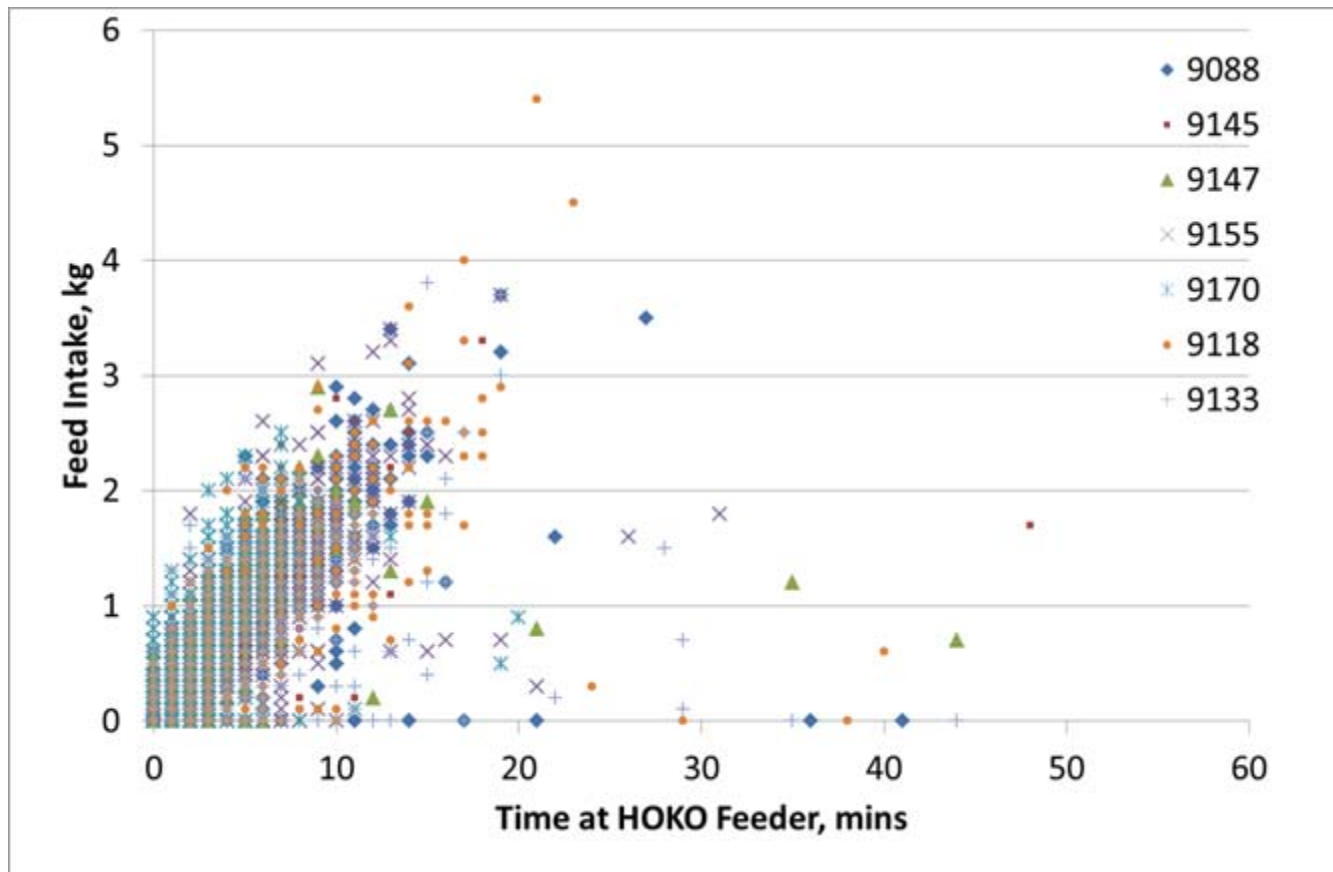
Best Indicator of Illness??

- Activity
 - sick cows tend to be less active
- Eating
 - sick cows tend to eat less
- Rumination
 - sick cows tend to ruminate less
 - is this because they eat less?

Can Eating Predict Illness?

- Is it possible to detect eating through changes in acceleration in a collar?
- Is it possible to relate those changes to differences in food intake?
- How well do these correlate?
- How well do they tie in with illness?

Feed Intake versus Time



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.....

