Early disease detection for weaned piglets

EAAP - 2019

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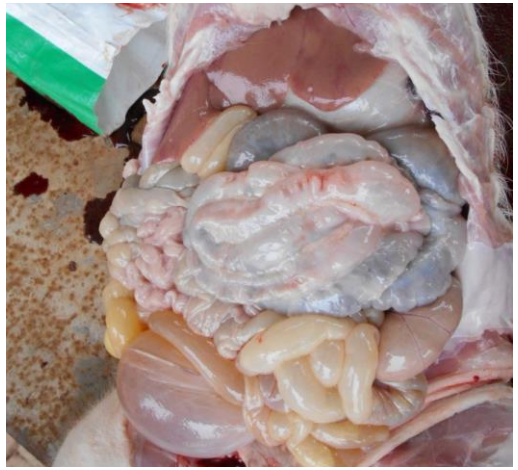
Today, late detection of pathology

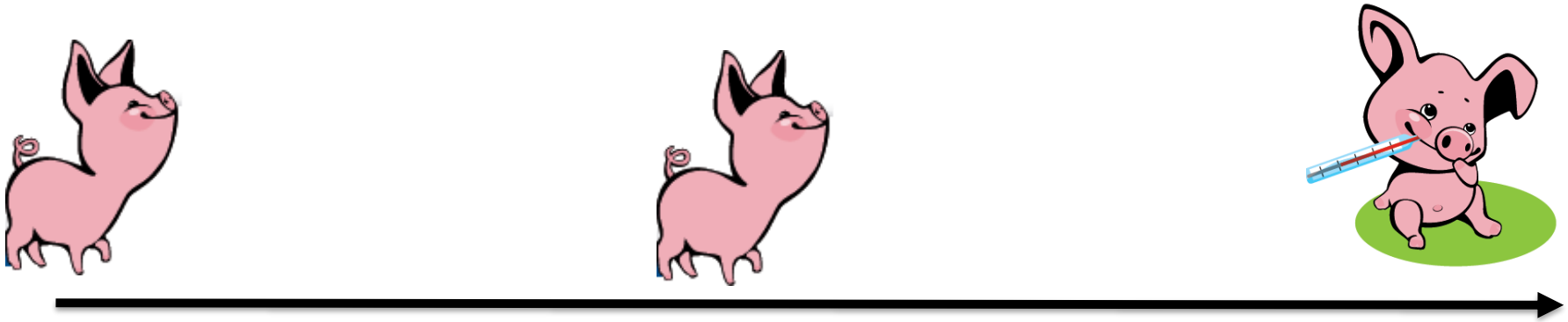


Many sick animals

Severe lesions

Hard or long recovery

What is early detection of pathology ?



