Step recognition and feature extraction for turkey gait measured with IMU sensors

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Aniek Bouwman, W. Ouweltjes, J. Mohr, B. Visser

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100years 1918 — 2018

#wur_abg, @bouwman_aniek, @breed4food

Acknowledgement

Background

Turkey gait is important health & welfare trait

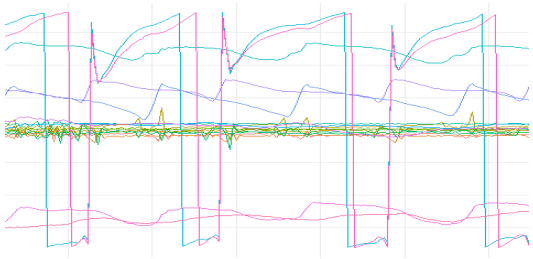
Current measures

- Subjectively scored
- Once in life
- Walk way test

Use objective sensor to predict the gait

Sensor

Signals



Model

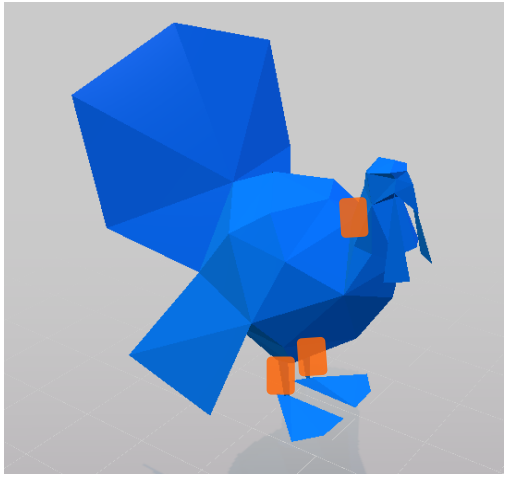
Gait score

3
5
2
...

IMU: Inertial Measurement Unit

Size: 47 mm × 30 mm × 13 mm
Weight: 16 gram
Model: 9 axis

xsens



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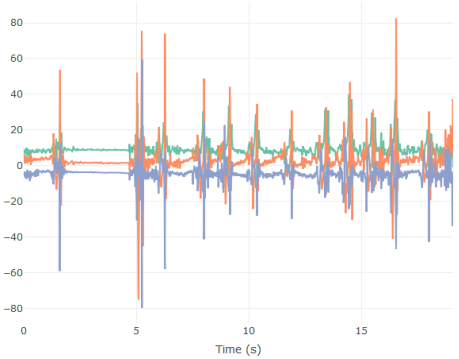
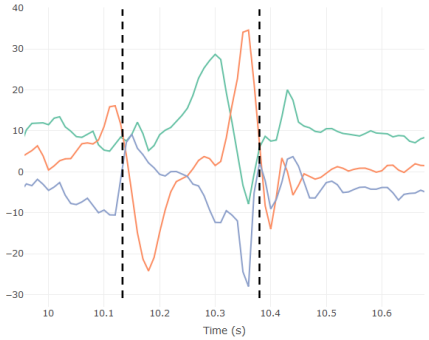
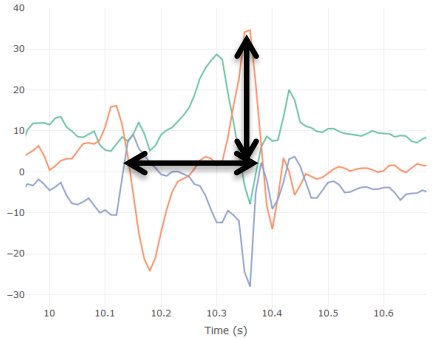
Process

