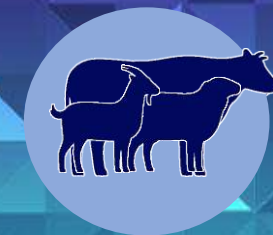




FACULTAD DE MEDICINA VETERINARIA Y ZOOTECNIA
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Application of Machine Learning Algorithms for Estimating Body Weight in Horses Using Morphometric Measurements

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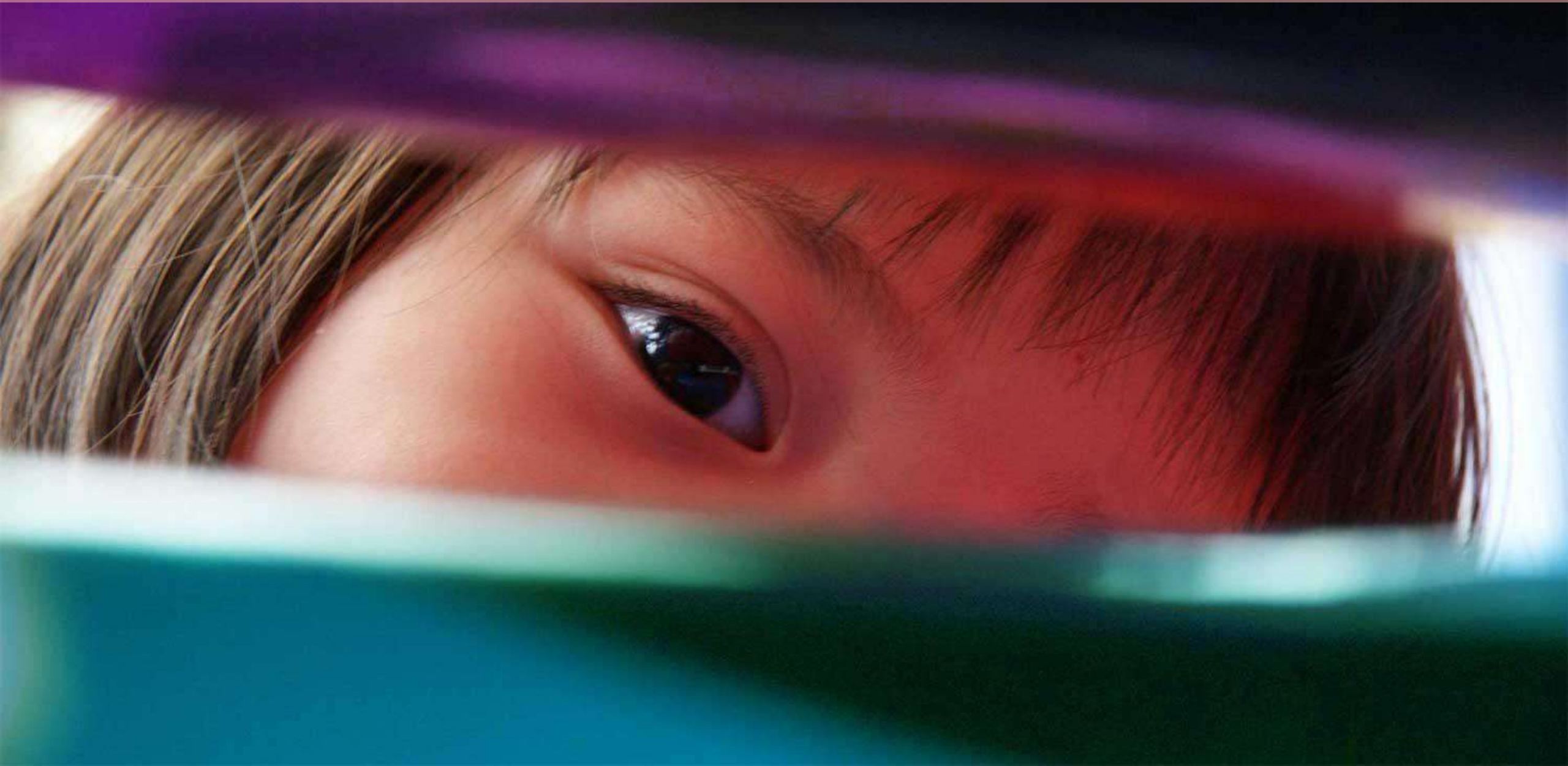
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Orgullosamente
UNAM



Introduction





Estimation of body weight (BW) in horses is essential for effective health monitoring, dosing and nutritional planning.



