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Prediction of daily nutritional requirements of gestating sows based on their behaviour and machine learning methods

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BACKGROUND & OBJECTIVE

- Precision Feeding aims to define the right feeding strategy according to individual’s nutrient requirements, to reduce feed cost and environmental losses.
- Usually, the nutrient requirements of gestating sows are calculated by a mechanistic nutritional model requiring input data such as sows and herd characteristics.
- Aim of this study: Prediction of nutritional requirements using machine learning methods and sensor data.

MATERIAL AND METHODS

Step 1: Scenarios definition
- Cleaning and calculations: 10 Scenarios (1 or combination of 2 sensors) => Digital Farm Configuration.

Step 2: Prediction of nutrient requirements using 9 ML algorithms
- Sow characteristics at insemination and housing conditions
- Reference values = Estimation of nutritional requirements by a mechanistic model (INRA Porc)
- SID Lys: Standard ileal digestible lysine; ME: Metabolisable energy; RMSE: Root Mean Square Error; MAPE: Mean Absolute Percentage Error; R²: coefficient of determination

RESULTS

Integration of sow and housing characteristics (scenarios SP) reduced the RMSE by 20% for energy and 35% for lysine.

CONCLUSION

- Machine learning methods using sensor data and behavioural data can accurately predict the sow’s daily requirements (error under 7% for energy and 12% for lysine) which could simplify the application of precision feeding on farms.
- Sow’s activity, feeding behaviour, and body weight are the best predictors. Adding sow and housing characteristics significantly improves the results.
- Gradient Tree Boosting is the most accurate ML algorithm.