Healthy

Sick without clinical signs

Sick with clinical signs

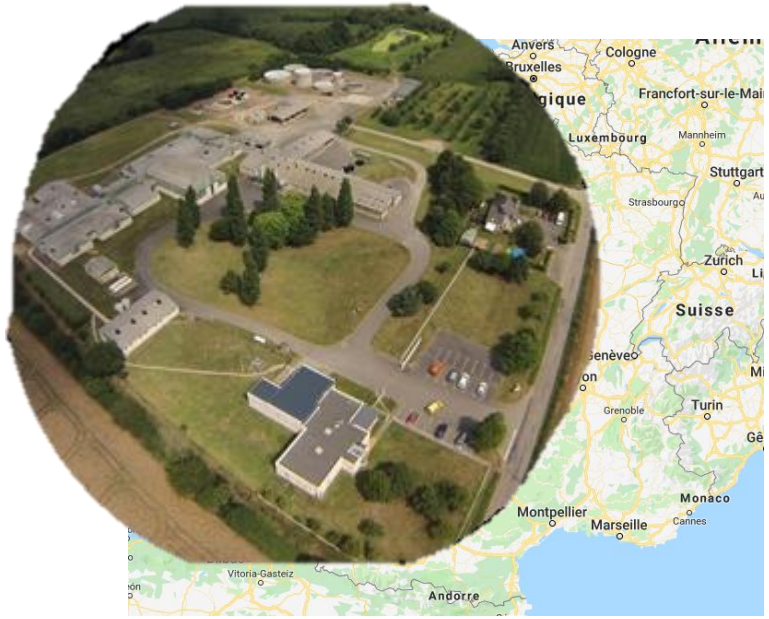
Early detection of pathology

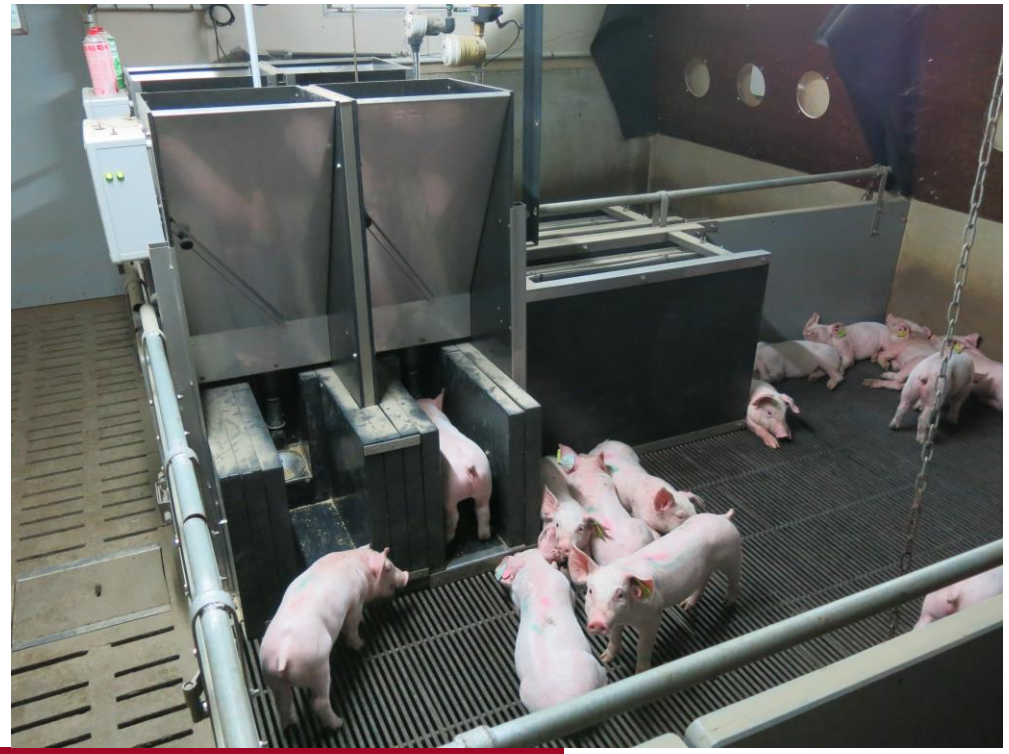
Late detection of pathology

- ↓ spread of disease
- ↓ number of pigs to treat
- ↓ dosage of antibiotics
- ↑ welfare and performances