Data → Steps → Features

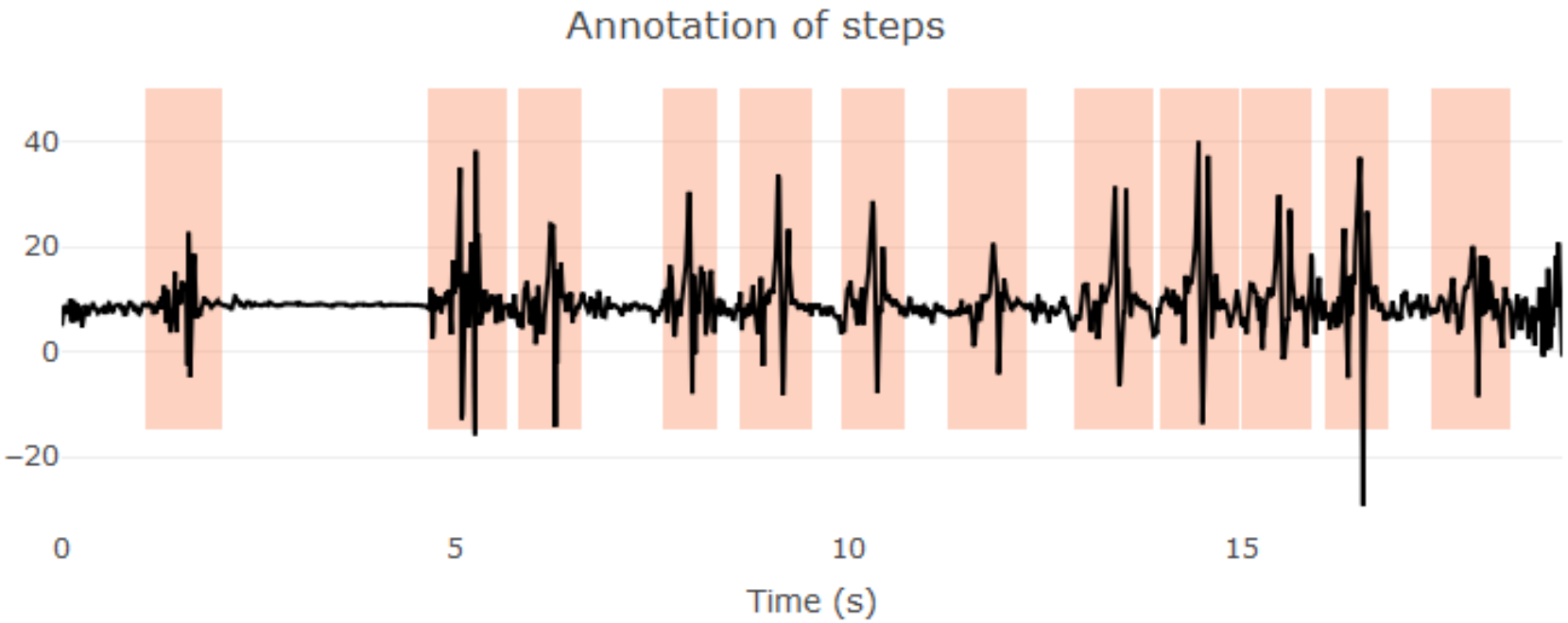






Annotation → Training & Validation → Predict all → Define step start & end

Annotation of steps



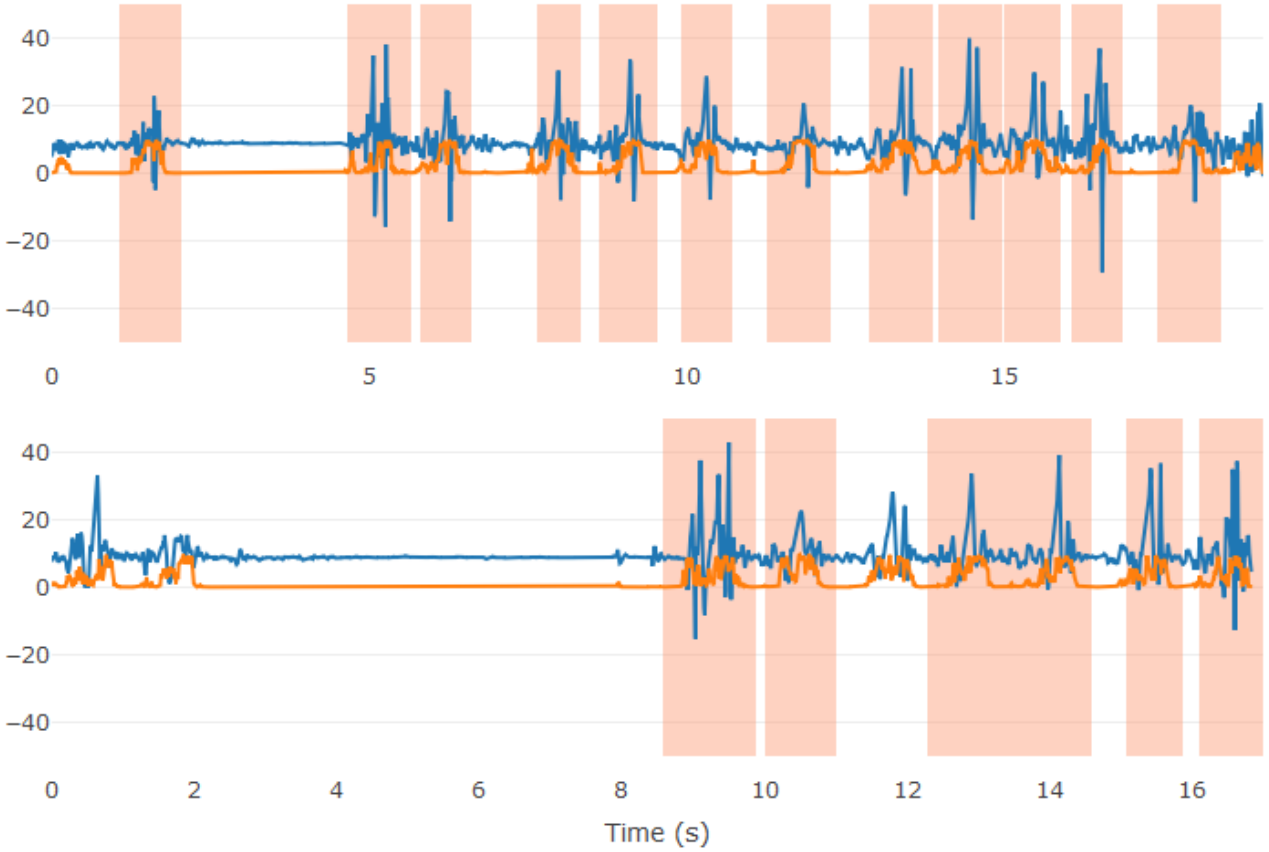
Step prediction

- 3 IMU profiles for training = ~30 annotated steps
- 2 IMU profiles for validation = ~20 annotated steps
