Identifying and characterizing disturbances from high-throughput phenotyping data

Vincent Le, Tom Rohmer, Ingrid David

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Introduction

Precision farming systems: Longitudinal data

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Qualify the robustness (response to disturbances), need to know the nature of disturbances

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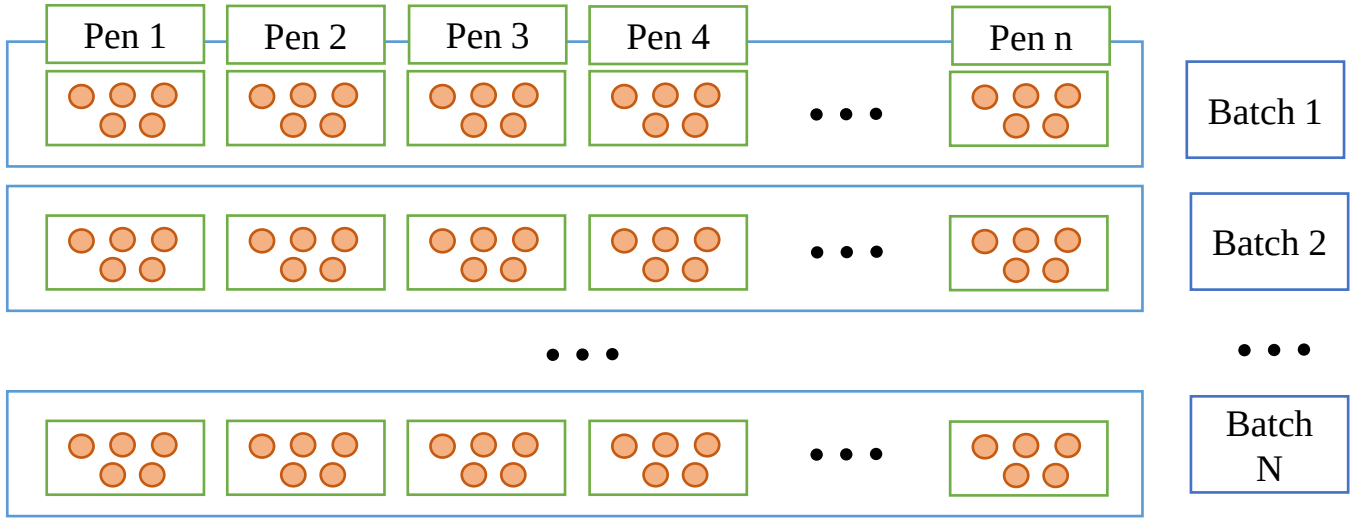
Disturbance unknow

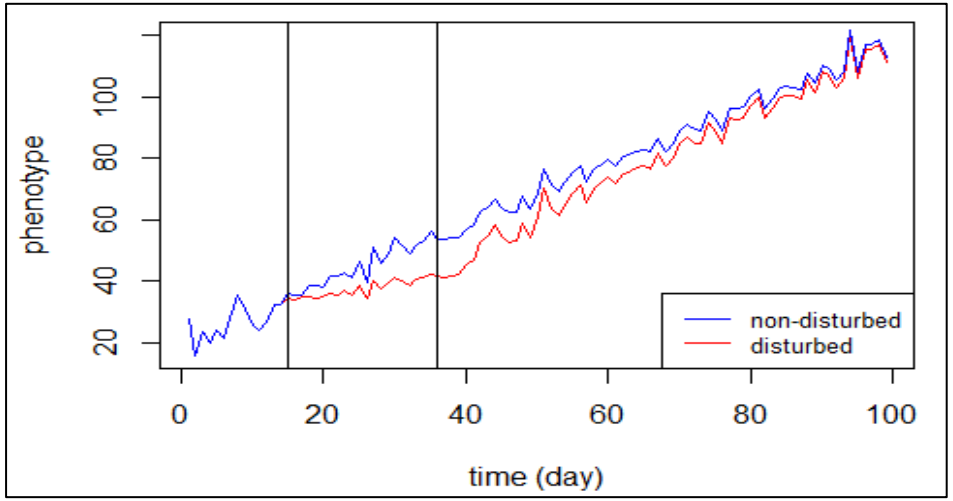
⇩

Up & Down Method

(On the data of individuals which are distributed in different batches and pens)

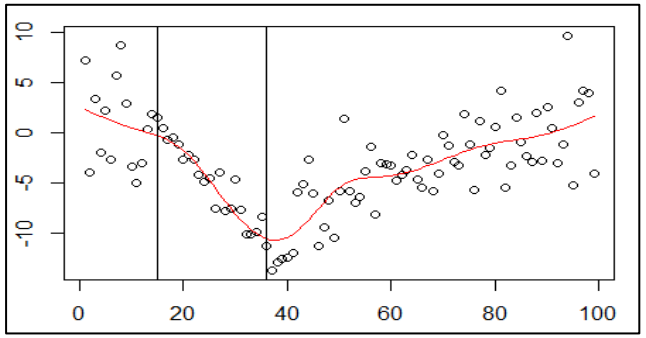
- Identify disturbances in different level
- Characterize and validate disturbances detected