'Rumiwatch' Halter

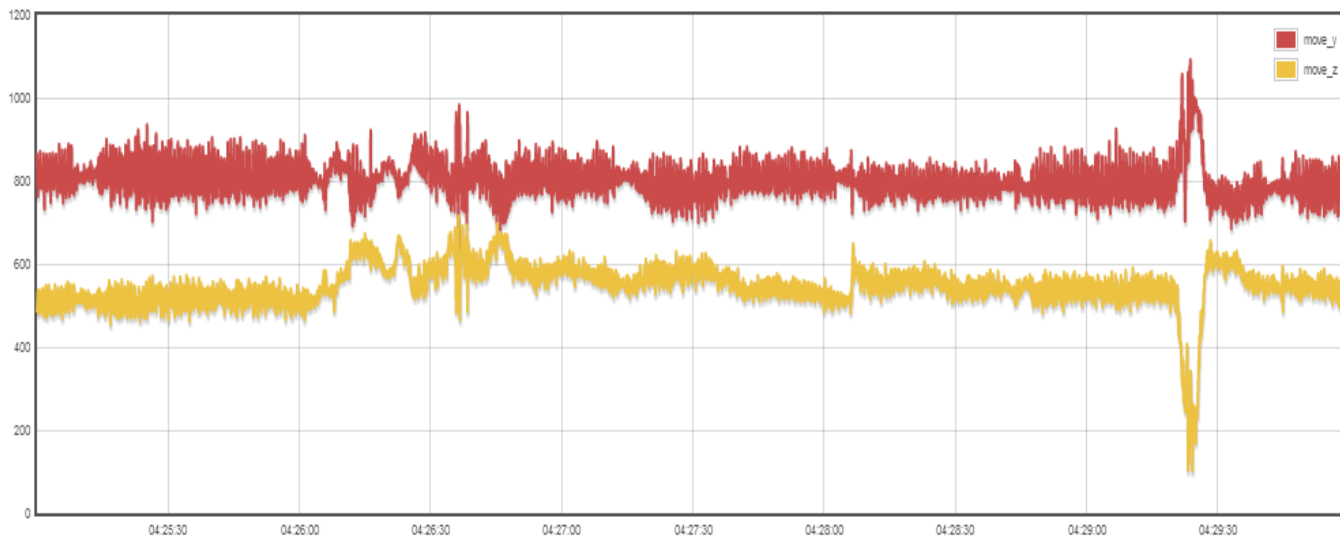


Raw 3-axis Accelerometer Output

Grazing Timeseries

Date From: To:

Time From: To:



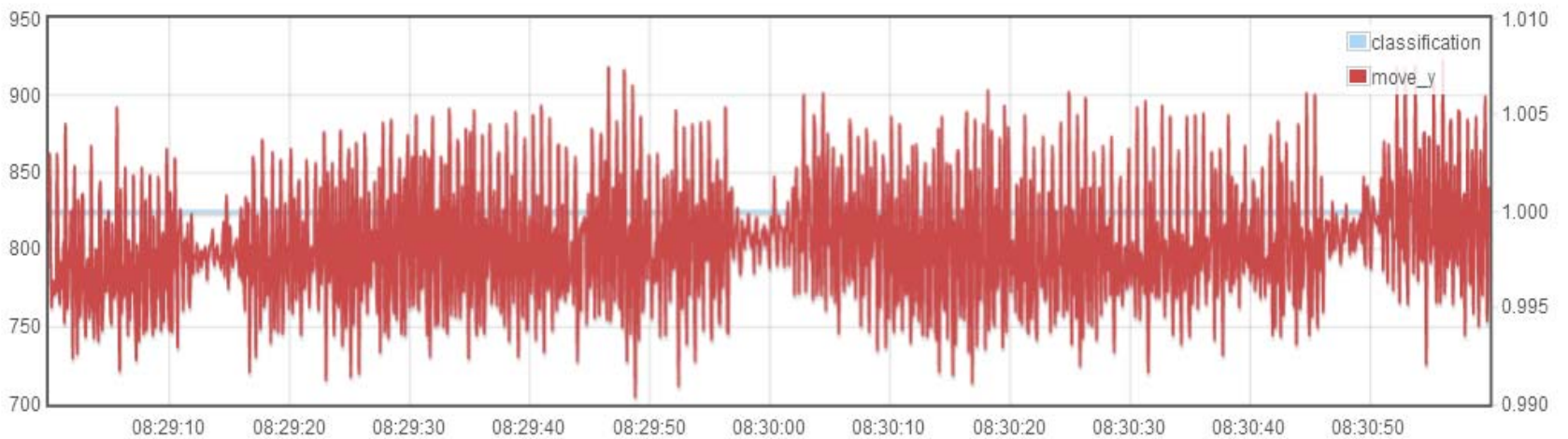
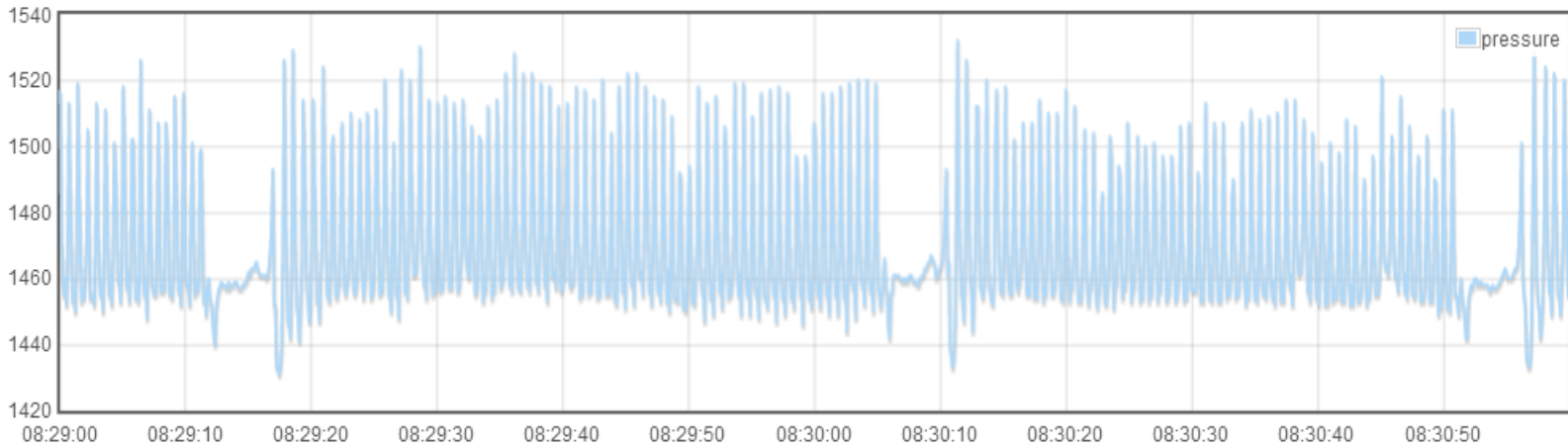
Choices:

- move_x
- move_y
- move_z

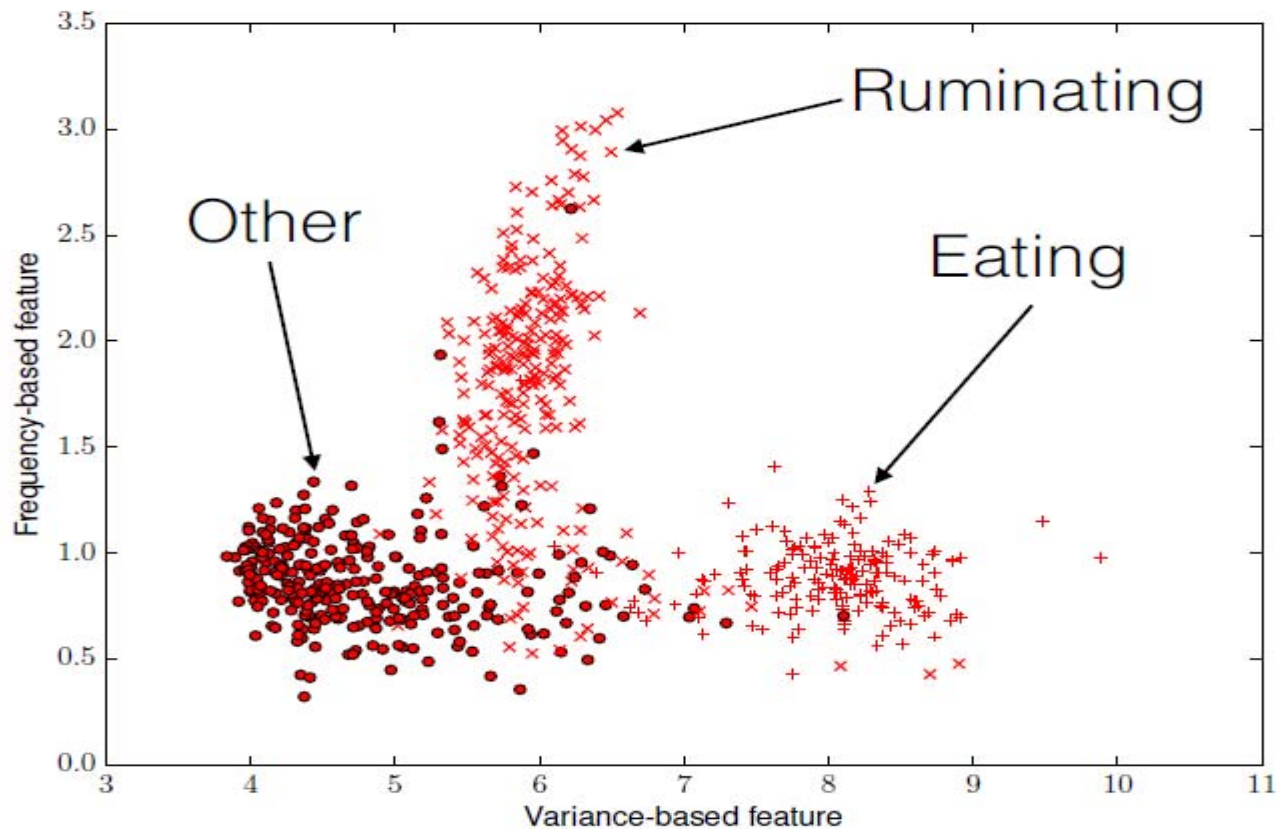
Feature Extraction

- Features relate to energy expended by cow in carrying out different functions
- Signatures are identifiable to the eye
- Problematic to quantify because they are non-stationary
- global head shifts massively distort statistics

