



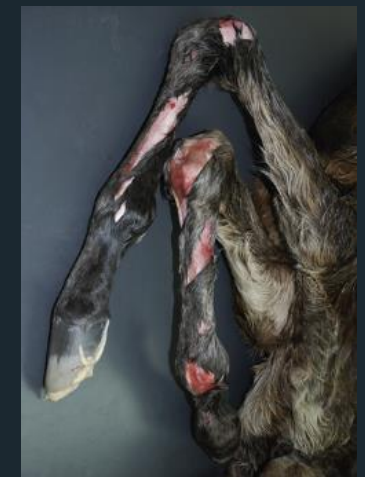
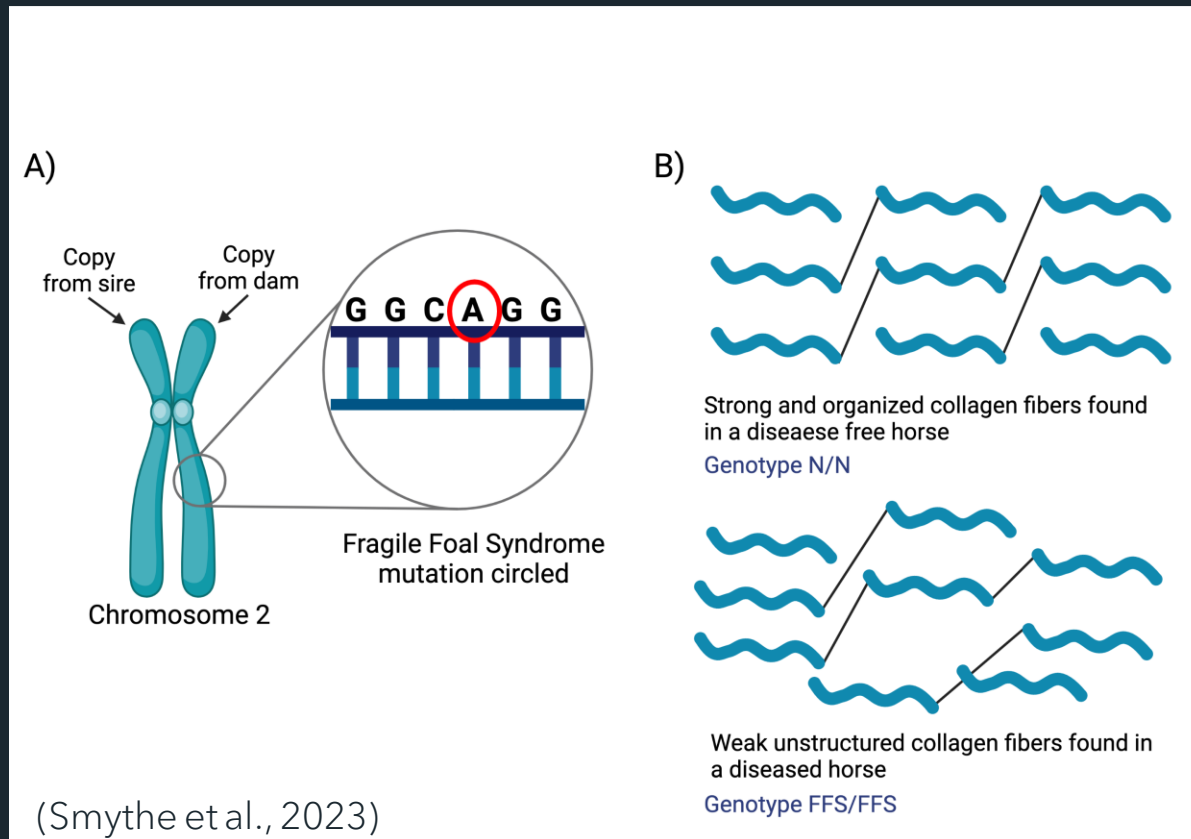
USING ARTIFICIAL INTELLIGENCE
GAIT PARAMETER ANALYSIS TO
IDENTIFY CONFORMATION TRENDS IN
FRAGILE FOAL SYNDROME CARRIERS
IN HORSES

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FRAGILE FOAL SYNDROME (*FFS*)



- *PLOD1* gene, c.2032G>A (kyphoscoliotic EDS in humans)
- Lethal Recessive Genetic Mutation (Martin et. al, 2021)

(Aurich et al., 2019)

FFS CARRIER FREQUENCY

(Reiter et al., 2020)

