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Inertial measurement unit technology for gait detection: a comprehensive evaluation of gait traits in two Italian horse breeds

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Session 28, Abstract 2215432



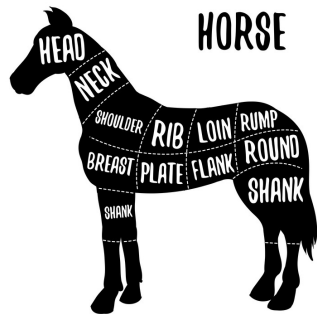
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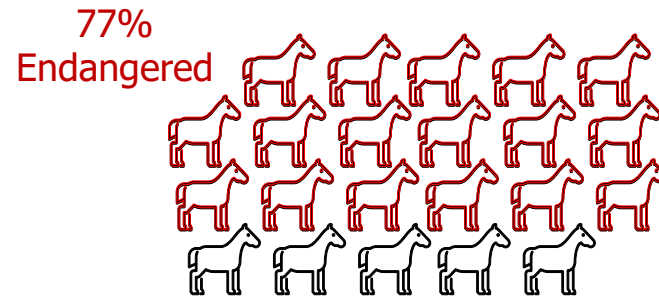


Evolution of the equine sector

Since the beginning of the genomic era, breeding selection has been changing fast, leading to a significant transformation in animal production, driven by market demand.



Trends in the Italian equine sector

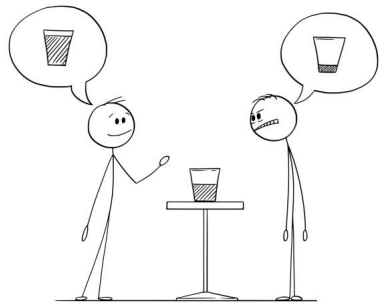


Preservation of
local breeds

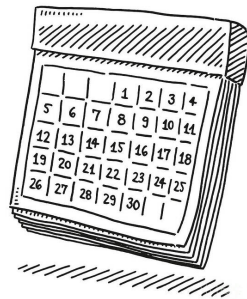
Genetic improvement
in selected breeds

Challenges in the selection process

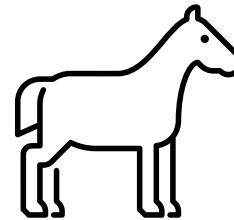
**Subjectivity
of
evaluation**



**Time
demanding**



**Limited
number of
animals**

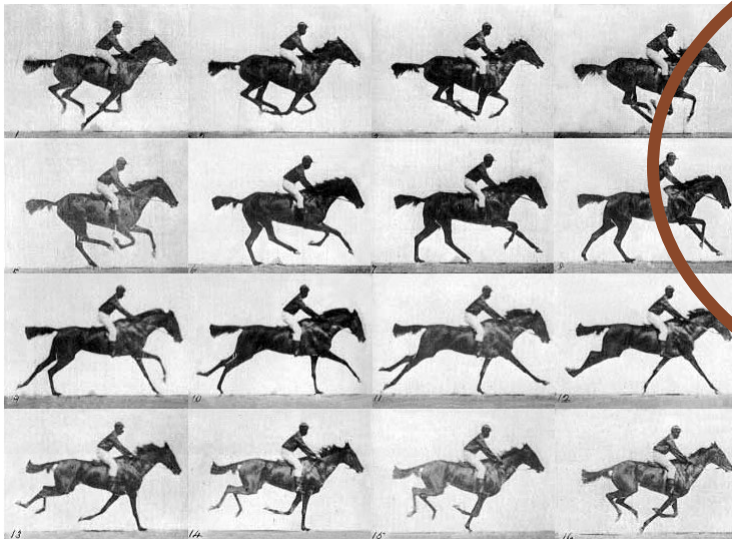


**Effect of body
shape on
performance**



Challenges in the selection process

**Focus on new
traits related to
performance**



**Inertial
Measurement
Unit
(IMU)**

**Objective
data
collection**





Study of gait traits collected via IMU:

- 1- Investigation of the effect of animal and environmental factors
- 2- Correlation analysis between judges' scores and IMU data
- 3- Prediction of ranking using IMU