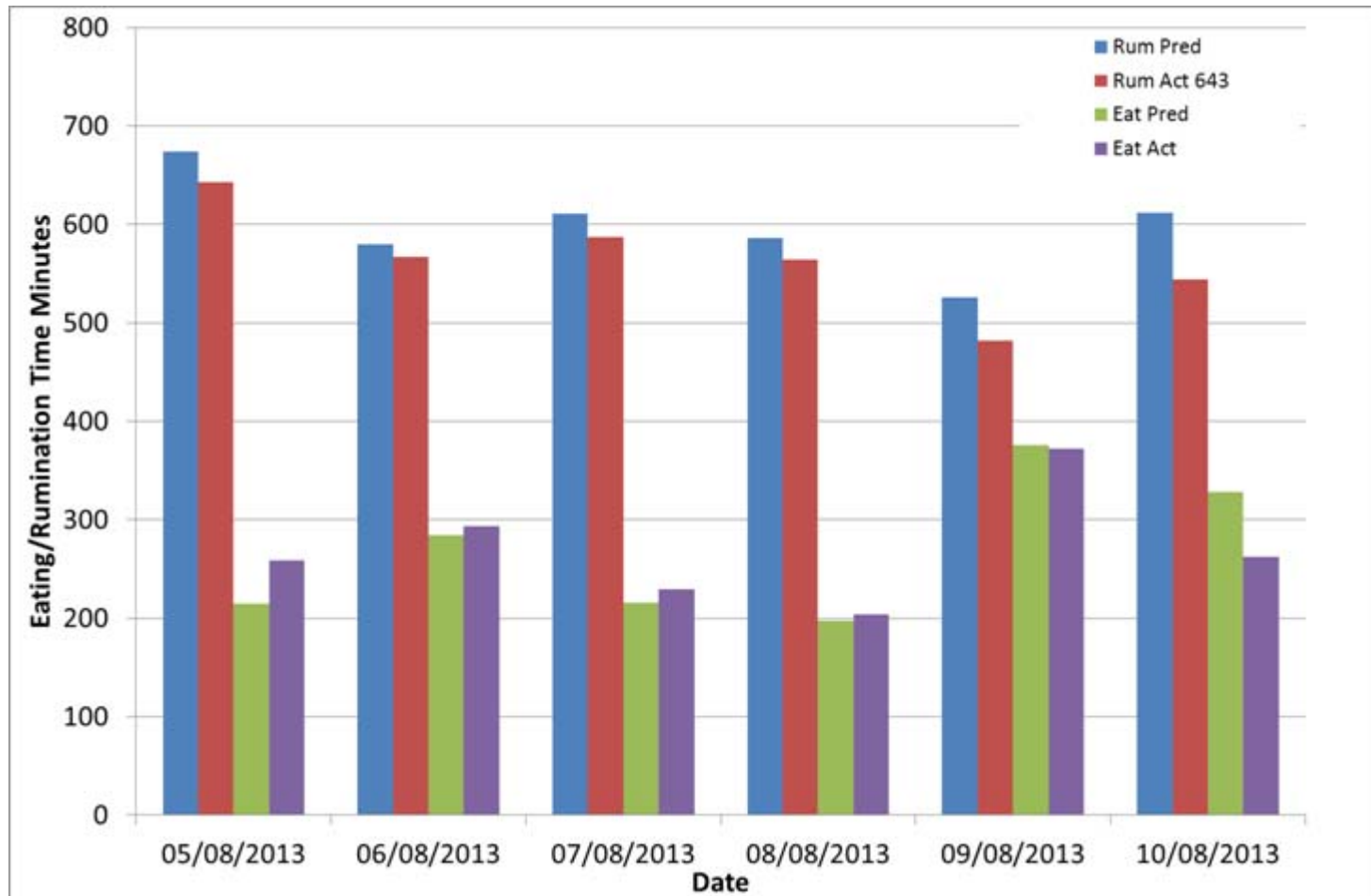
Halter and Accelerometer



Classification Results



Performance



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
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- A single sensor collar implementation can be used to provide multiple strands of valuable information on individual animal's conditions that supports the farmer in optimising the efficiencies of his business