Maybe for some stables it is common to have a scale, however, in many countries such facilities are not available, so it is useful to use proxis for live weight estimation



A brown horse is shown in profile, facing left, in a field. The background features a sunset with a bright sun low on the horizon. A digital overlay of white lines and data points is visible on the left side of the image. The text is positioned in the upper right corner.

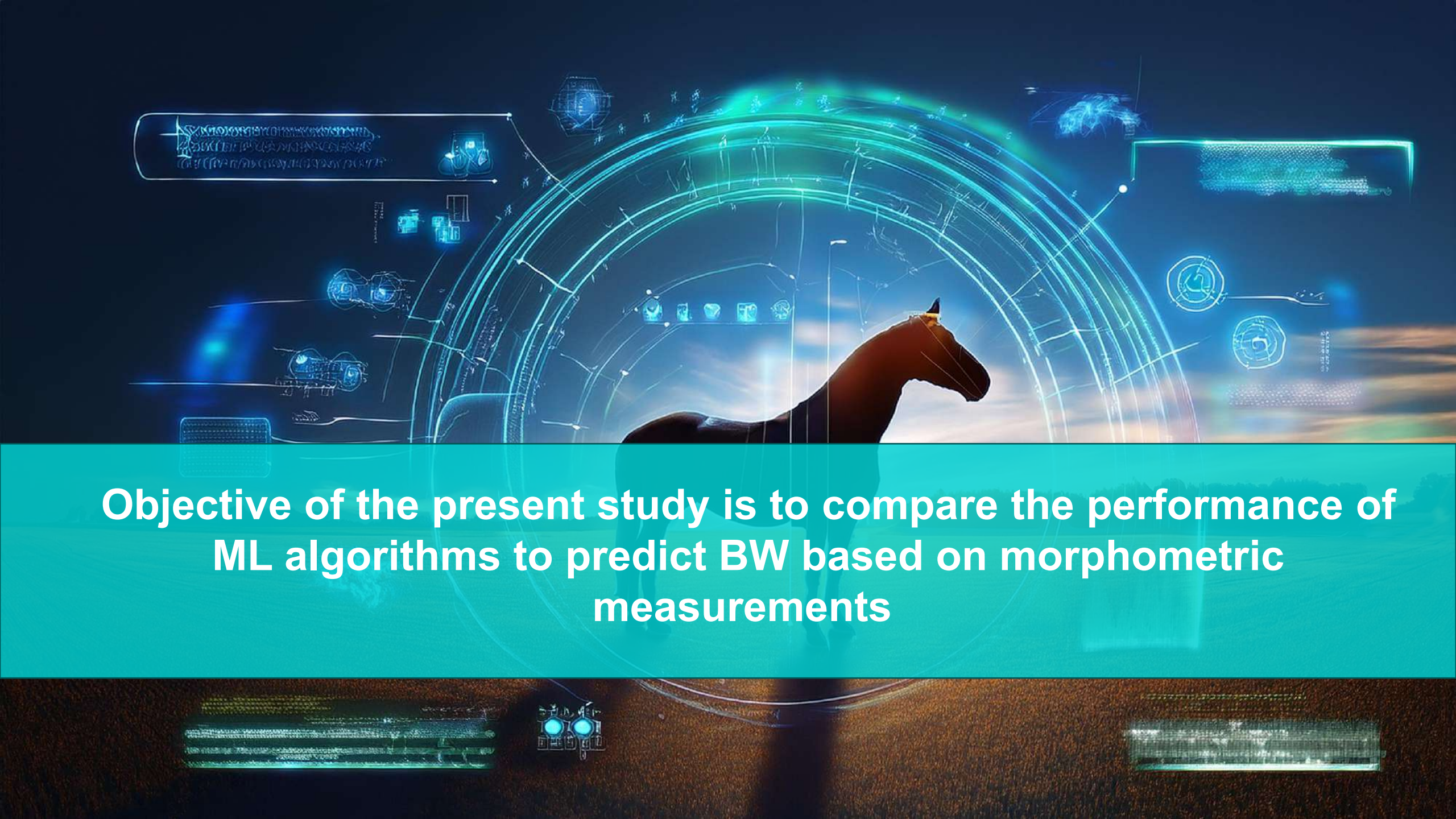
Traditional methods based on
morphometric measurements
such as height at withers, chest
girth and body length have been
widely used

A brown horse stands in a field at sunset, with a digital overlay of a network diagram. The overlay consists of a grid of nodes and connecting lines, with some nodes highlighted in blue. The horse is in the foreground, facing left, and the background shows a sunset over a field with a fence. The text "Through the development of multiple regression models" is overlaid on the right side of the image.