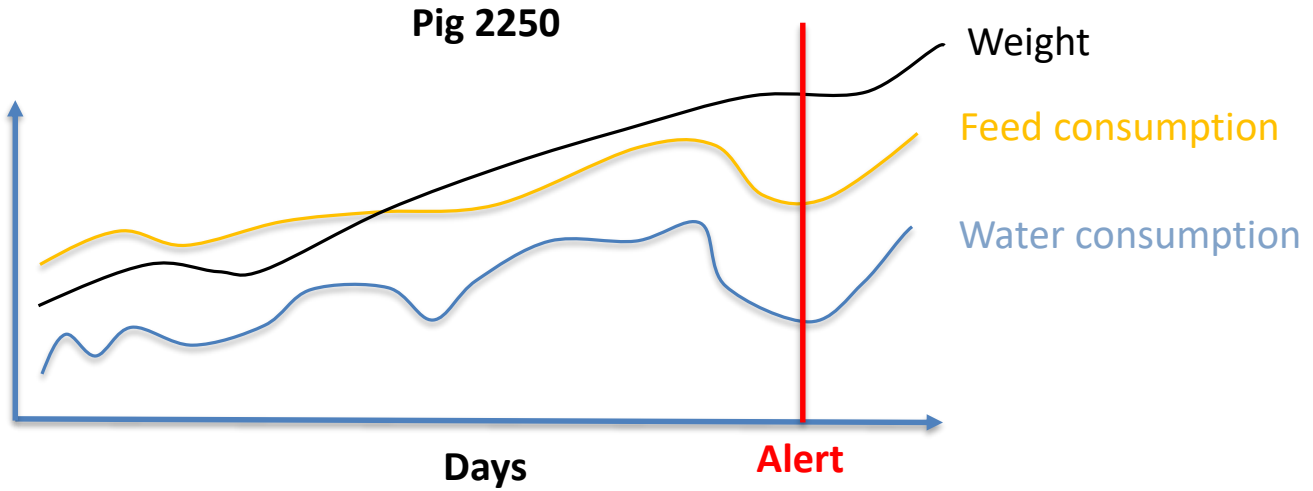
Our method to detect pathology earlier

- Ifip's experimental farm
  - PigletDetect
  - Two batches of 102 piglets
  - 17 piglets per pen