1% in Thoroughbreds

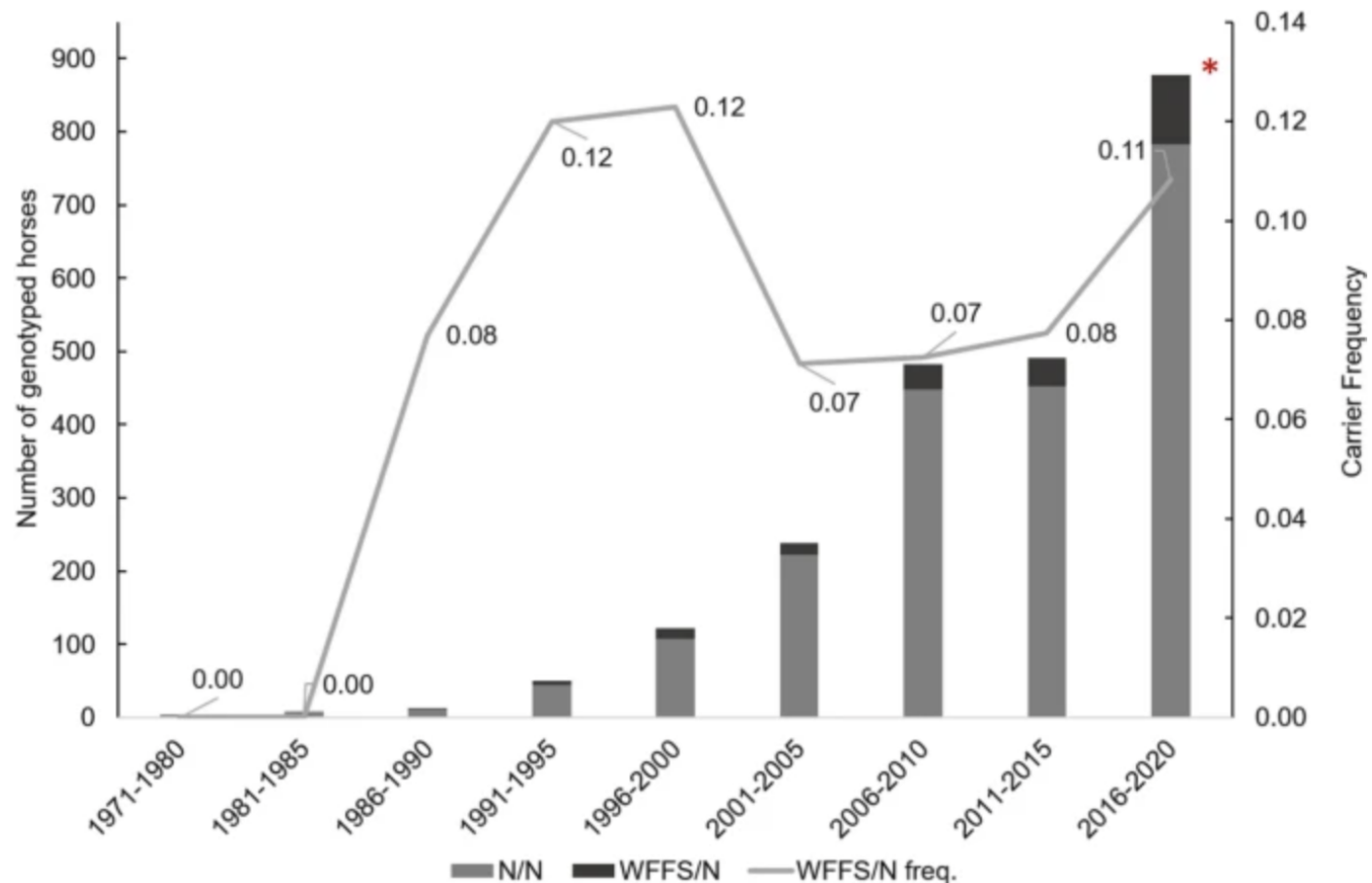


17% in Warmbloods



INCREASED FREQUENCY OF *FFS* IN SWEDISH HORSES

Fig. 1

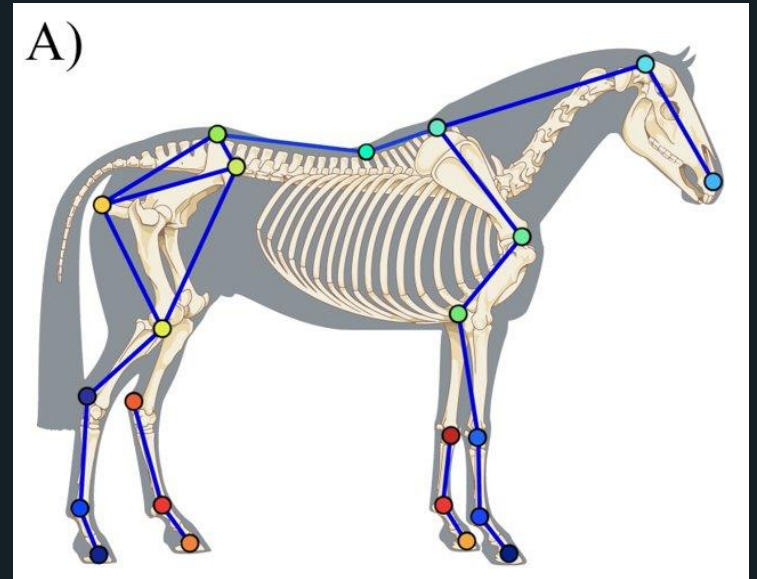


(Ablondi, et al., 2022)