IMU – Equisense Motion



Electrode



9- Axis IMU

- Gyroscope
- Magnetometer
- Accelerometer

Movements		
1	A X C	Enter in trot Halt – immobility – salute Proceed in trot Track to the right
2	Da M a M	Proceed in trot
3	MXK	Diagonal (trot)
4	Da K a K	Proceed in trot
5	Tra A e F	Transition at left canter
6		Two laps on track at left canter
7	M	Transition at trot
8	MCH	Trot
9	HXF	Diagonal (trot)
10	Tra A e K	Transition at right canter
11		Two laps on track at right canter
12	H	Transition at trot
13	HCM	Trot
14	MXK	Diagonal (trot)
15	A	walk
16		Two laps on track at walk
17	A X	Down the center line Halt – immobility - salute

IMU – Traits

Rideability traits

Frequency

Number of stride per minutes

Regularity

Consistency of horse's rhythm

Elevation

Vertical movement of the horse's body

Speed

In km/h

Movements		
1	A X	Enter in trot Halt – immobility – salute
	C	Proceed in trot Track to the right
2	Da M a M	Proceed in trot
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17	A X	Down the center line Halt – immobility - salute

Stride = all the events that separate two successive steps of the same limb



Health traits

Heart rate

In bpm

Symmetry

Comparison between half stride

1st AIM

Effect of animal and environmental factors

N° of horses: 135

Model:

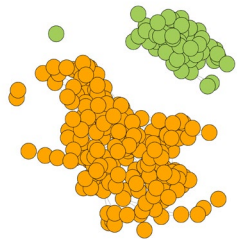
2nd AIM

Correlation

● Bardigiano



Addition



● Murgese

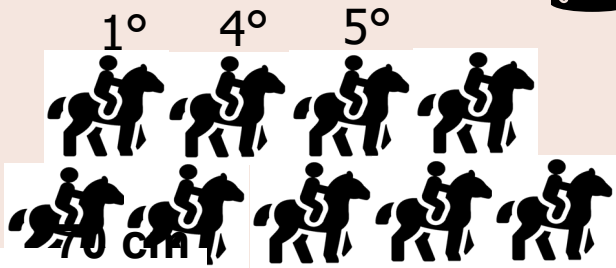


Interaction:

3rd AIM

Prediction

N° of horses: 77

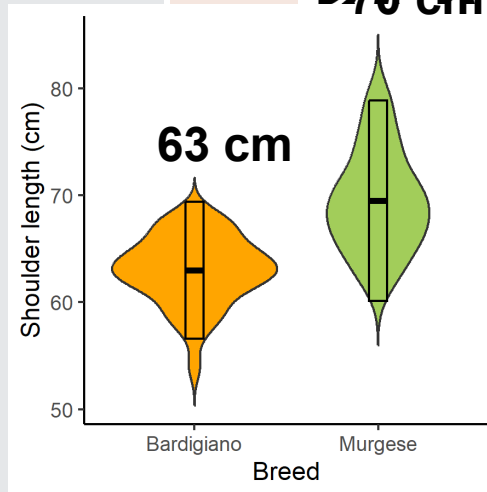
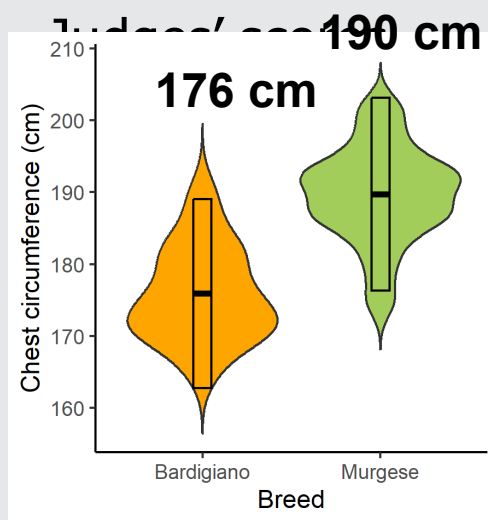
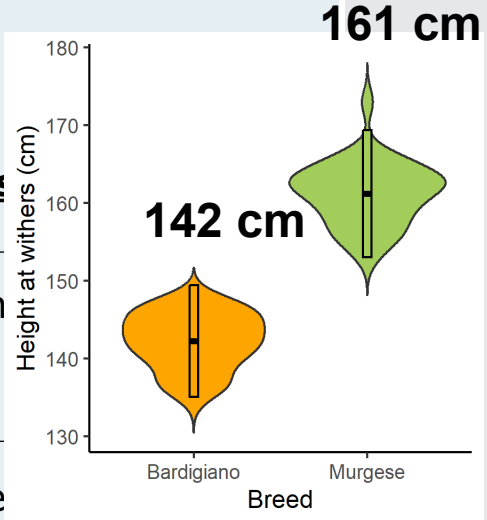
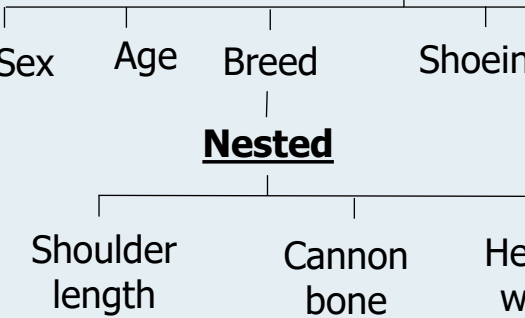


