Utilizing Deep Neural Networks to Assess the Quality of Movement in the Arabian Horse

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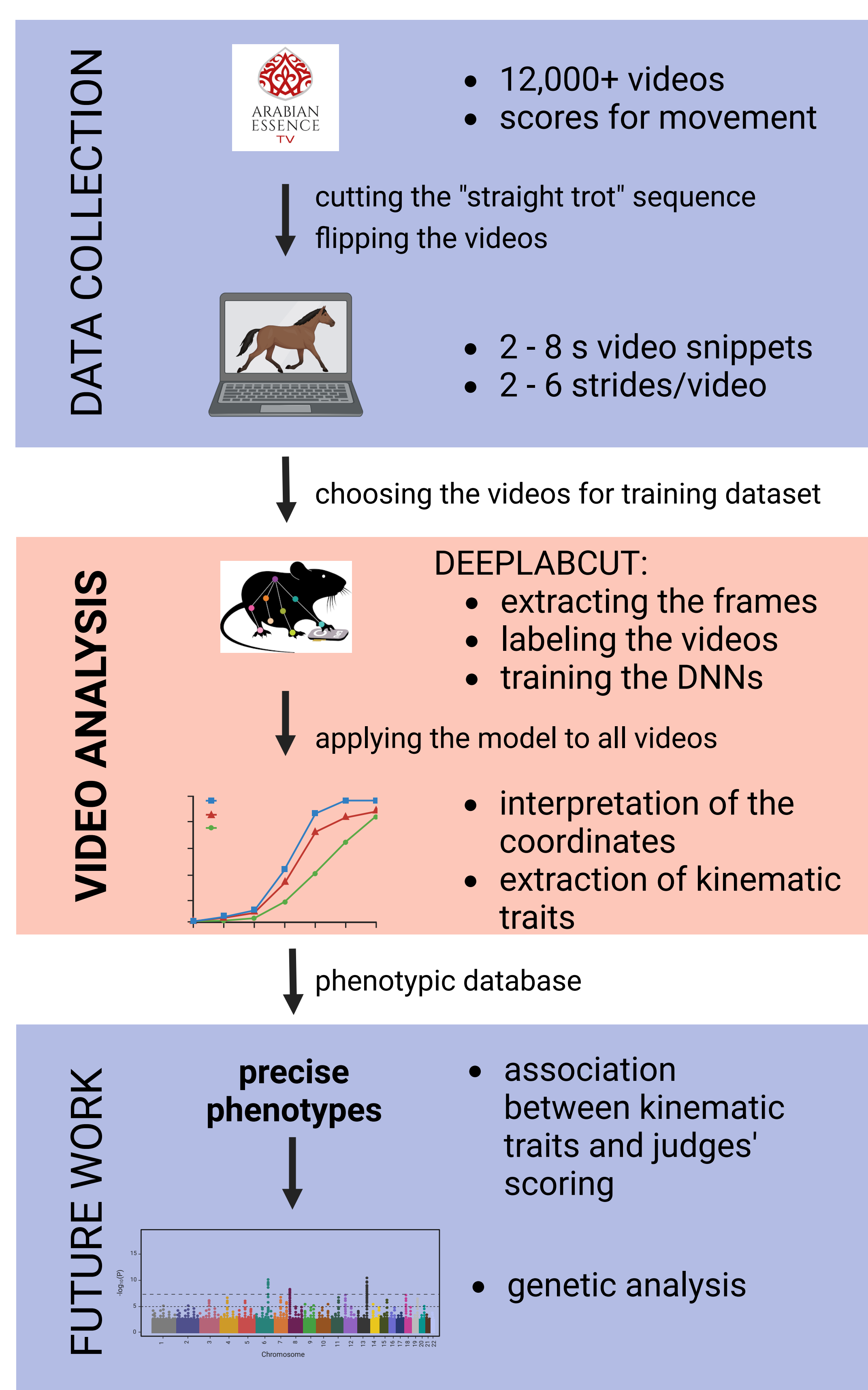
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Background

- **Quality of movement** is one of the most marketable traits in the Arabian horses.
- Despite the economic importance, the assessment of movement remains **highly subjective**.
- Precision phenotyping of **quantitative kinematic traits** is needed for further genetic analyses and for supporting breeding decisions.

Objectives

- To develop a **system for markerless tracking** of Arabian horses presented in halter shows.
- To identify specific **kinematic traits** associated with optimal performance of the Arabian horse.
- To build a **database of phenotypes** for further genetic analyses.