Through the development of
multiple regression models

Machine learning (ML)
algorithms have shown the
potential to predict BW.





Objective of the present study is to compare the performance of ML algorithms to predict BW based on morphometric measurements

A low-angle shot of a lighthouse at night. The lighthouse is white with a dark band near the top. A bright beam of light emanates from the top, illuminating the Milky Way galaxy, which appears as a dense, pinkish-purple band of stars stretching across the dark blue night sky. The sky is filled with numerous stars. The lighthouse is positioned on the right side of the frame, and its beam points towards the upper left. The Milky Way is visible in the background, arching over the lighthouse. The overall scene is serene and majestic.

MATERIALS AND METHODS



Mexico: State of Mexico,
Nuevo Leon and Mexico City



Location

Mexico: State of Mexico,
Nuevo Leon and Mexico
City



Database

142 horses (88 females and
54 males) over 2 years of
age

Morphometric measurements

Height at withers (HW), chest
girth (CG), neck
circumference (NC) and body
length (BL)

Additionally: Age and BCS



Partition

The data set was randomly divided into 70% for training and 30% for testing

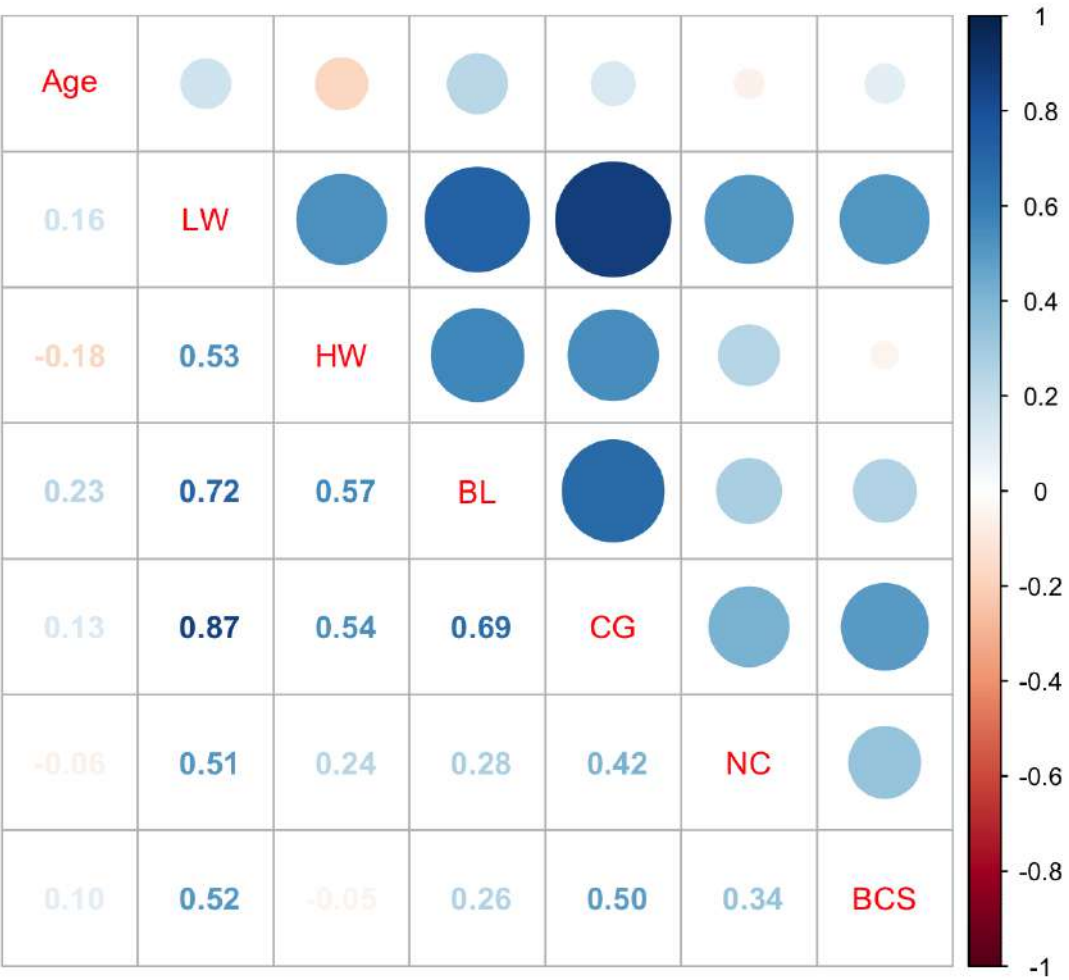
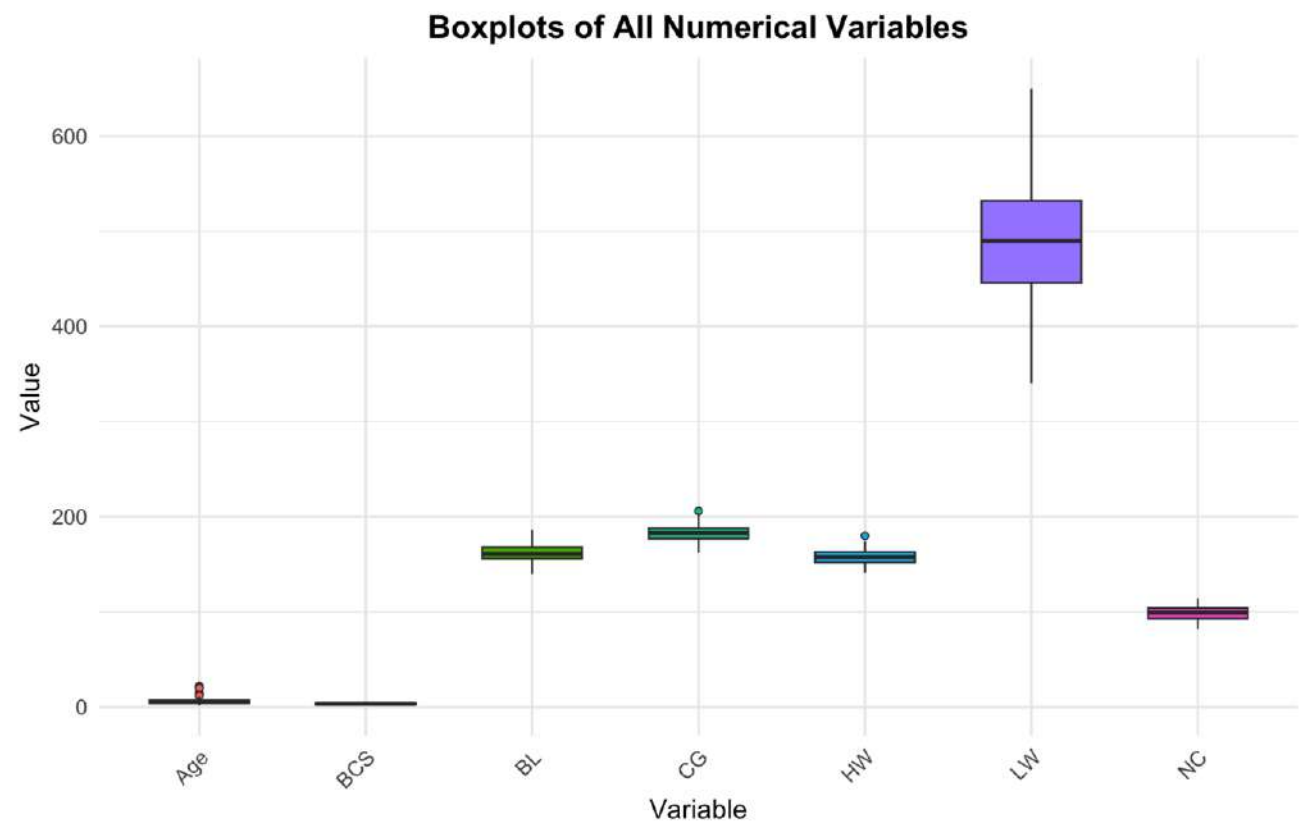


