Anticiper Fédérer et accompagner

CT calibration as against dissection

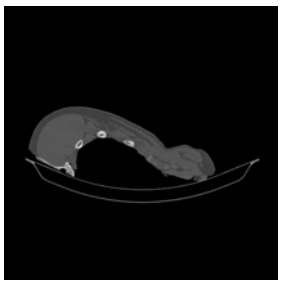
Gérard DAUMAS

2nd CT Workshop on pig classification
16/04/09 – Monells

Dissection

Example of a belly

CT imaging



CT calibration as against dissection

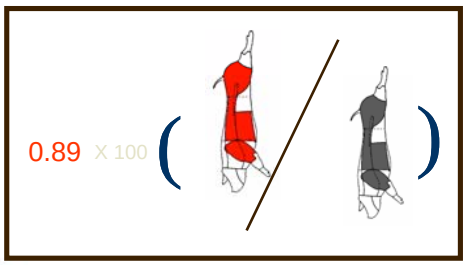
(Y) Dissection ~ (X) CT input

Some issues

- Which Y from the dissection ?
- Which Xi from the CT ?
- Which model (~) ?
- Which constraints from the general framework ?
- How to estimate the model's parameters?
- How to validate the estimations ?
- How to sample ?

LM% definition from simplified (2006) to full dissec.(2009)

Muscle weight / carcass weight



Input from the CT

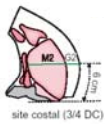
Levels of grey
LM muscle
LM %

Which model ?

- Which Xi from CT ?
  LM%, LMvolume, levels of grey, …
- Which Y from dissection ?
- Linear models:
  - LM% ~ LM%CT
  - LMweight ~ LMvolume
  - LMweight ~ Hounsfield Values
  - LM% ~ Hounsfield Values

Classification background

Example of CGM method in France



LM% prediction

$$LM\% = 62.19 - 0.729\ G2 + 0.144\ M2$$

3 compulsory constraints

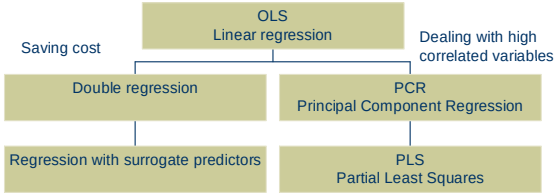
- LM% is assessed by means of authorised grading methods
- Only statistically proven assessment methods may be authorised
- Authorisation is subject to compliance with a maximum tolerance for statistical error

EU requirements for calibrating classification instruments

- Representative sample
- N > 120 or n1 > 50 if Double Regression
- A proven statistical procedure
- RMSEP < 2.5

« Proven statistical methods »

(see Statistical Handbook - Causeur et al, 2003)



An additional constraint

- EUPIGCLASS recommendations have led to changes in the EU regulations
- Total (full) dissection may be replaced by CT on the condition that satisfactory comparative dissection results are provided

2 steps including CT

- CT calibration as against dissection
- Classification instrument calibration as against CT



2 ways to calibrate classification instruments (1)

- 2 separate calibrations implying 2 separate samples
  - Regression with surrogate predictors (1996)
  - Two-phase updates based on reference predictors (Statistical Handbook, 2003)
  - Linear regression models under conditional independence restrictions (Causeur & Dhorne, 2003)

2 ways to calibrate classification instruments (2)

- 2 joined calibrations implying 1 global sample and 1 subsample
  - Double regression

A double regression scheme

Carcass	F	M	CT	LM%
1	x	x	x	x
2	x	x	x	x
...	x	x	x	x
50	x	x	x	x
61	x	x	x	
...	x	x	x	
...	x	x	x	
120	x	x	x	

LM% ~ CT + F + M

CT ~ F + M

LM% ~ F + M

Drawbacks :

• CT calibration may depend on the tested classification instrument

•All the instruments must be included in the CT calibration experiment

A 2-phase scheme

Dissection trial (CT calibration)

Carcass	CT	LM%
1	x	x
2	x	x
...	x	x
N	x	x

LM% ~ CT

Trial for instrument 1

Carcass	F1	M1	CT
1	x	x	x
2	x	x	x
...	x	x	x
50	x	x	x
61	x	x	x
...	x	x	x
...	x	x	x
120	x	x	x

CT ~ F1 + M1

LM% ~ F1 + M1

Trial for instrument 2

Carcass	F2	M2	CT
1	x	x	x
2	x	x	x
...	x	x	x
50	x	x	x
61	x	x	x
...	x	x	x
...	x	x	x
120	x	x	x

CT ~ F2 + M2

LM% ~ F2 + M2

Validation

- A criterion of prediction: RMSEP
- Implication: random sample
- Full cross-validation = leave-one-out
- Or calibration & validation datasets, but more expensive

Robust estimation

- A certain proportion of spoiled data

1. Use a robust method (LTS regression) to identify influential data
2. Decide on each of these data
3. Perform classical LS on the restricted dataset
4. Calculate RMSEP with the suspicious data

Sampling

- Random sample
- Selection of LM volume: not very useful & difficult in practice
- Stratification of important factors influencing muscle density (if applicable)

Conclusions

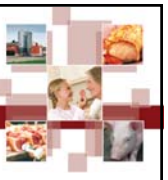
- There are numerous possibilities for calibration
- A natural option is:
  LM% = LMw / Cw = dM x (LMv / Cw) + error
- Both calibrations can be performed separately because the hypothesis of conditional independence holds
- An update is needed only if the factors influencing muscle density have changed significantly

Next steps

- To agree on rules for calibrating CT against dissection
- To transform CT from a secondary to a primary reference

ifip institut du porc

Anticiper | Fédérer et accompagner



Thank you for your attention !

Gérard DAUMAS
gerard.daumas@ifip.asso.fr