- Method: Gradient Boosting Machines (using H2O)

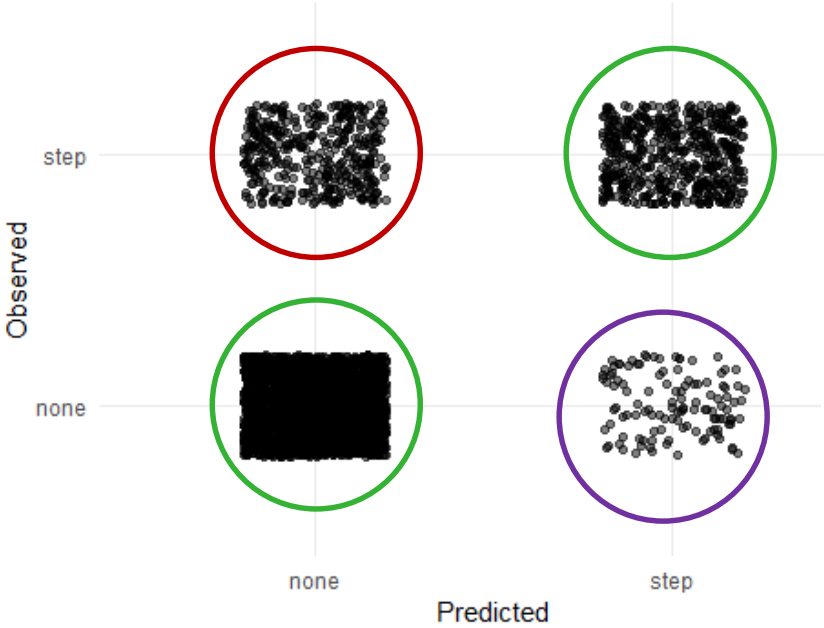
- Every timepoint
- Predict step vs none

- Input
  - Lag 5-10 for each variable
  - Leap 5-10 for each variable

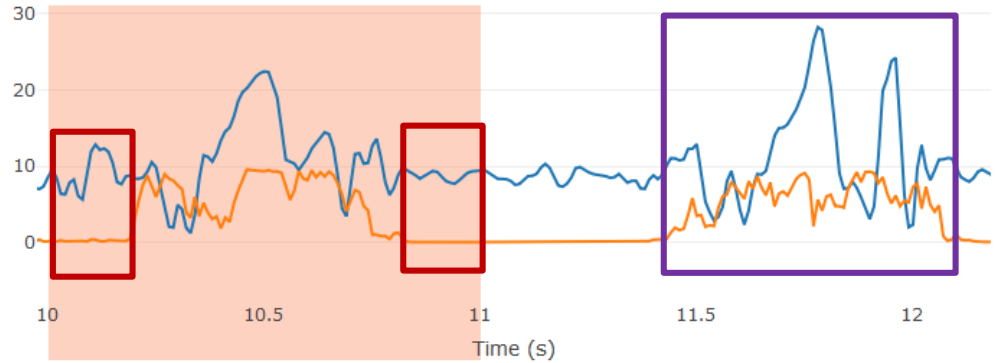
Validation of step prediction



Prediction error?