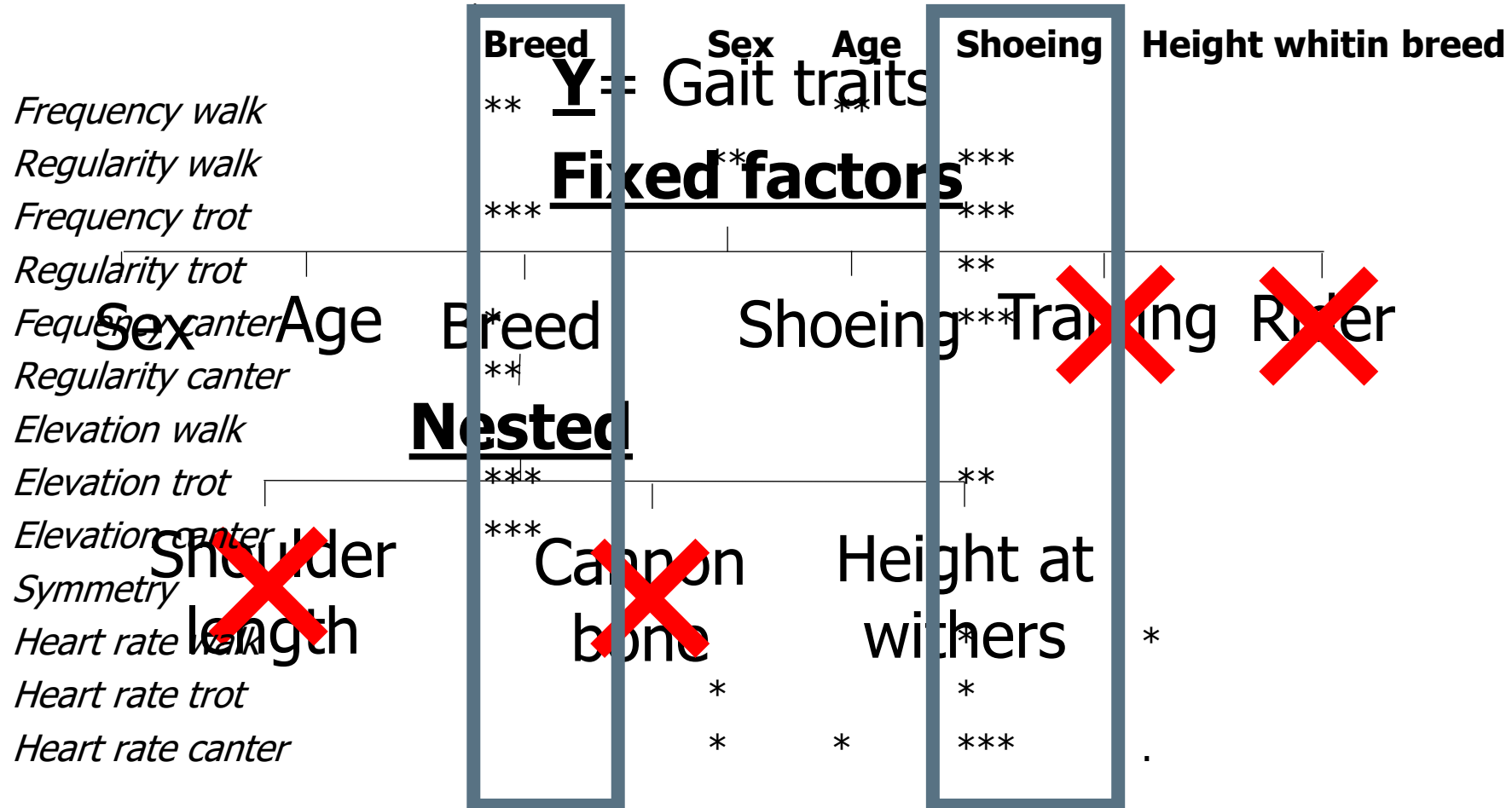
Used:

ted vector
e
nt Boosting
e

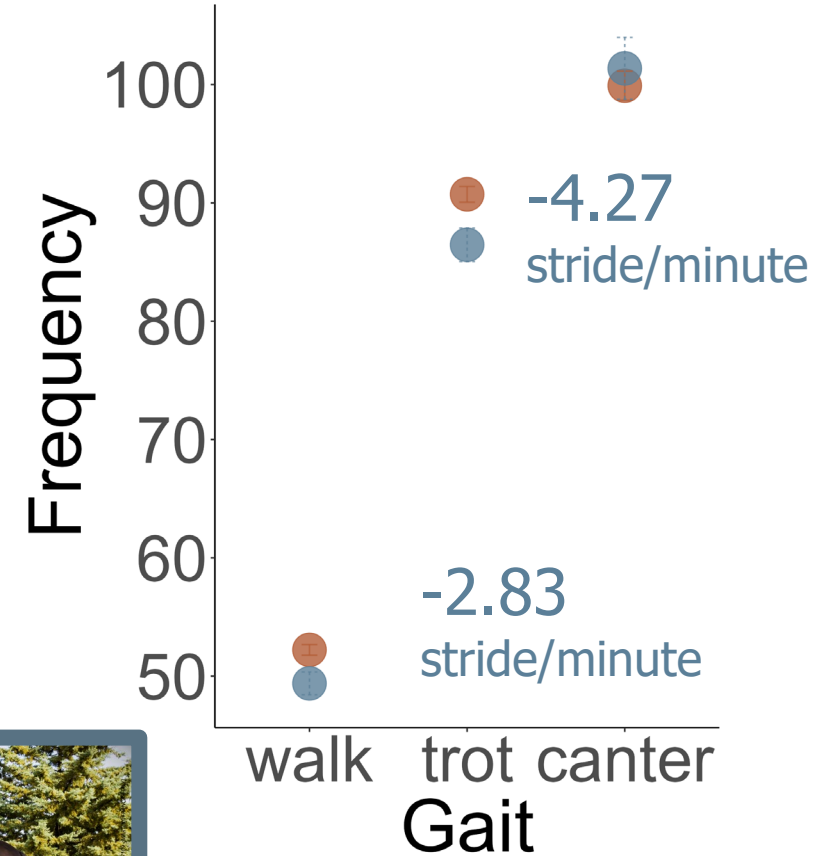
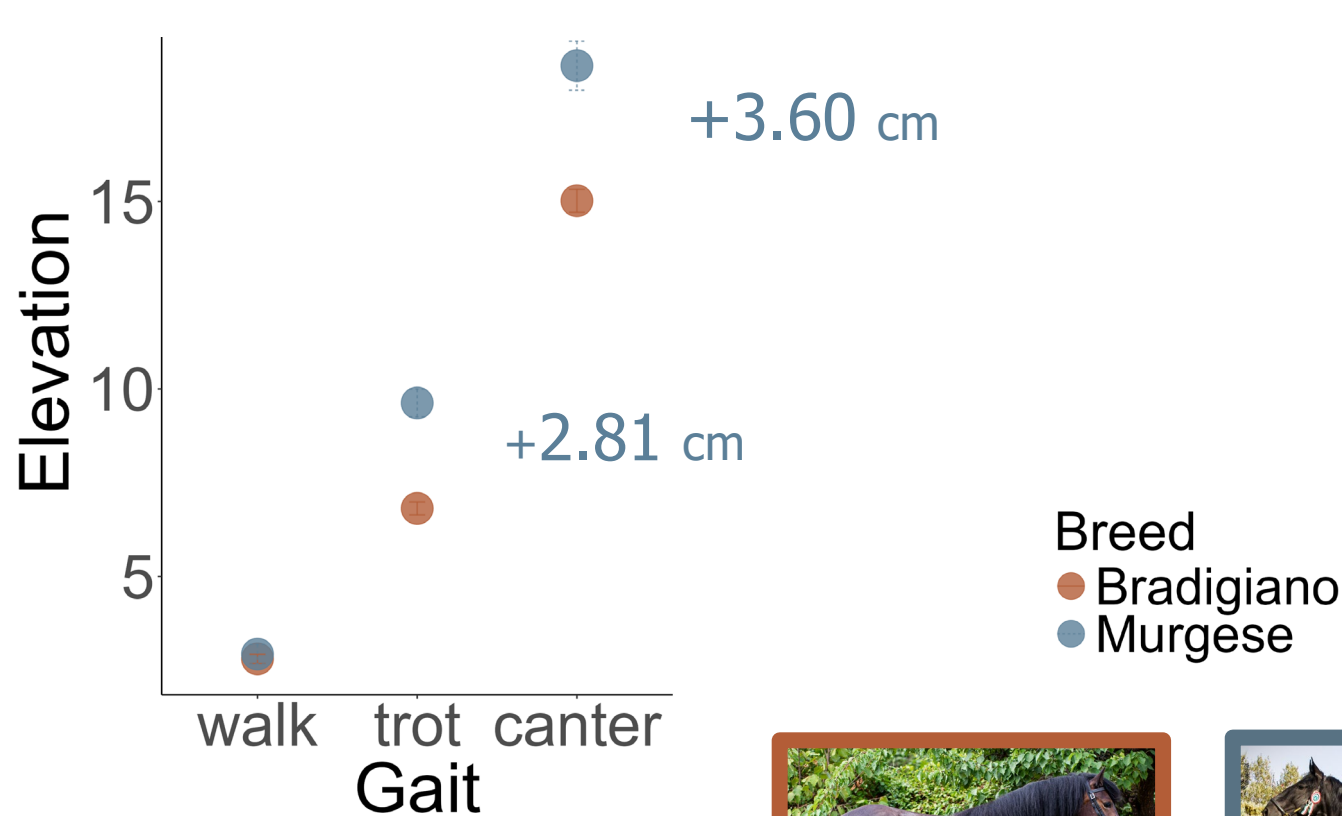
- K-Nearest Neighbors
- 10-fold cross-validation*

