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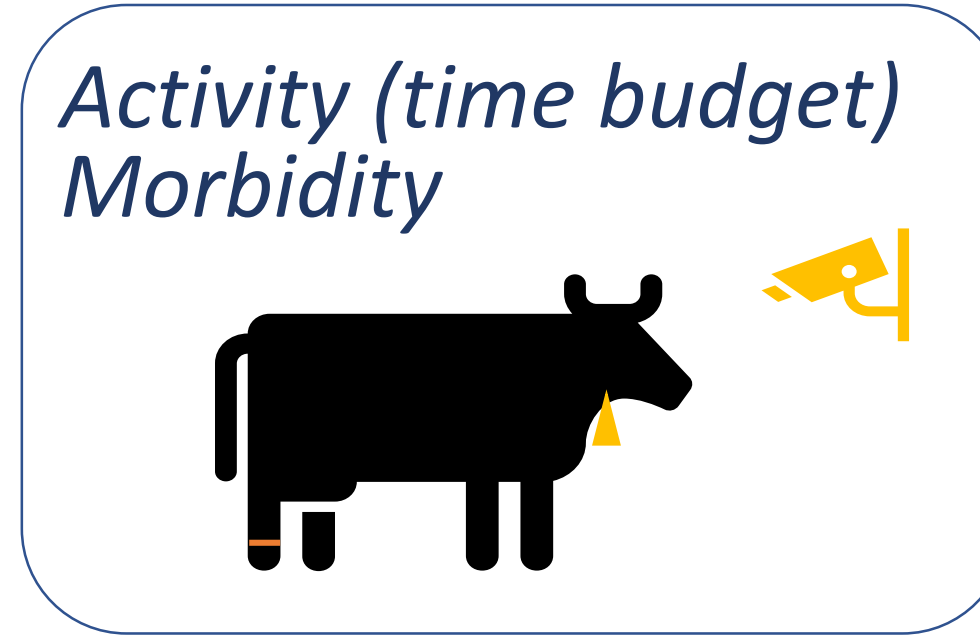
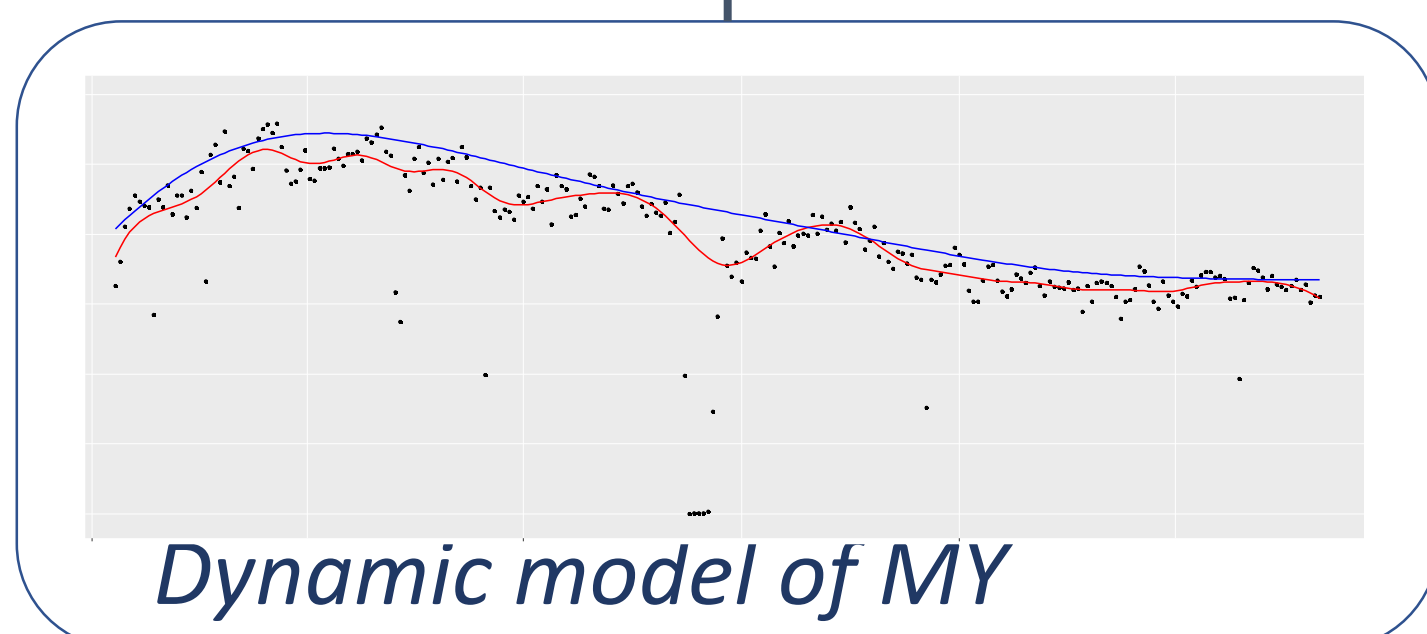
Analysis of dairy cows' activity using a hybrid modelling approach for the early detection of health problems

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Early detection of disease in animals allows farmers to refine the use of medicines and enables early intervention, reducing the potential pain an animal will experience. Animal activity is one indicator of the state of wellbeing of the animal, and one of the first indicators of the degradation of health and welfare in animals. The objective of this work is to study the potential of individual times-series activity data to forecast degradation in health state of dairy cows.

Early detection of perturbations

Dynamical model of performance provides new data derived from model hypotheses, such as time of disturbance and the animal perception of the environment.



Parameters to be fixed :
Input duration
Output duration
Health problem



Early detection

Example. Early detection of Mastitis from routine monitoring data

350 dairy cows from experimental farm Thiverval-Grignon (France)

- Number of steps, lying time, changes of position
- Duration at feeders and number of visits
- Morbidity reports

Random Forest Algorithm

Resulting dataframe combining all extracted intervals from all animals

| input | output |
|--------------------------------|---------------------------------------|
| ⋮ | ⋮ |
| sensor data from input k | 0 or 1 (mastitis in output k ?) |
| sensor data from input $k + 1$ | 0 or 1 (mastitis in output $k + 1$?) |
| sensor data from input $k + 2$ | 0 or 1 (mastitis in output $k + 2$?) |
| ⋮ | ⋮ |

| input length | output length | AUC Score |
|--------------|---------------|-----------------|
| 72 | 96 | 0.447755 |
| 72 | 120 | 0.647289 |
| 96 | 24 | 0.5712 |
| 96 | 48 | 0.615797 |
| 96 | 72 | 0.544339 |
| 96 | 96 | 0.550918 |
| 96 | 120 | 0.607423 |
| 120 | 24 | 0.665554 |
| 120 | 48 | 0.685845 |
| 120 | 72 | 0.550856 |
| 120 | 96 | 0.578437 |
| 120 | 120 | 0.622143 |

AUC is used to measure the performance of the predictor.

Conclusion and perspectives

- The moderate value of AUC is related to the small number of mastitis cases in the dataset.
- The larger is the size of training sample the more robust is the predictor.
- Using deviations of milk yield as objective measures of environmental disturbances.

Interested to test the algorithm on your dataset?
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