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Development of a Big Additive Model to predict boar semen quality

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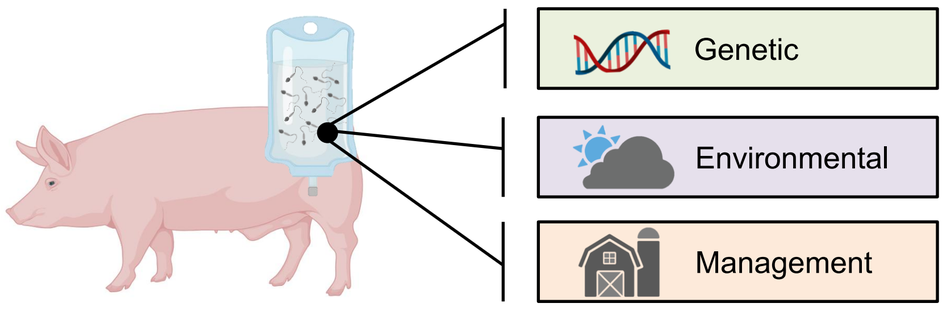
INTRODUCTION & AIM

The quality of semen in pig farms is a key factor for the efficiency of artificial insemination programs.

Factors that influence semen quality



Problem

Boar selection for semen collection is commonly based on technician experience rather than data-driven criteria

Objective

Develop an Artificial Intelligence (AI)-based model to predict boar ejaculate quality and support data-driven decision-making in semen collection.

METHOD

1 Data collection

6899 semen samples from **78** Duroc boars

- Boar age (months)
- Operator performing the collection
- Ejaculate volume (mL)
- Number of doses prepared
- Time interval between collections (days)
- Temperature and humidity
- Season
- Sperm motility (%)
- Sperm concentration (×10⁶/mL)
- Sperm morphology (%)

2 Big Additive Model (BAM)

- Integrates multiple variables
- Detects nonlinear relationships
- Generates predictions of ejaculate quality

Number of good spermatozoa = concentration × volume × (% motile and morphologically normal/100)

The model classifies the samples into four categories according to their quality:

- **Low**
- **Medium-Low**
- **Medium-High**
- **High**

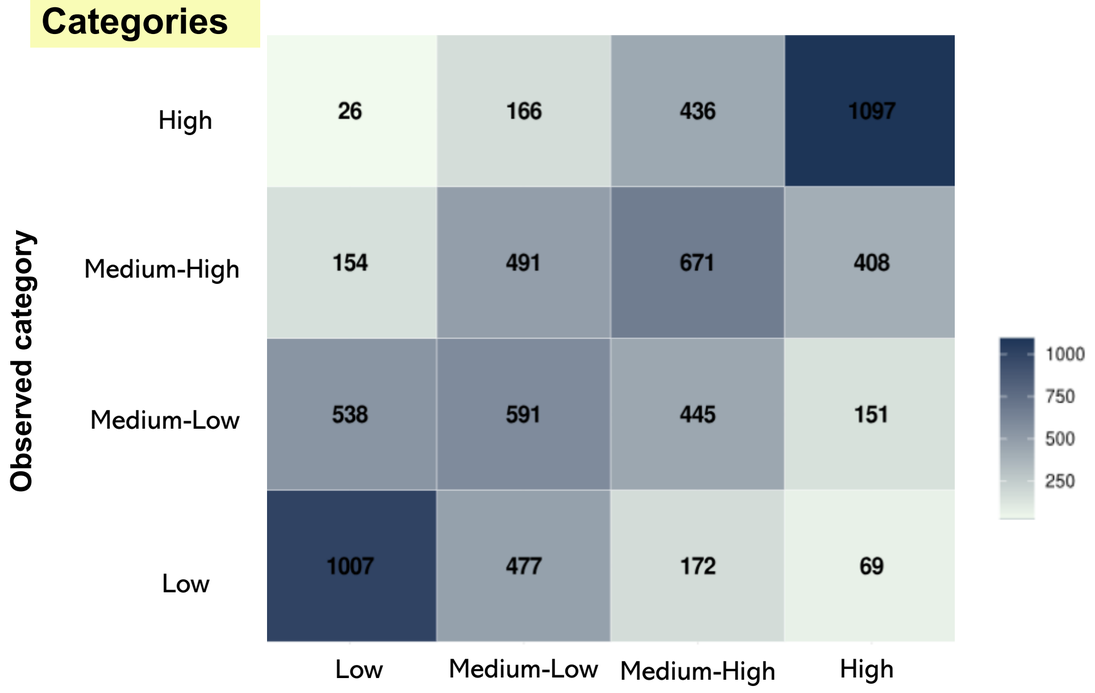
RESULTS & DISCUSSION

Model performance

- Coefficient of determination (R^2) = 0.485
- Root mean square error (RMSE) =17730.56
- Mean absolute error (MAE) = 13832.95

Moderate predictive performance

Categories



Classification performance

Overall accuracy = 48.79%

High/Medium-High quality
Accuracy: 88.87%

Low/Medium-Low quality
Accuracy: 86.03%

CONCLUSION

1. **BAM model showed moderate predictive performance for ejaculate quality.**
2. **High accuracy was achieved when distinguishing good vs poor semen quality.**

AI-based models may support data-driven decisions in boar semen collection.

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