Y= Gait traits
Fixed factors

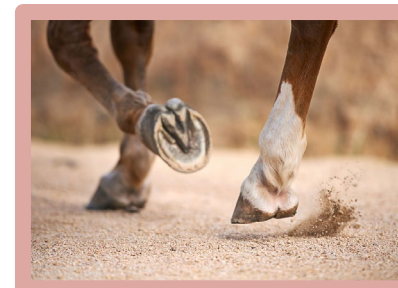
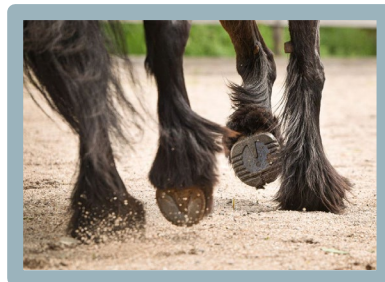
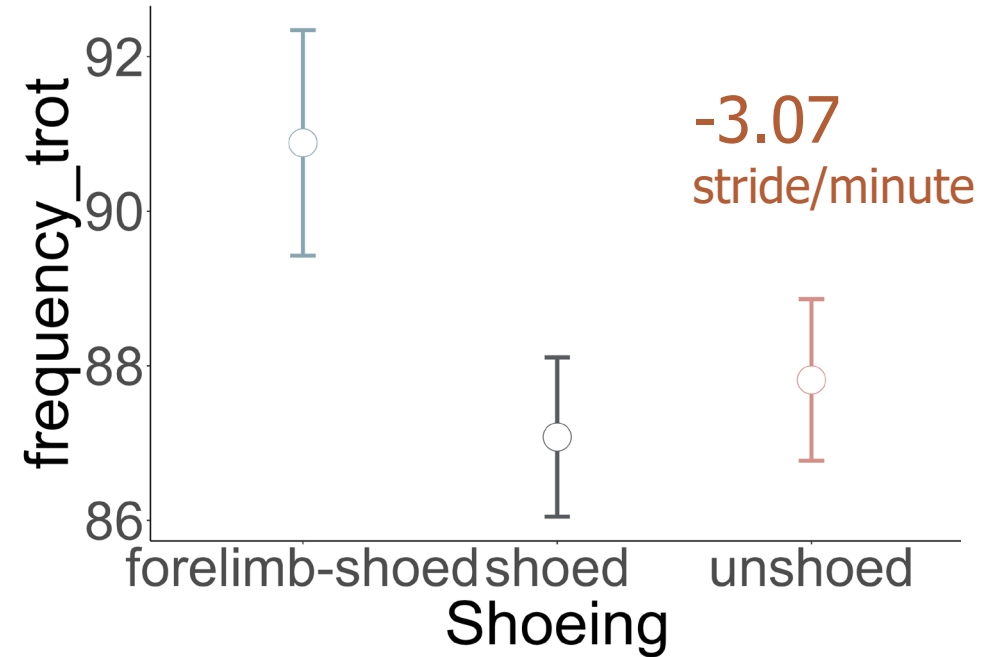
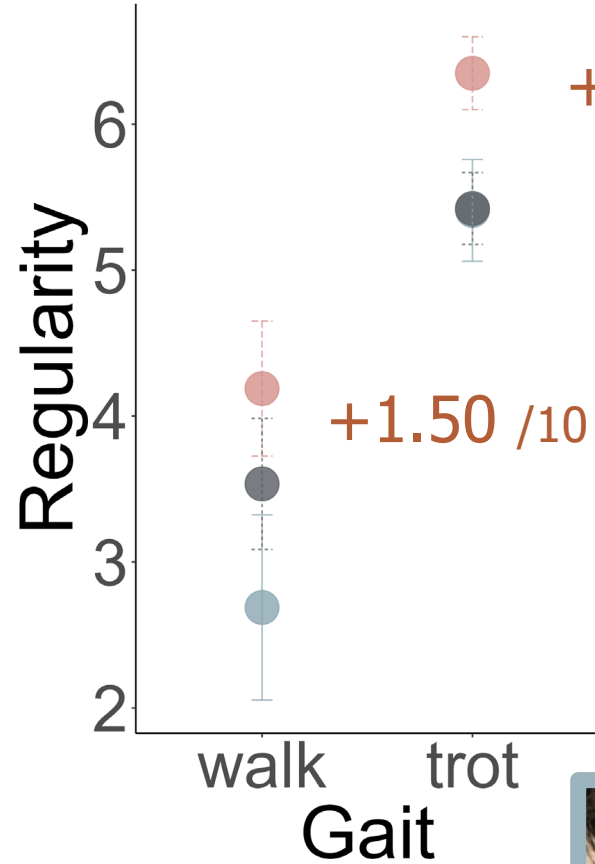