Methods

DATA COLLECTION

ARABIAN ESSENCE TV
- 12,000+ videos
- scores for movement

cutting the "straight trot" sequence
flipping the videos

- 2 - 8 s video snippets
- 2 - 6 strides/video

choosing the videos for training dataset

VIDEO ANALYSIS

DEEPLABCUT:
- extracting the frames
- labeling the videos
- training the DNNs

applying the model to all videos

- interpretation of the coordinates
- extraction of kinematic traits

phenotypic database

FUTURE WORK

precise phenotypes
- association between kinematic traits and judges' scoring
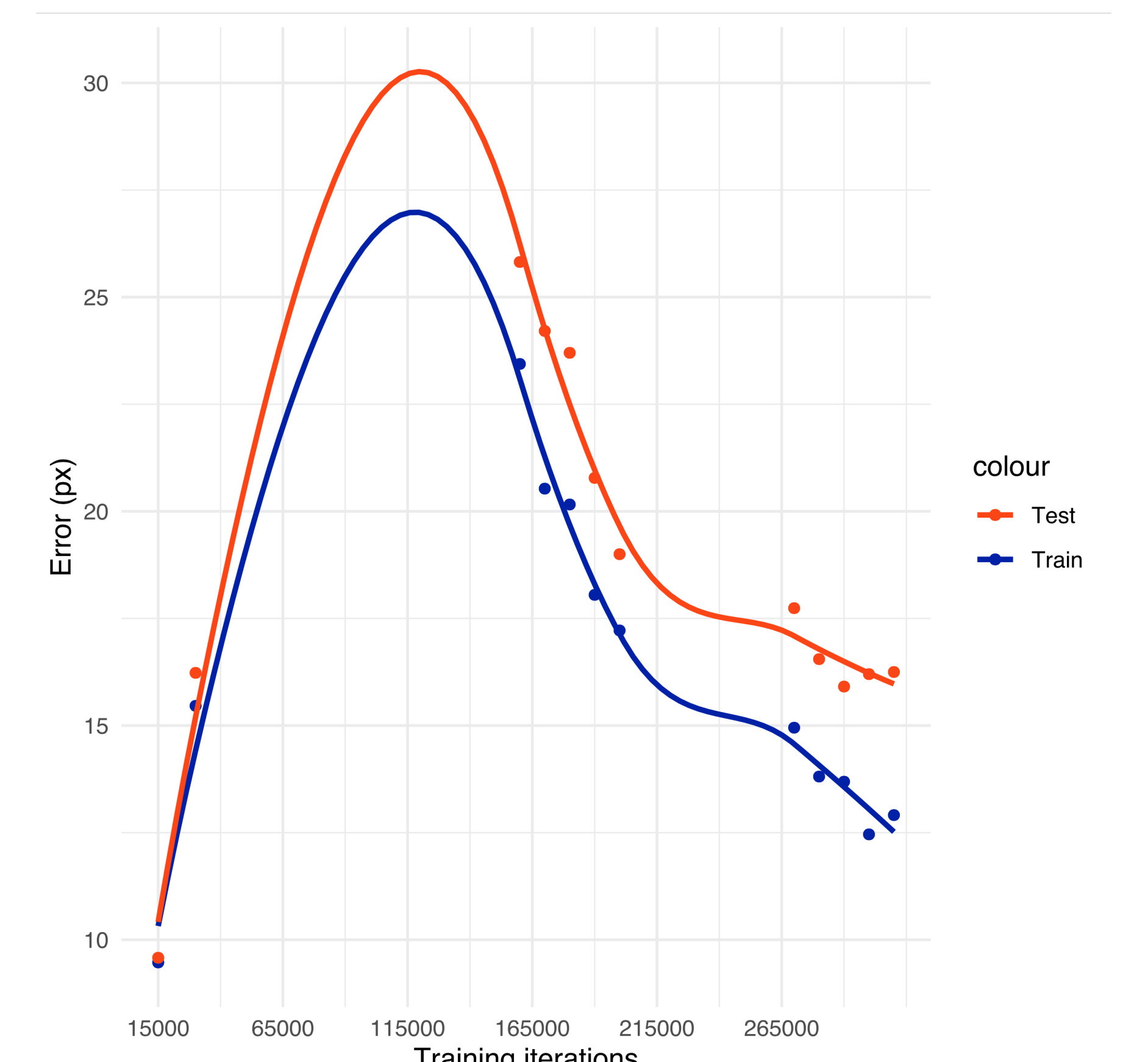- genetic analysis