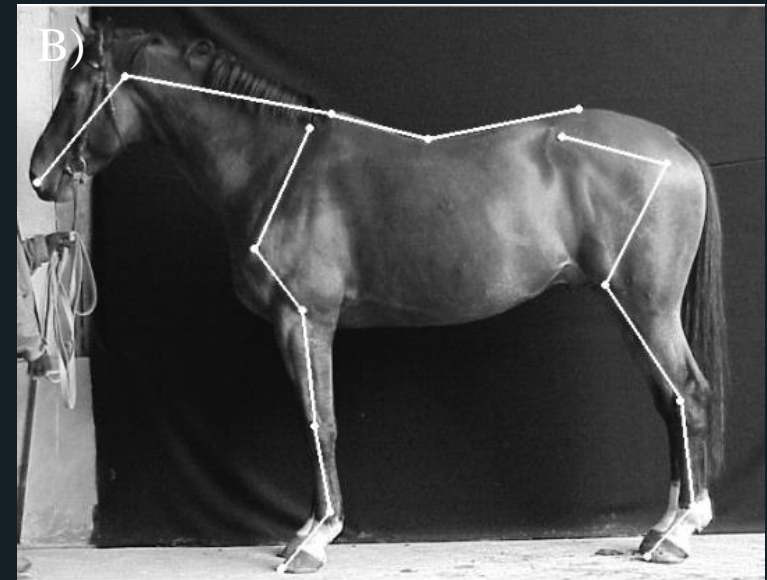
CONFORMATION

IMPORTANT FOR SOUNDNESS,
ATHLETIC ABILITY, AND INTENDED
USE OF THE HORSE

- HORSES ARE SELECTED BASED
ON TRAITS FOR PERFORMANCE
- (Ablondi et al., 2019)



(Smythe et al., 2023)



(Barrey, et al., 2002)

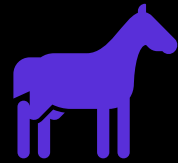
HYPOTHESIS

- CARRIERS OF *FFS* WILL HAVE LONGER LIMB AND NECK LENGTHS THAN NON-CARRIER HORSES.

OBJECTIVES

- USE ARTIFICIAL INTELLIGENCE TO MAP CONFORMATION AND MEASURE ANATOMICAL CHARACTERISTICS
- GENOTYPE HORSES TO DETERMINE *FFS* CARRIER STATUS

