Testing the performance of the Sow Stance Information System (SowSIS) to automatically detect lameness in breeding sows

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Why detect lameness in sows?

Pain and stress

Early culling

Lameness

Production decrease

Costs

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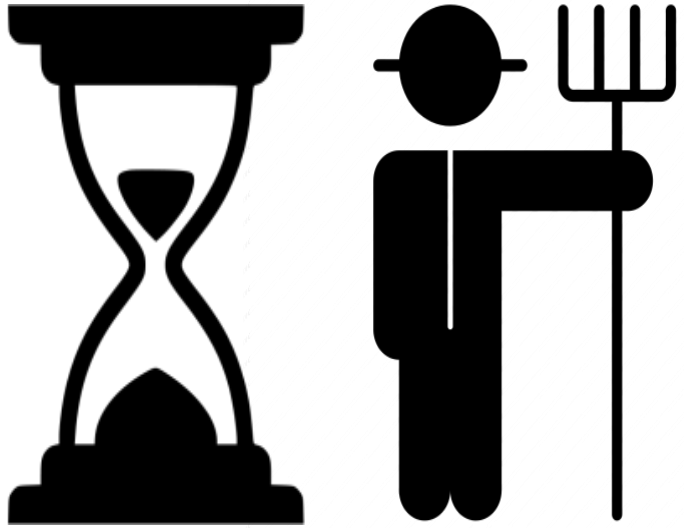
Why is lameness difficult to detect?

Sows rest most of the day

Pigs hide lameness



Time consuming and subjective

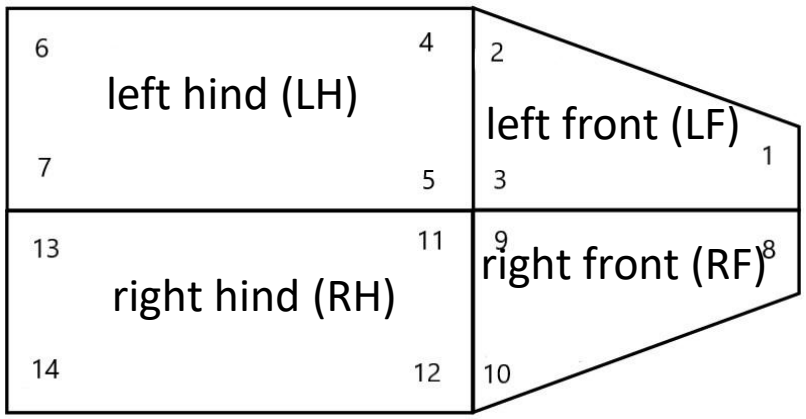
Aims of the study

Can we correctly identify lame sows using SowSIS data?

Can we train the SowSIS to correctly identify the lame leg?

Automatic lameness detection: SowSIS

- Force plate system: data output in kg per leg
- Multiple load cell-mounting
- Built into electronic sow feeder (ESF)
- Daily non-invasive stance data of individual sows during feeding visits