1st AIM Effect of animal and environmental factors



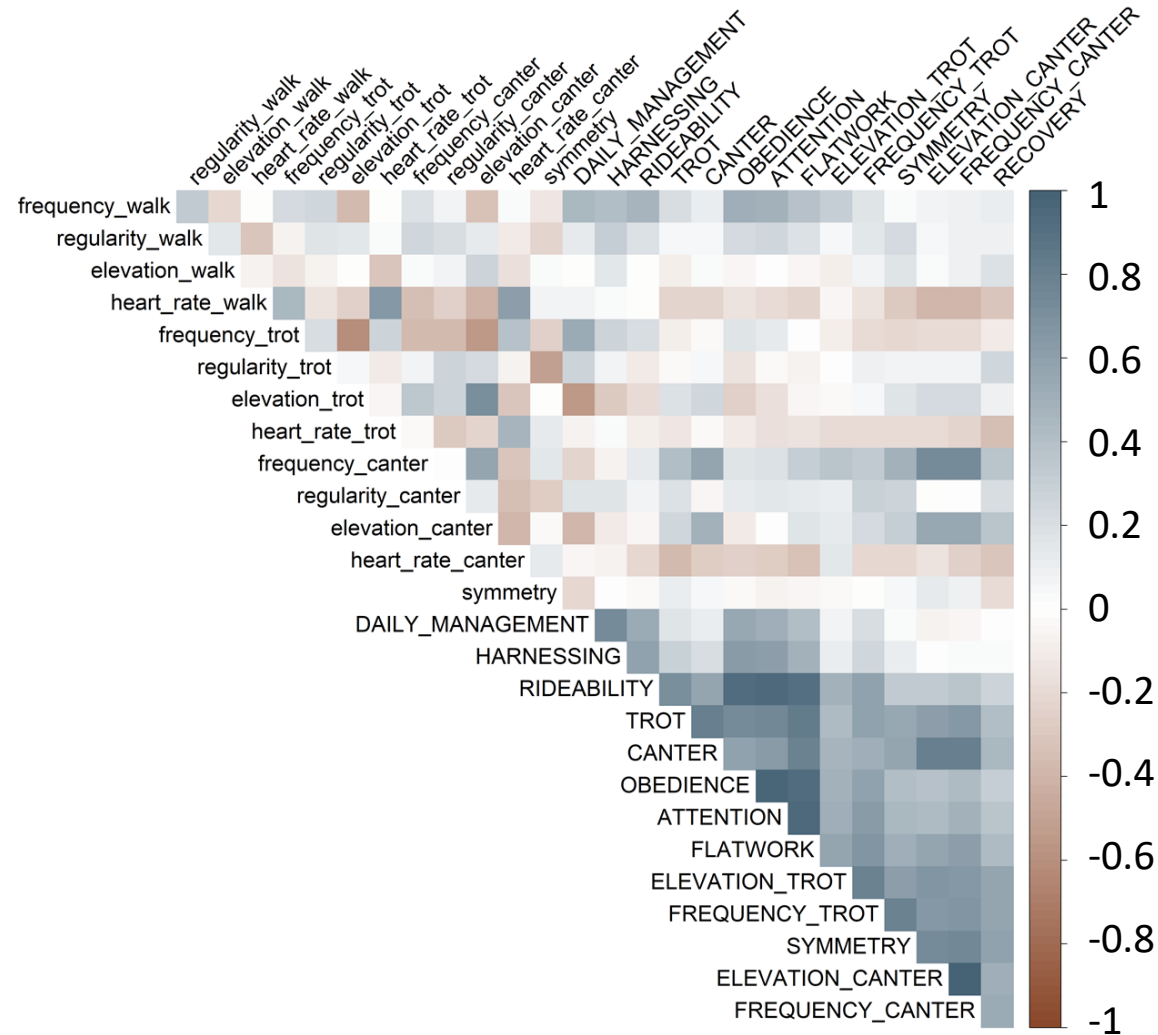
1st AIM Effect of animal and environmental factors