SAMPLE POPULATION



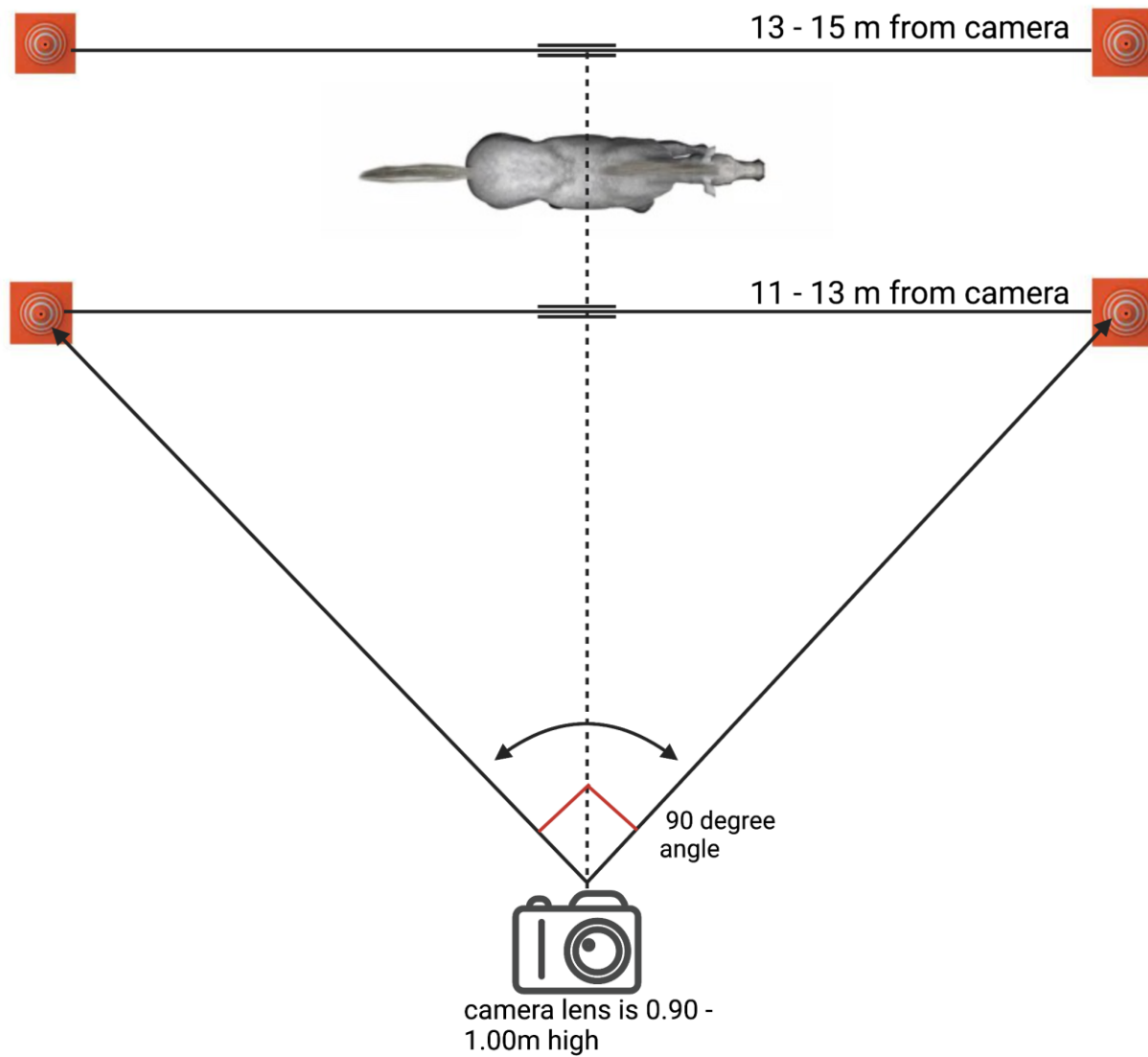
N = 35 horses

- Mares: 10
- Geldings: 25
- Warmbloods: 17
- Thoroughbreds: 18
- Carriers: 8
- Non-Carriers: 27

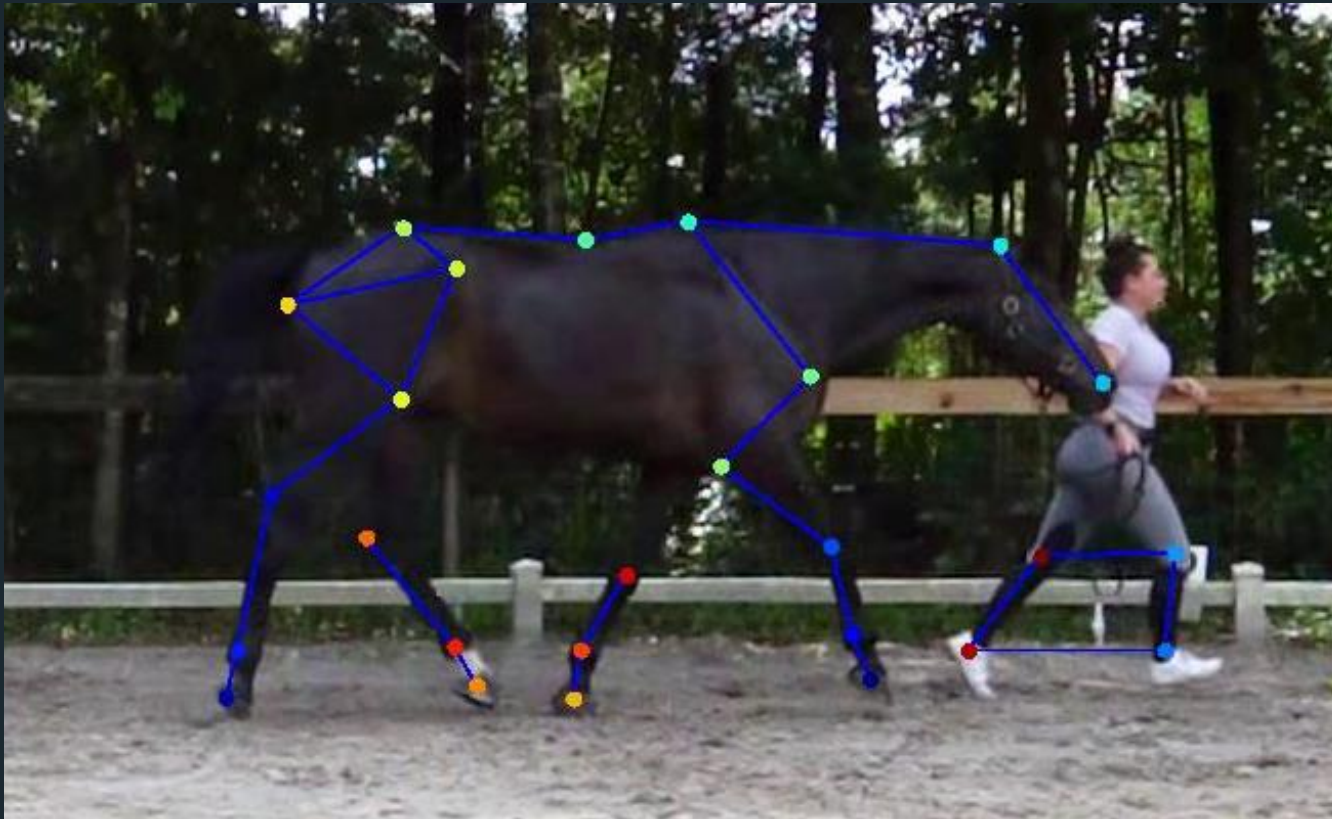


Privately owned, sport horses

VIDEO COLLECTION



VIDEO PROCESSING



Conformation

Parameters:

- Head length
- Neck length
- Right forelimb length
 - Elbow to knee
 - Knee to fetlock
- Right hind limb
 - Stifle to hock
 - Hock to fetlock

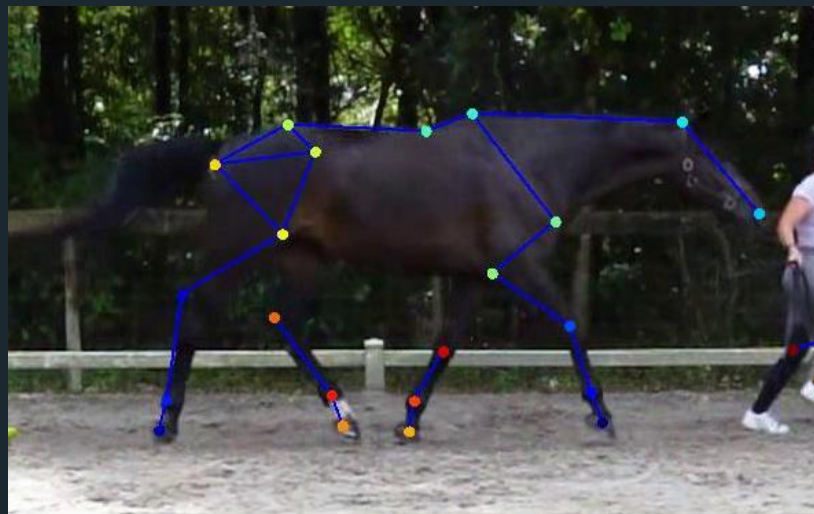


DeepLabCut:
a software package for
animal pose estimation

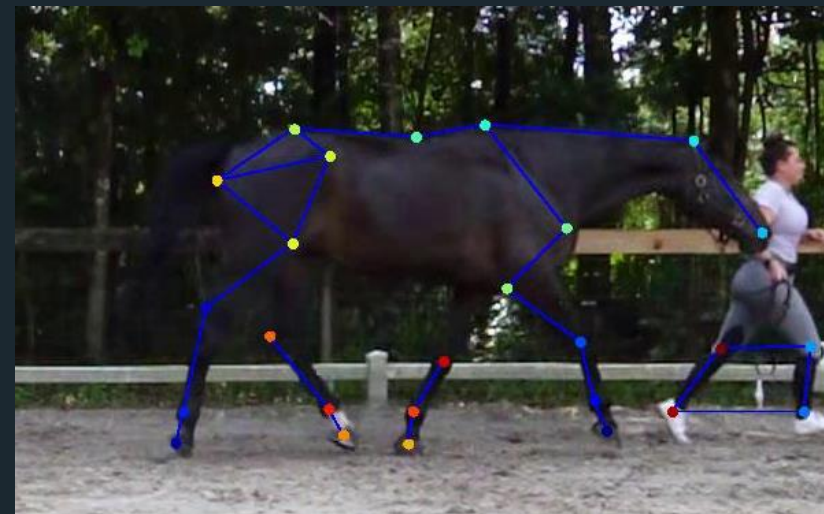
LABELED VIDEO FRAMES



Frame 1

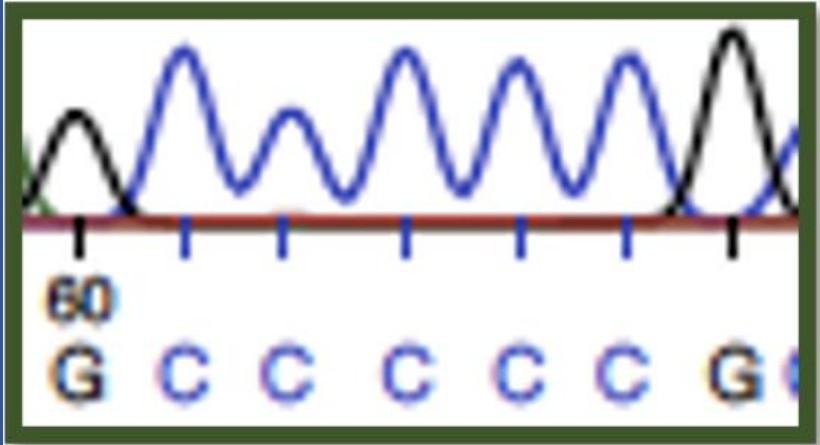


Frame 2



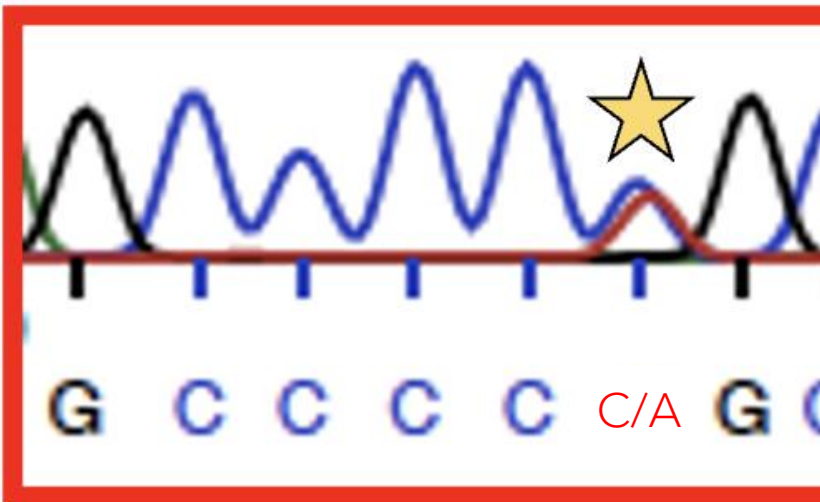