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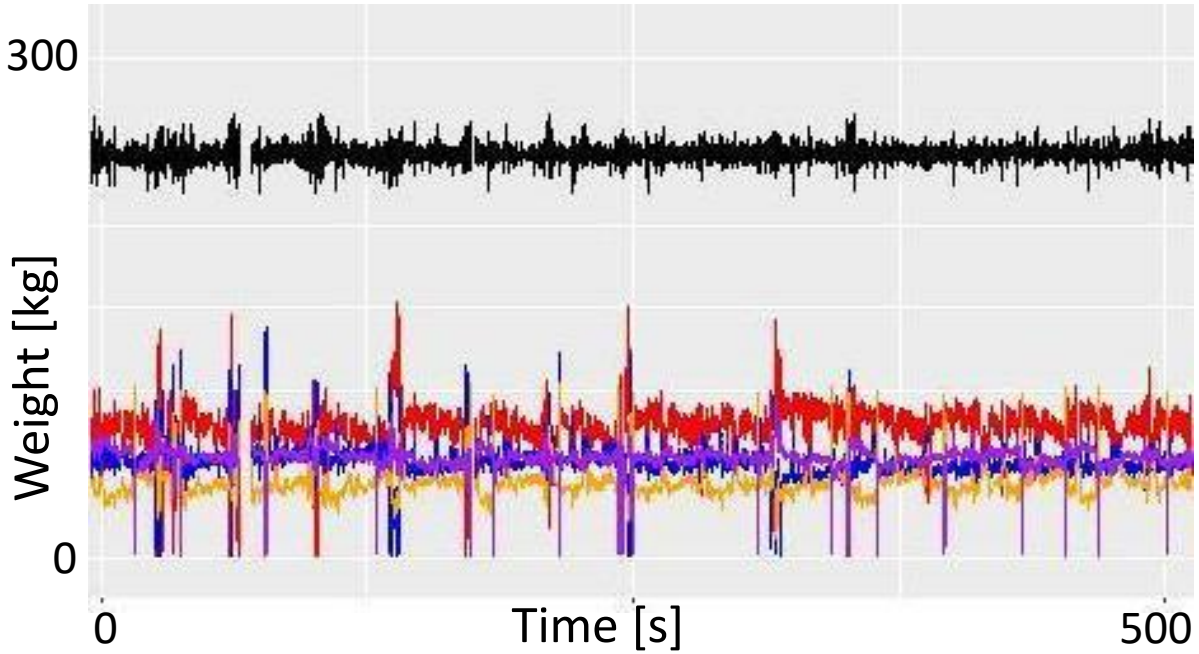
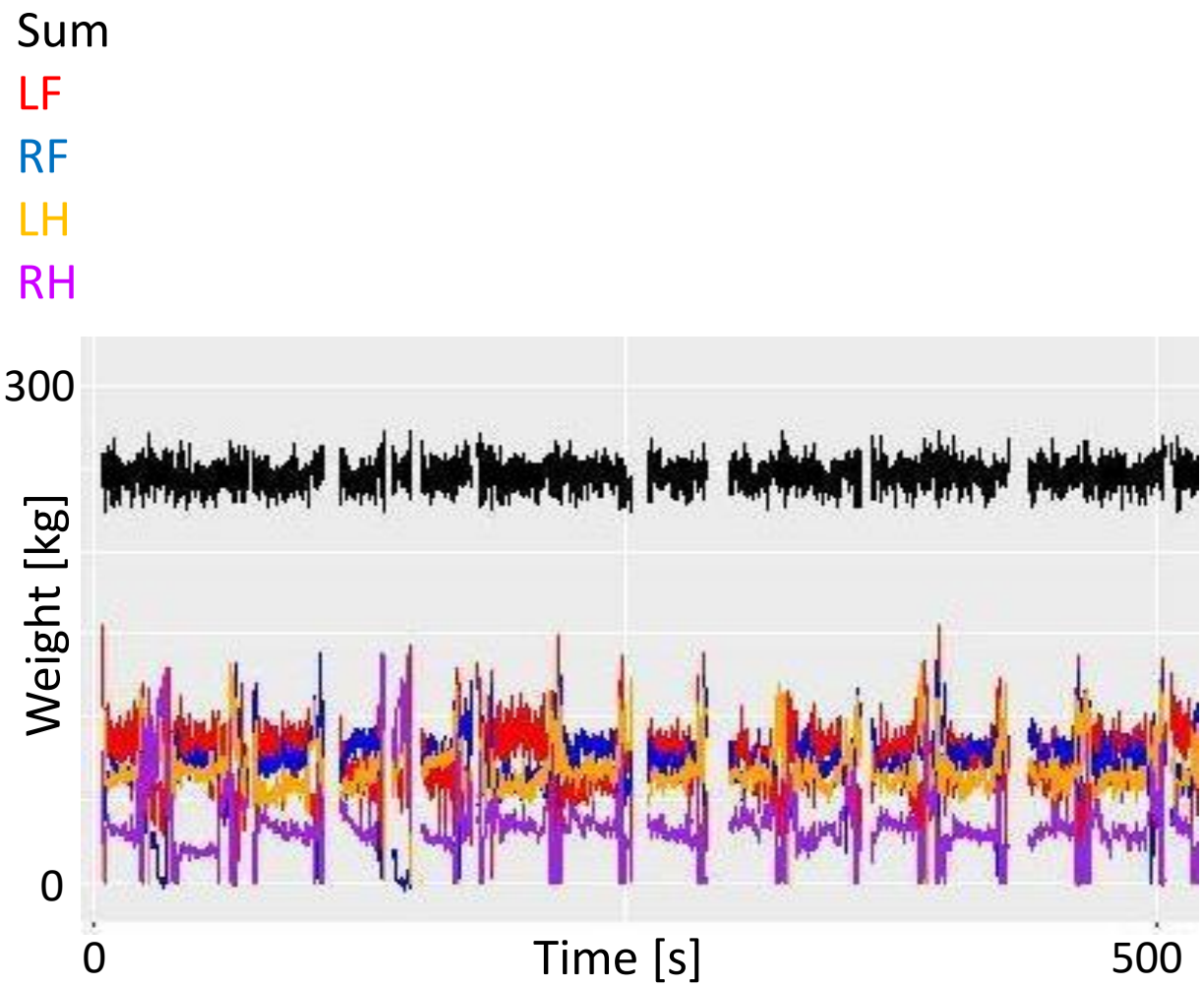
Visualizing lameness