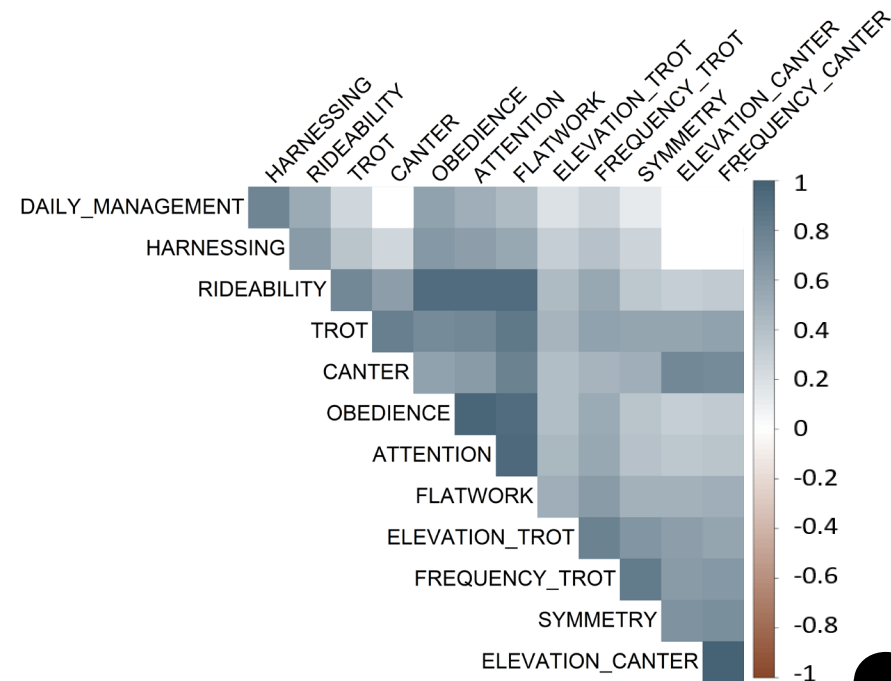
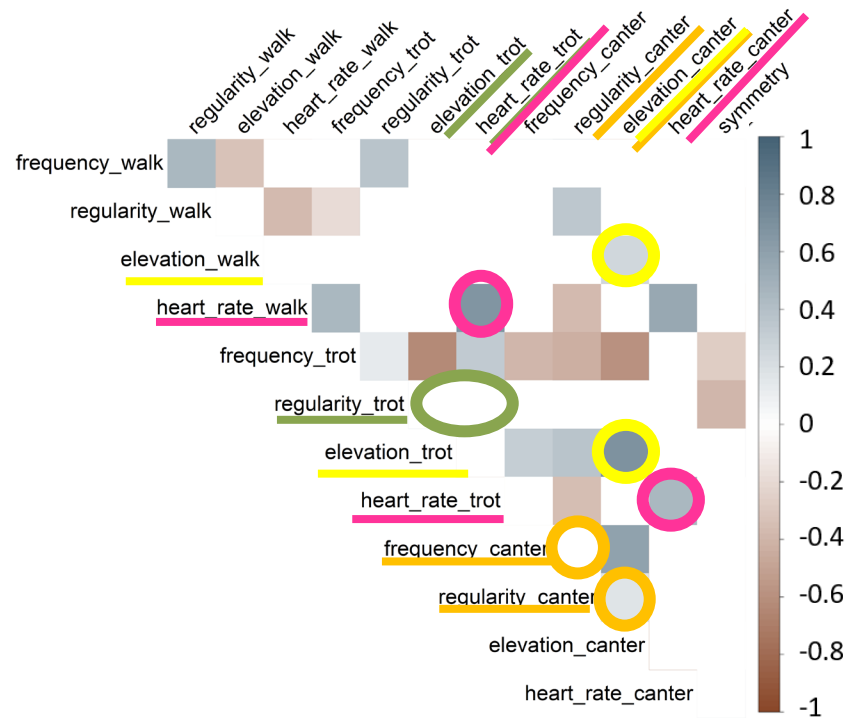
Shoeing