Our method to detect pathology earlier



Connected drinker

Connected feeder

Connected weighing station

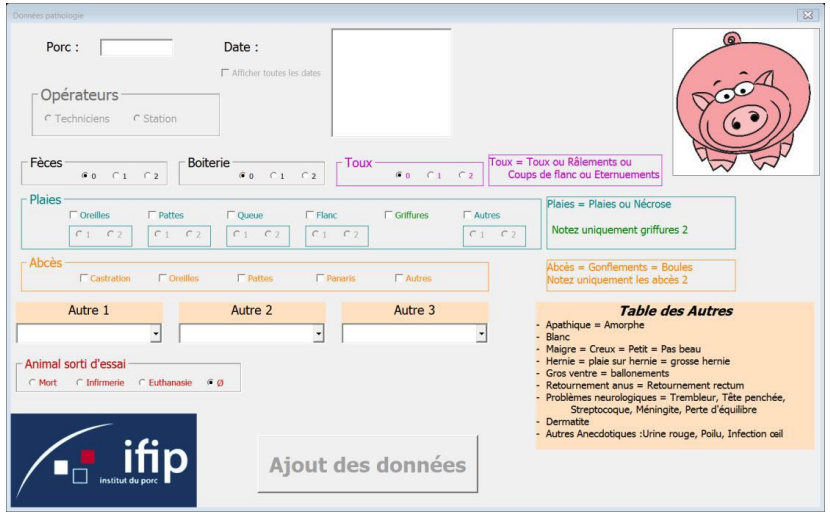
Our method to detect pathology earlier

- Data Processing

Our method to detect pathology earlier

Database design

➔ **what data are stored and how they interrelate**

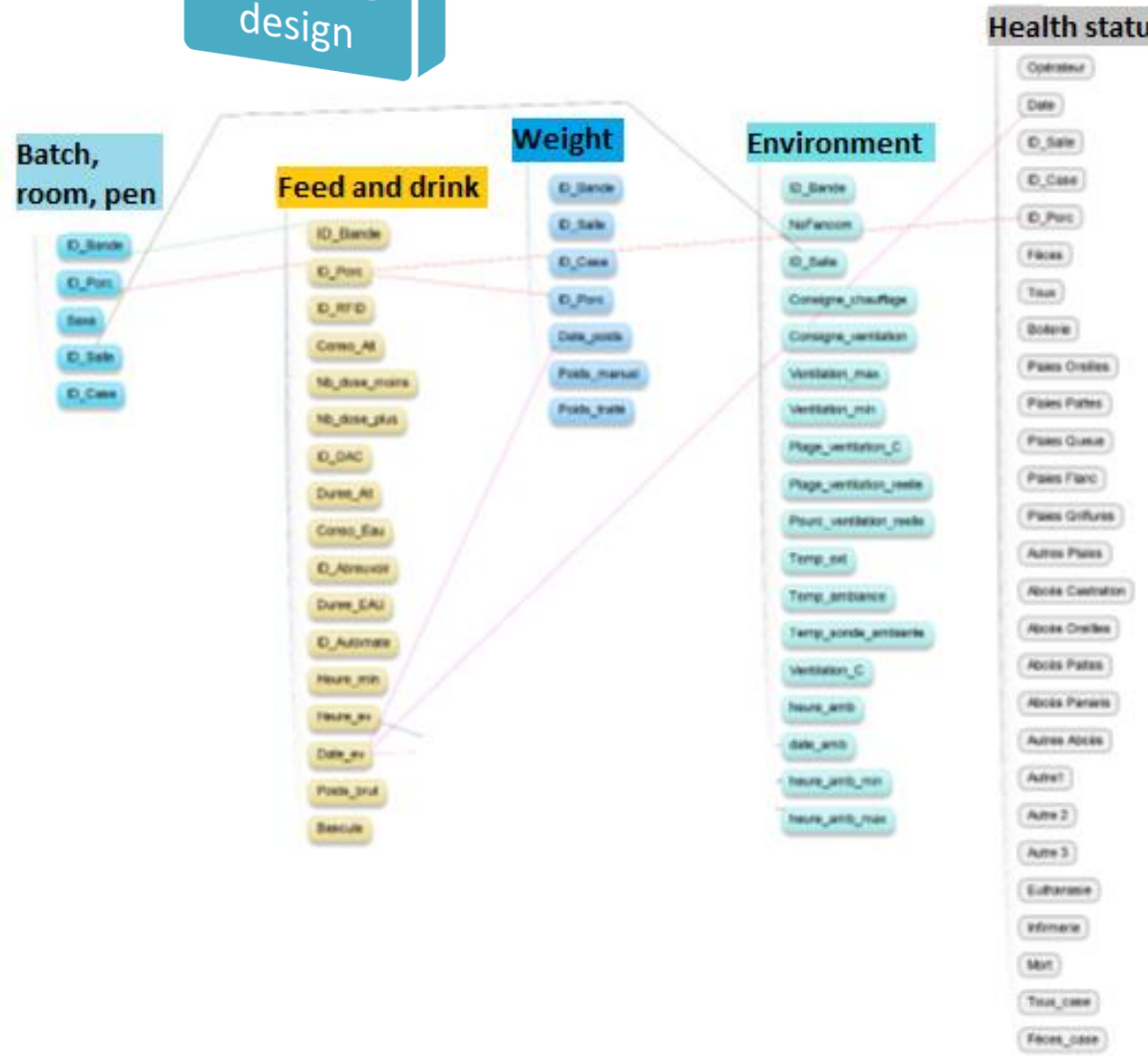


Health status scoring
Scores = 0, 1 or 2

Clinical observations: 5 days/week x 5 weeks

Our method to detect pathology earlier

➔ **what data are stored and how they interrelate**



54 variables
600 000 rows for 204 pigs

Our method to detect pathology earlier

- Selection of the most relevant existing variables and creation of others
- Examples :
  - Data aggregation over 6 hours → 600 000 to 28 600 rows
  - 1 weight / piglet / day
  - Sick animal = each day, ∑ scores (digestive, respiratory and lameness) ≥ 2

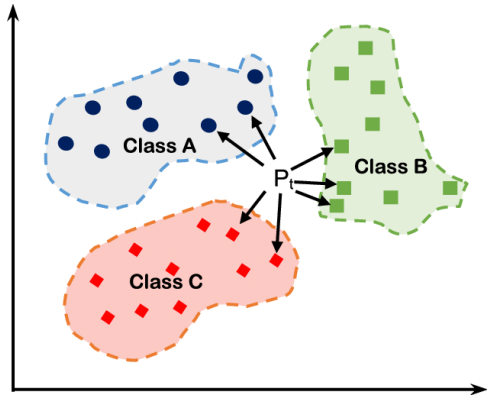
- Use of "lag functions" to take into account historical data in the detection of a change in a pattern : data of the 6-hours-period into each day were linked

Our method to detect pathology earlier

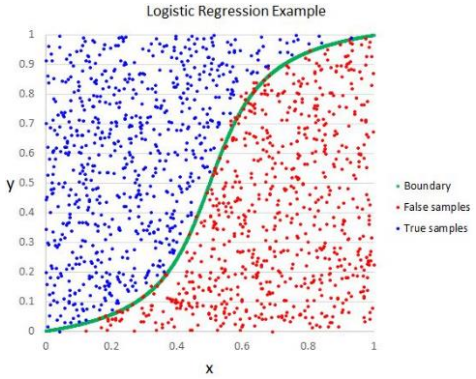
Model building and testing

- ➔ Database was split into 70 % for learning & 30 % for testing
- ➔ The learning base was split itself into 10 random samples
- ➔ 9 methods were tested on each sample