Frame 3

ffs/ffs



500 bp

FFS/ffs



GENOTYPING

- Qiagen Puregene Tissue Kit
- Working Dilution = 25 ng/ μ L
- PCR primers
- (Ayad et. al 2022)
- RFLP \rightarrow *FAU1*
- Gel Electrophoresis
- Confirmed via sequencing

STATISTICAL ANALYSIS

Selected 3 still frames per horse in similar pose

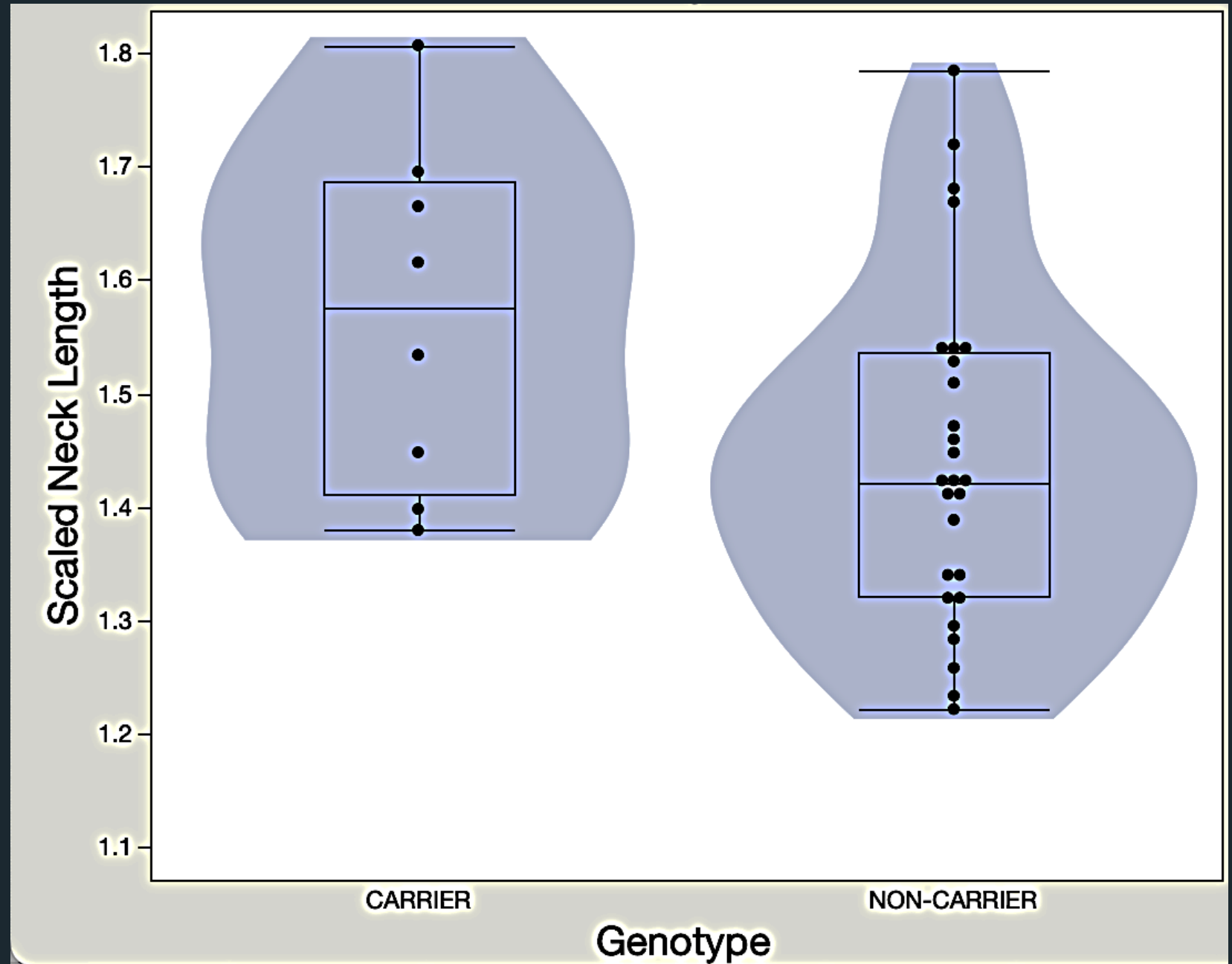
Scaled conformation measurements by head length