30%
test

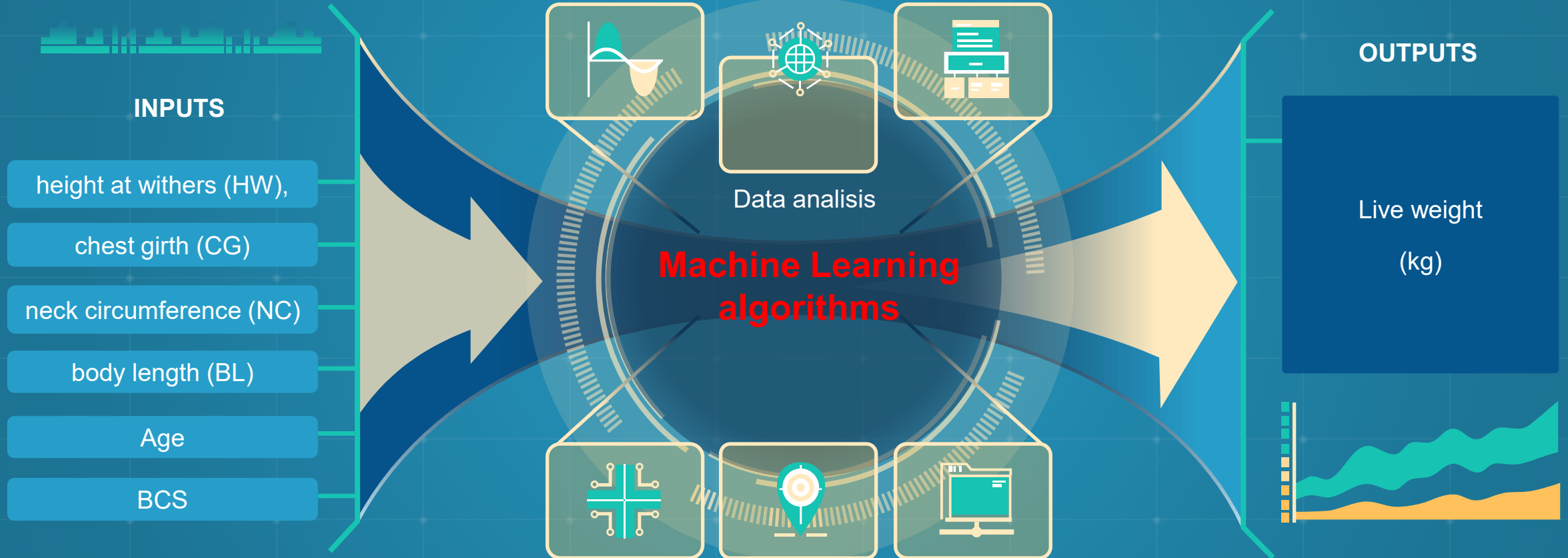
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Exploratory análisis



Data analysis



Machine Learning algorithms

- Multiple linear regression (MLR)
- MLR with interaction (MLRi)
- Stepwise MLR (MLRs)
- Artificial neural networks (ANN)
- Generalized additive model with penalized splines (GAMLSS)
- Support vector machines (SVM)

Fitting performance

Coefficient of
determination
(r^2)

Root mean square
prediction error
(RMSE)

Mean absolute
percentage error
(MAPE)

Results

A low-angle shot of a white lighthouse at night. The lighthouse is illuminated from within, and its light is visible at the top. The background is a dark night sky filled with stars and the Milky Way galaxy, which appears as a bright, hazy band of light. The lighthouse is positioned on the right side of the frame, and the sky fills the rest of the image. There are two teal-colored rectangular overlays: one on the left side containing the word 'Results' and another on the right side.



Table 1. Goodness-of-Fit Metrics for Machine Learning Models

Model	R Square		MAPE		RMSE		
	Train	Test	Train	Test	Train	Test	
MLR	83.41%	81.70%	2.08%	9.71%	0.05	0.05	←
MLR interactions	94.94%	-53.07%	2.95%	4.83%	0.06	0.06	
MLR StepAIC	94.94%	-53.07%	3.57%	4.54%	0.07	0.07	
GAMLSS	84.12%	80.75%	2.08%	9.71%	0.05	0.05	←
ANN	89.03%	77.71%	4.51%	4.42%	0.08	0.08	→
SVM	90.27%	74.19%	4.48%	4.41%	0.08	0.08	→