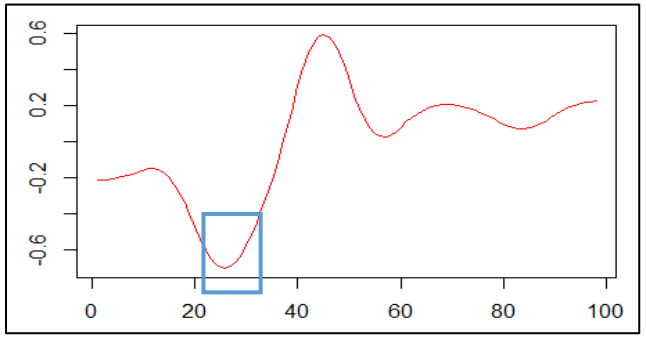


Method Up & Down

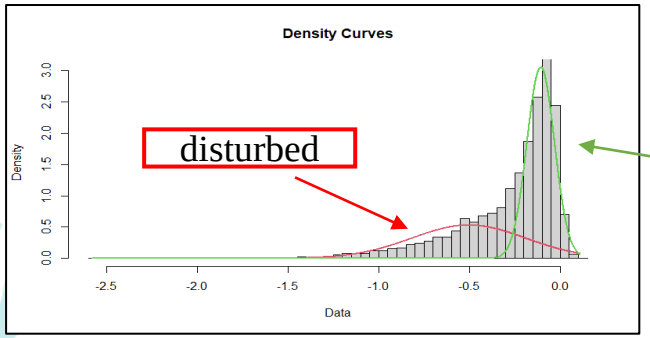
Corrected phenotype



Smoothing



Extract the minimum of the slope (first derivative)



Mixture model to separate in 2 populations

UP

Batch (Median of pens within batch)

Pen (Median of individuals within pen)

Individual

DOWN

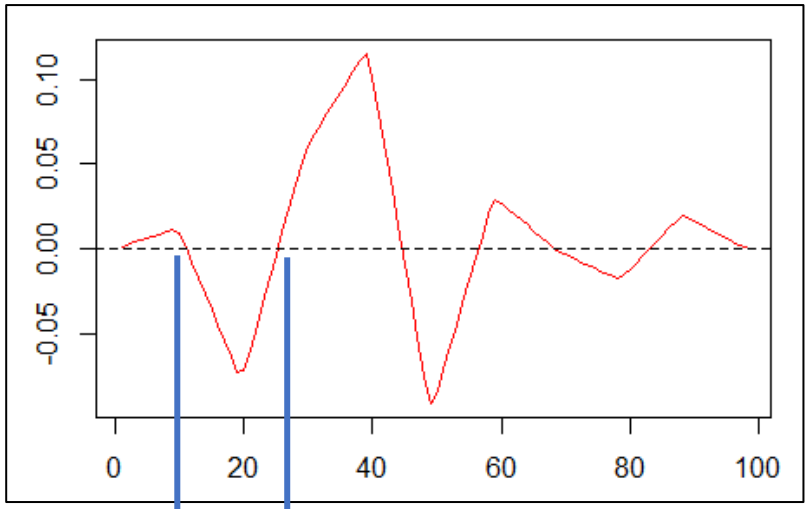
Batch

Pen

Individual

Detect the moment of the disturbance(s) that the pen (or individual) had to face thanks to the second derivative combined with the value of the slope at that time

Second derivative



Moment of perturbation 1

Moment of perturbation 2

This part allows:

- To validate detected disturbances
- To show the number of disturbances that the element had to face

Results

Qualification – Non-parametric smoothing method Nadaraya-Watson (300 simulations)

	Specificity	Sensibility
Batch	0.98	0.9
Pen	0.92	0.71
Individual	0.96	0.39

- **Sensibility:** the probability to detect an element when it is really disturbed
- **Specificity:** the probability to not detect an element when it is really not disturbed

Simulations

- 20% of perturbation in each level (individual, pen and batch)
- Intensity of a disturbance varies from 0.5 to 2.5
- Duration of a disturbance varies from 1 to 25 days

Others tested strategies to identify disturbed animals/pens/batches

- Work on Residuals (Variance & Autocorrelation & Symmetry)
- Work on Coefficient of variation

Conclusion & Perspectives

- The Up & Down method is promising for simulated data
- Work on real data