- forelimb-shoed
- shoed
- unshoed

2nd AIM Correlation



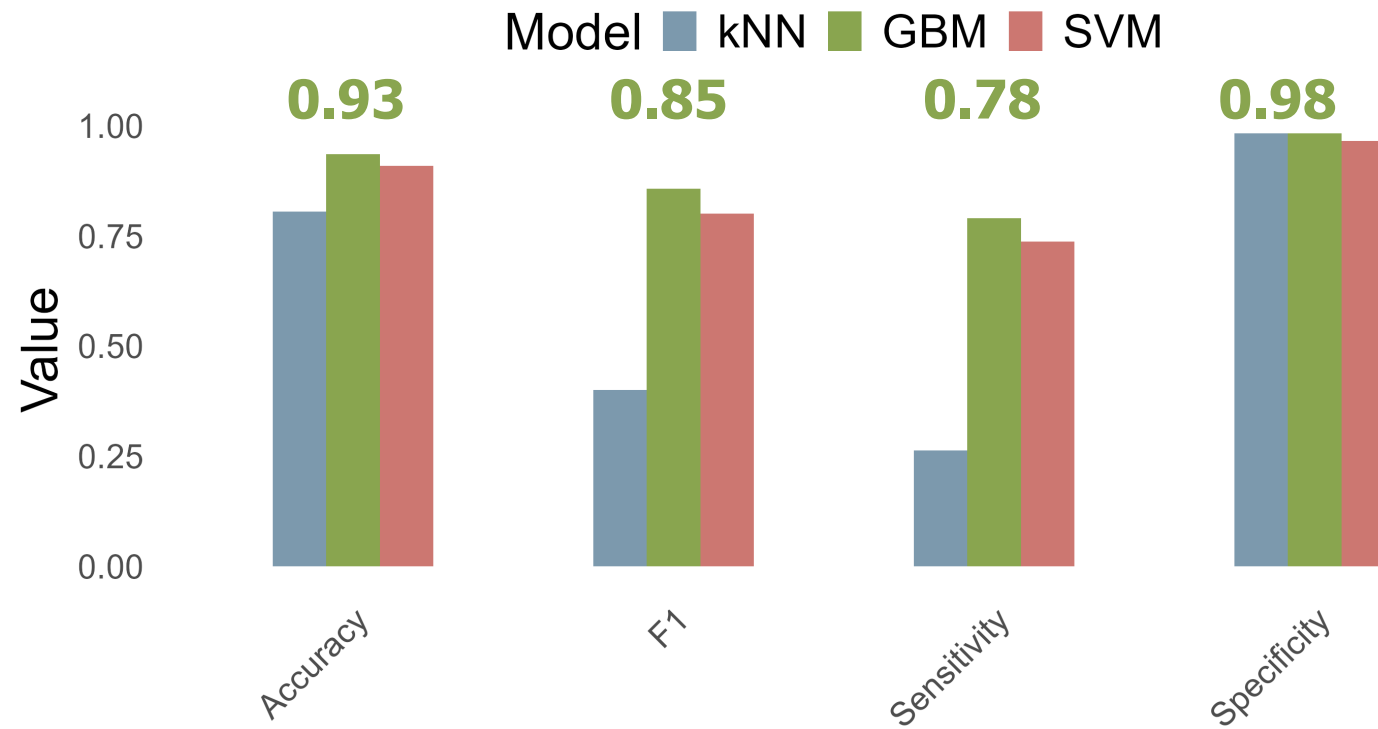
2nd AIM Correlation



3rd AIM Prediction



Model Performance Metrics



Thank you for listening!

Take home messages

- Importance of choosing the right phenotype in the selection process
- Objective data collection
- Influence of animal and environmental factors on gaits
- Possibility of using sensor data to evaluate horses