Error rate =0.15

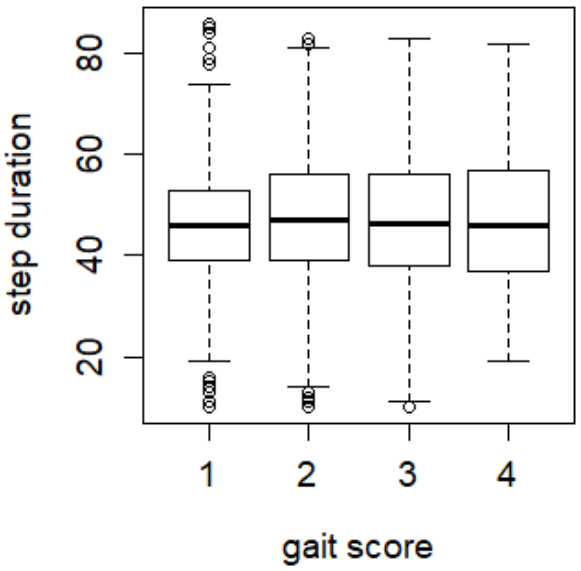


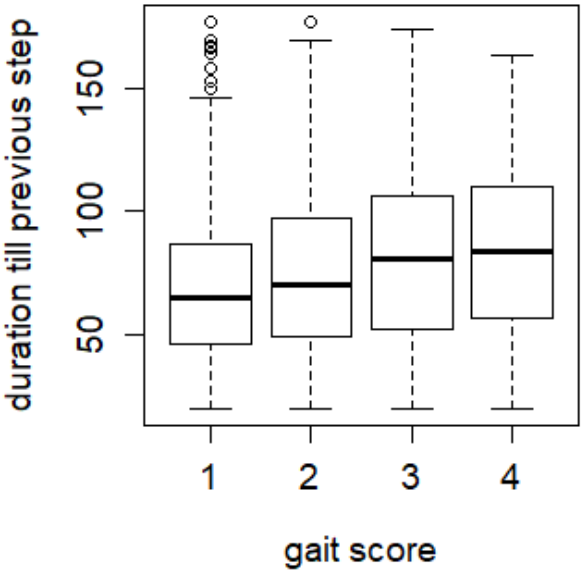
Features

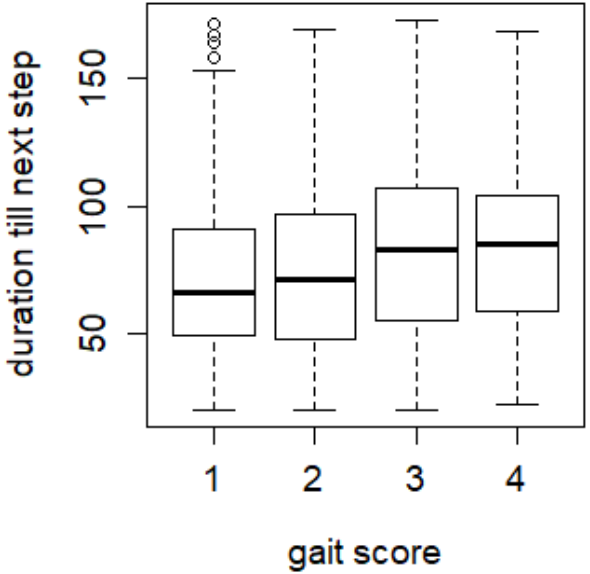
- Step-prediction based 5 annotated animals ~50 steps
    - 1560 steps; 83 animals; 2 leg IMUs/animal

- Step features
    - Step duration: number of timepoints between start & end
    - Duration till previous & next step
    - After QC 1038 steps

Features vs gait score







Conclusion

Accurate step prediction using supervised machine learning

- No pre-processing applied
- Limited training samples
- Prediction better than annotation

Features for gait score prediction

- Duration between steps more relevant than step duration itself
- Other features to be explored: e.g. Acc peak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