Not lame



Lame on RH

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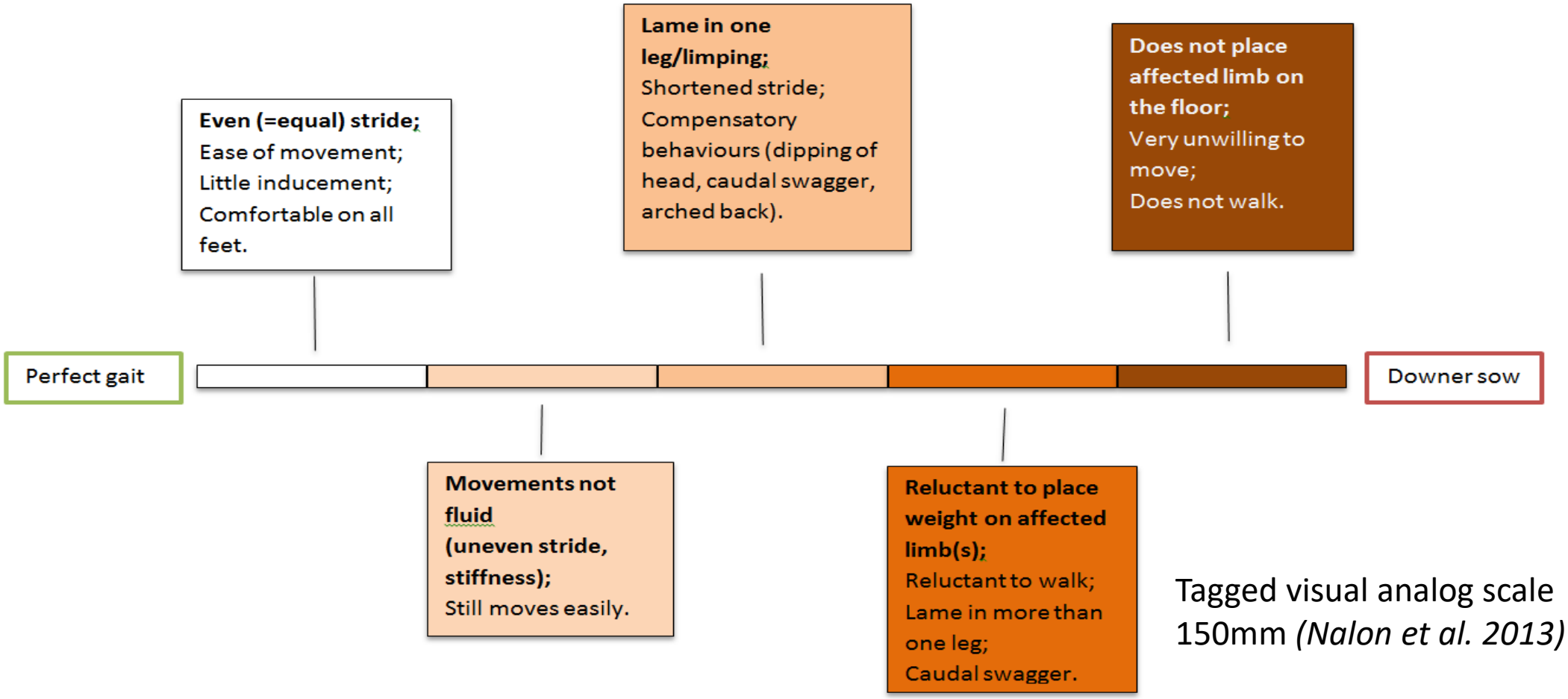
Reference data: visual gait score



Tagged visual analog scale 150mm *(Nalon et al. 2013)*

- Standard for lameness: >60 mm is lame

Can the SowSIS correctly identify lame sows?

- Test **leg-independent** variables (36) of gait scoring days

Multilevel linear regression

1) univariably testing the influence of leg-independent variables on Gait Score (GS)
2) test significant variables (9) in multivariable model ➔ Prediction model: deviation of relative weight on a pair of legs from 50% (mean L/R, max L/R and max F/H) and kicks/minute

Sow as random factor to correct for repeated measurements

Predictive performance lameness model

Gait Score

Prediction model	
Sensitivity	52%
Specificity	96%
Lame prediction value	81%
Not lame prediction value	87%