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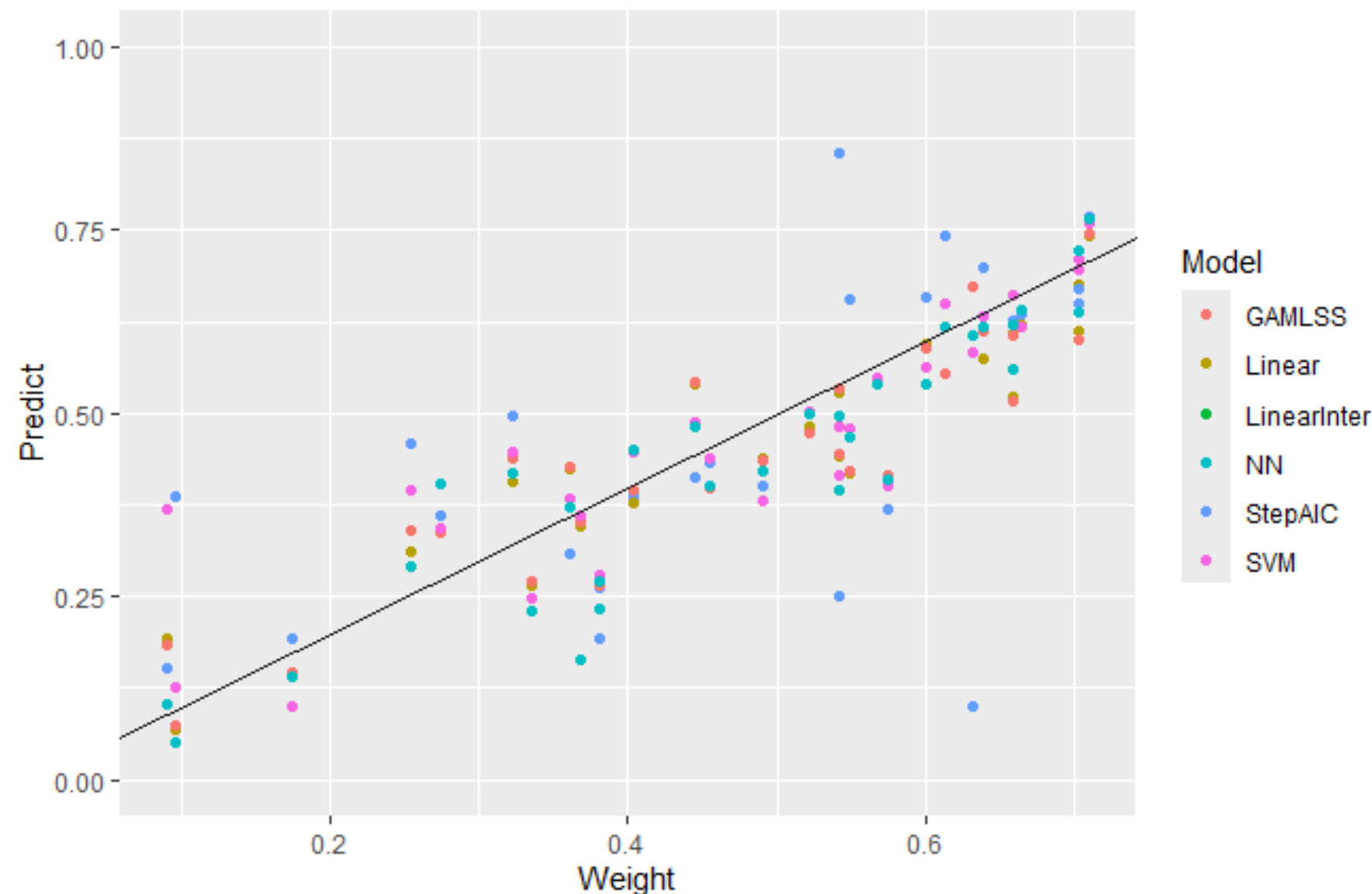
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Overfitting



Figure 2. Scatterplot of observed (x-axis) vs. predicted (y-axis) values, illustrating model accuracy on test data.



Conclusions



01

Based in R square and RMSE, MLR and GAMLSS showed the best overall performance for BW estimation, high accuracy and generalisation

02

Accorgding with MAPE, SVM and ANN showed good predictive ability, however, their susceptibility to overfitting limits their reliability

Areas for Improvement / Next Steps



- **Expand sample size:** Increase the dataset to include **>500 horses** for better model robustness.
- **Include additional variables:** Consider **breed, activity level**, and other relevant factors.
- **Explore alternative ML algorithms:** Test models like **decision trees, rule-based systems, and random forest**.
- **Enhance algorithm usability:** Focus on **portability** and develop a **user-friendly app** for practical implementation.

tryadd

Confiabilidad Global en Nutrición Animal



Thank you