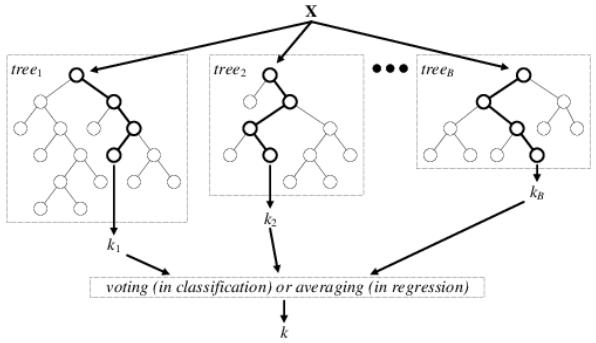
KNN



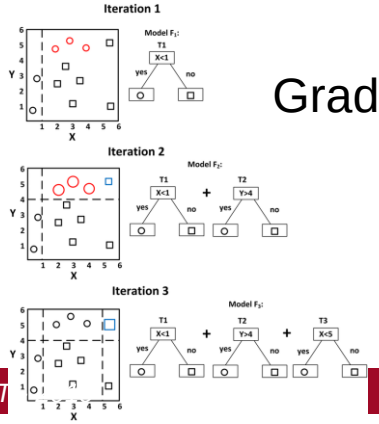
Logistic regression



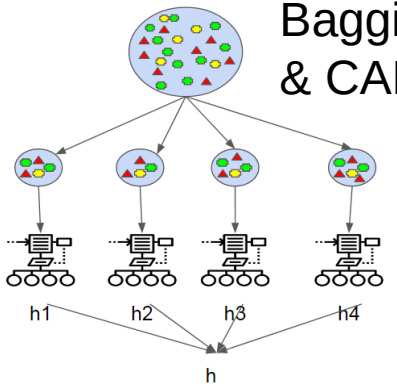
Random forest



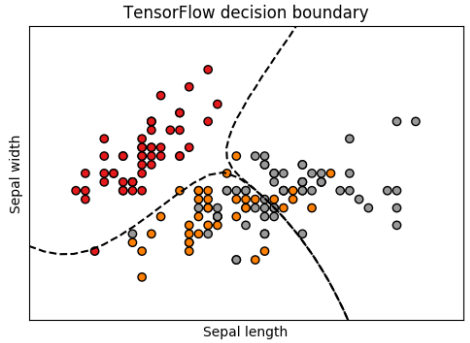
Gradient Boosting



Bagging CART & CART



Naive Bayes



Our method to detect pathology earlier

The performances of the models (sensitivity and specificity) were described by a confusion matrix

Predicted condition given by the model	Actual condition given by human observations	
	Sick	Healthy
Sick	True positive	False positive
Healthy	False Negative	True negative

Sensitivity

Specificity

Results

➔ Partial results concerning model's performances

	Sensitivity	Specificity
Bagging	83 %	92 %
KNN-3	88 %	81 %
KNN-5	86 %	80 %
KNN-8	83 %	78 %
Random Forest	69 %	93 %
Naive Bayes	61 %	56 %
Logistic Regression	29 %	85 %
CART	19 %	97 %
Gradient Boosting	14 %	99 %

Discussion

- Good performances but
  - PigletDetect was a first step in experimental conditions
  - Here, results came from 2 batches in the same farm / health status/ room / genetic, … → model could be less robust in other conditions.
  - The model will soon include
    - the other batches used in this project
    - Other statistical methods tested by INRA, partner of the project

And now

HealthyLivestock
健康畜禽

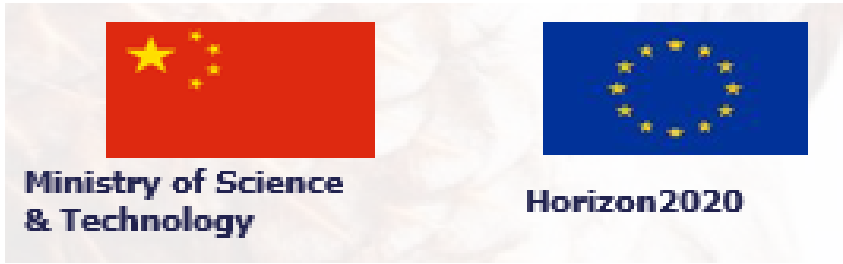
- New batches
  - Of weaned piglets and **fattening pigs**

- Add 2 new monitorings
  - Activity level
    - Accelerometers
    - Cameras
  - Coughing

- Validation in a commercial farm

Thanks

- To our funders and partner



Merci de votre attention

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