Lameness cut-off >60 mm

vs

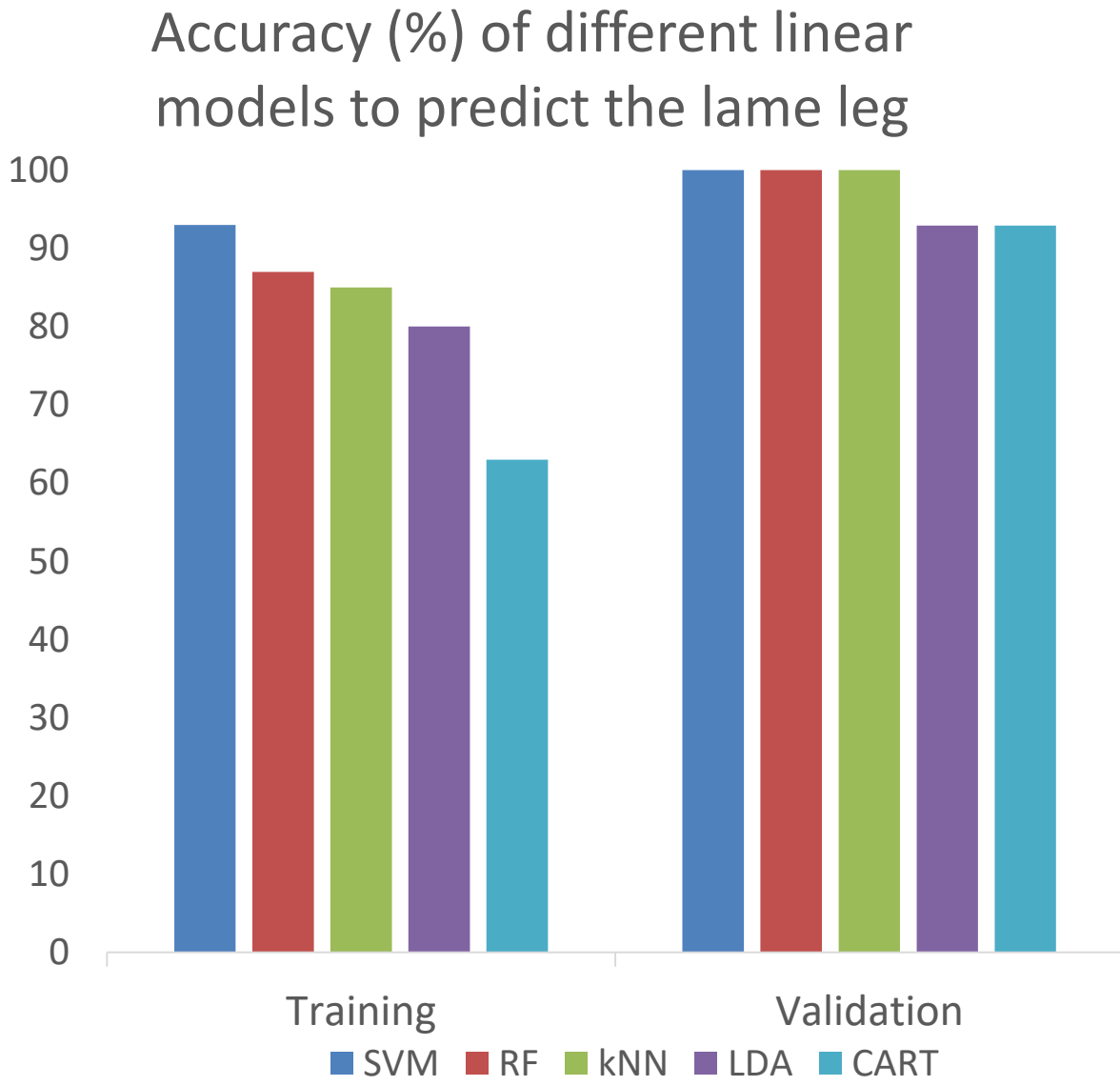
Rounded Gait Score

Prediction model	
Sensitivity	72%
Specificity	90%
Lame prediction value	77%
Not lame prediction value	87%

Lameness cut-off >55 mm

Can the SowSIS identify which leg is lame?

- Small dataset (n=31)
  - Only hind legs
- Select **leg-dependent** variables (5) to fit into the models using random forest
- Machine learning techniques
- Compare five different models:
  - Support vector machine
  - Random forest
  - Kappa nearest neighbours
  - Linear discriminant analysis
  - Classification and regression trees



Conclusions and things to consider

- **The SowSIS can correctly detect 72% of lame sows using a MLR-model**
  - More data of lame sows needed
    - Model not trained on full lameness scale
    - Dataset skewed towards not lame (77.2%)
  - Rounded gait scores improve prediction → determine optimal cut-off value for predicted scores
- **The SowSIS can correctly identify the lame leg (when lame on the hind leg) using machine learning techniques**
  - Only hind legs → easier to detect?

Future work

- Optimize lameness detection model
- Incorporate detailed reference gait score
- Test lameness prediction performance of SowSIS using longitudinal data

Thank you!

Flanders
is agriculture and fisheries

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