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

M. DURAND, C. LARGOUËT, L. BONNEAU, J.Y. DOURMAD, C. GAILLARD

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

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.

Machine Learning algorithms

0.00 0.25 0.50 0.75 1.00
0 5 10 15 20 25 30 35 40
0 1 2 3 4 5 6 7 8 9

LASSO RIDGE PR SVR GTB RF LASSO RIDGE PR SVR GTB RF

Lower MAPE obtained using scenarios SP with automatic weighting system + feeder for lysine (5.31%) and with feeder + activity sensors for energy (3.88%).

R² values were higher with Gradient Tree Boosting (0.95 for energy and 0.99 for lysine) compared to those obtained with linear regression (0.52 and 0.83).