Performance of the preliminary model

Sample test frames labeled by current model (training set = 93 videos, 310,000 iterations)
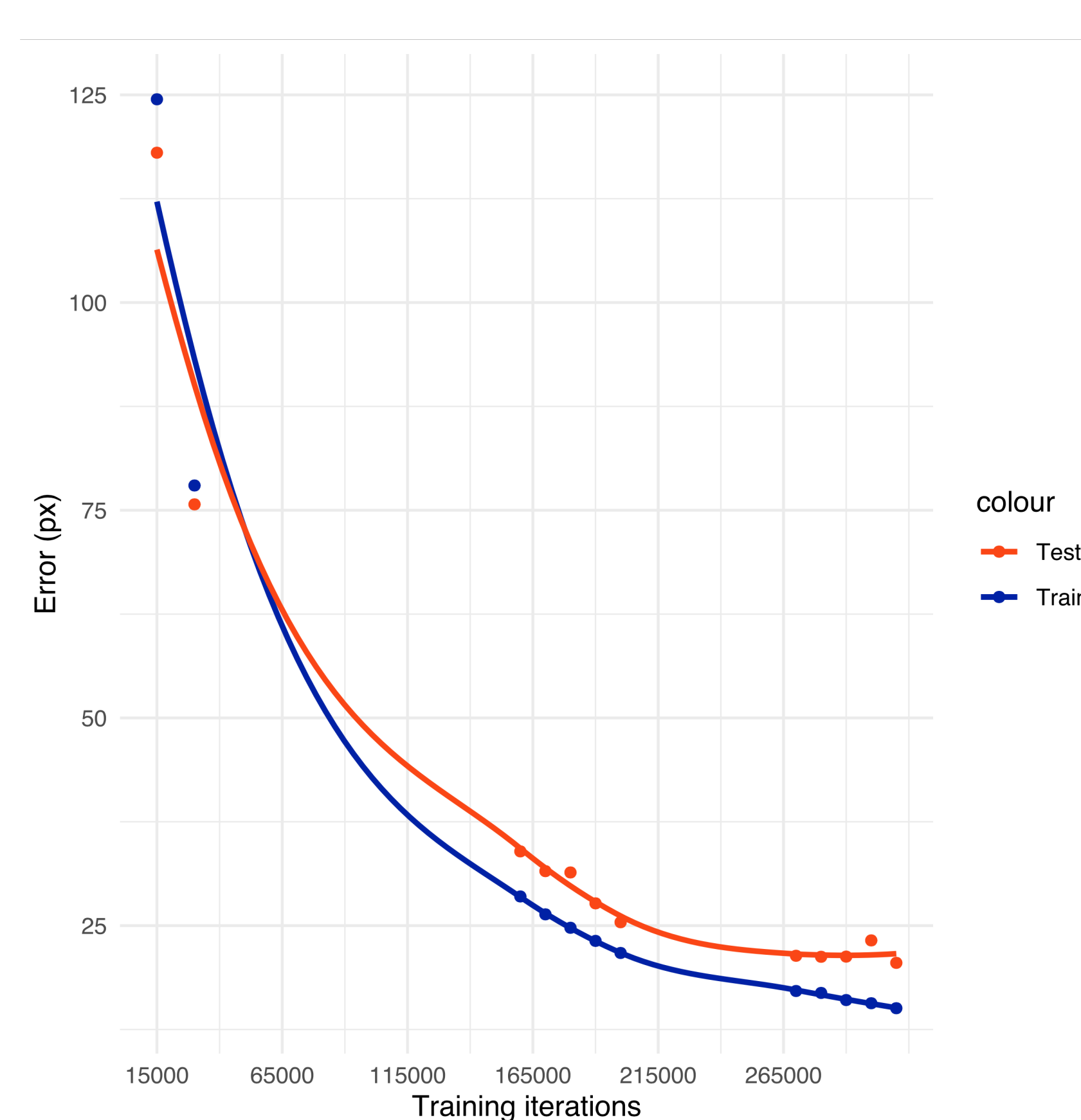
Decrease in model error without p-cutoff

Decrease in model error with p-cutoff = 0.6

Study limitations

- panned camera: distance parameters are impossible to assess
- blurriness of some frames cause difficulties with labeling
- relatively low quality of the videos (720p)

Next Steps

1. Increase the training dataset to 200 videos.
2. Employ the object stabilization algorithm.
3. Establish the parameters for the final model.
4. Make the catalog of kinematic traits.

Watch sample videos associated with this project:

9th UF/IFAS Animal Sciences Symposium, October 12-13 2023, St. Augustine, FL