Box-cox transformation to normalize measurement distributions

Performed t-test for differences in limb and neck lengths between non-carriers and carriers

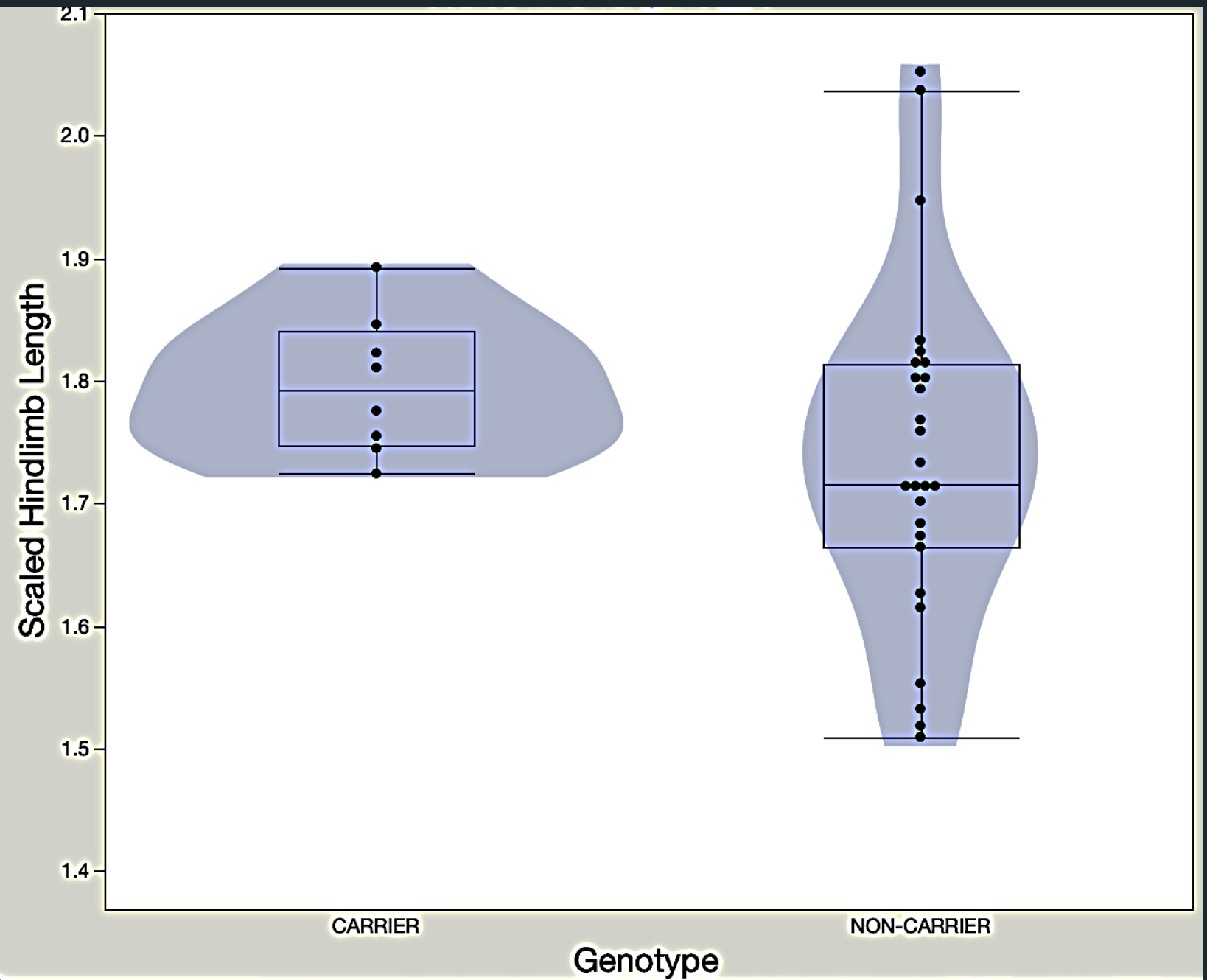
RESULTS

• $P=0.0329$



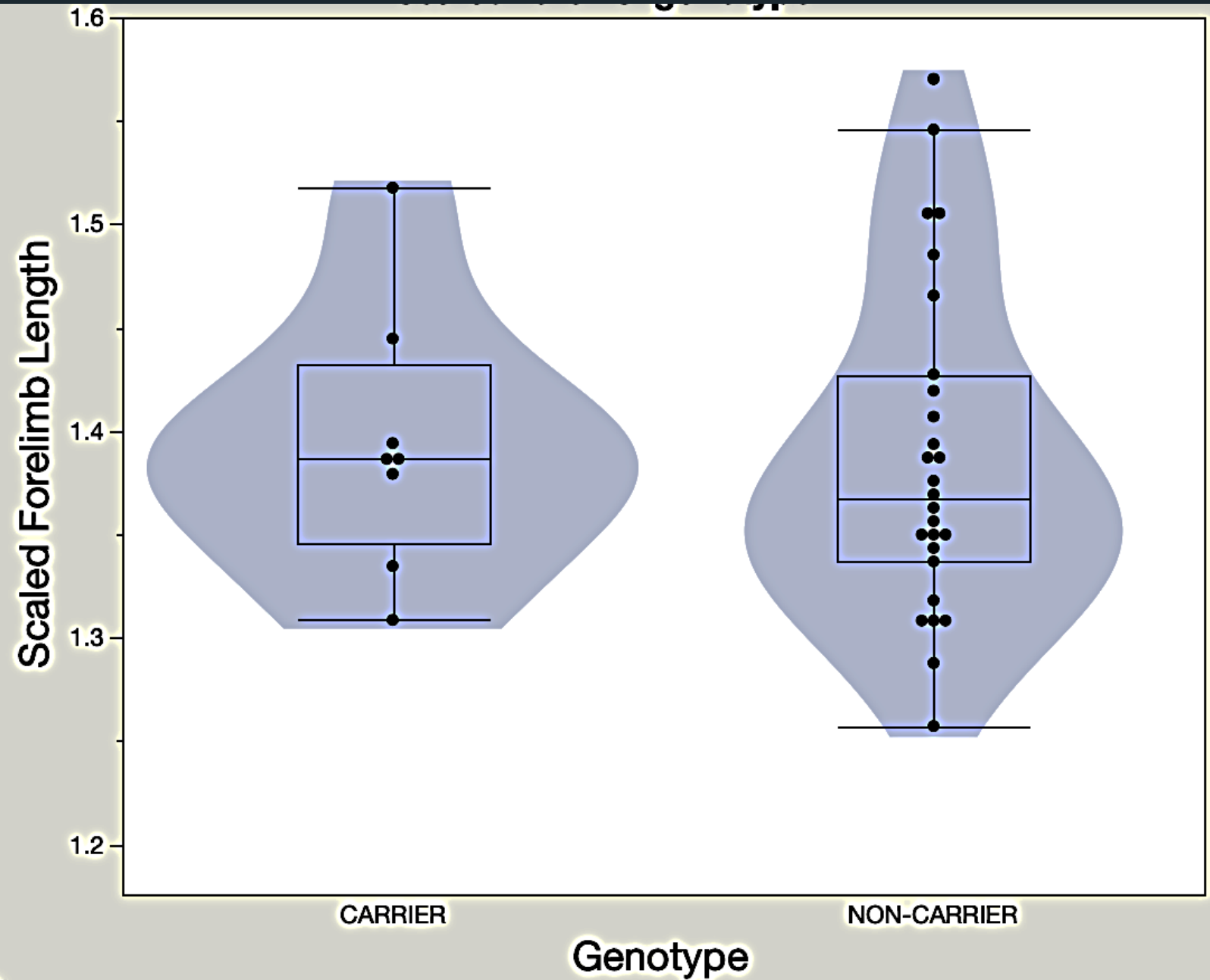
RESULTS

- $P=0.0425$



RESULTS

- $P=0.4023$



Performance of Swedish Warmblood fragile foal syndrome carriers and breeding prospects

Michela Ablondi, Martin Johnsson, Susanne Eriksson, Alberto Sabbioni, Åsa Gelinder Viklund & Sofia Mikko 

Genetics Selection Evolution **54**, Article number: 4 (2022) | [Cite this article](#)

Non-Showjumping Horses



Showjumping Horses



LIMITATIONS

Sample Size

- Increase overall sample size

Parameters

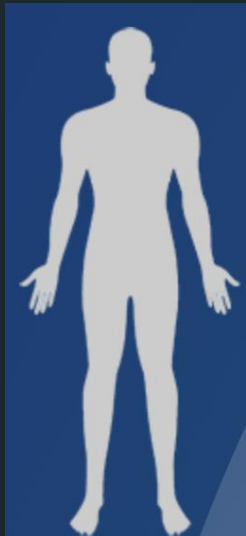
- Use more than just limb and neck length
- Ex. Back length, shoulder, etc.

External
Factors

- Age, breed, sex, training, discipline

CONCLUSION

- Used AI pipeline to confirm significant difference between hind limb and neck length in carrier vs WT horses.



Disproportionate tall stature

A tall and slim body build with increased arm span to height ratio (>1.05) and a reduced upper-to-lower segment ratio (<0.85), i.e., unusually long arms and legs. The extremities as well as the hands and feet are unusually slim.

FUTURE WORK

- Use conformation parameters to investigate other impacts on performance and soundness

(Rare Diseases, 2023)

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 - USDA Multistate Project [S1094]
 - USA Equestrian Trust [AWD10966, 2021]
 - Agriculture Genome to Phenome Initiative [USDA-NIFA award 2021-70412-35233]
- Contact: hrahael@ufl.edu



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