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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

1. Electronic feeder
2. Automatic weighting system
3. Camera, accelerometer
4. Electronic drinker

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

Housing conditions

Reference values = Estimation of nutritional requirements by a mechanistic model (INRA Porc)

9 supervised ML algorithms trained for regression tasks

Train dataset: (70 %)  
Test dataset: (30 %)

**RESULTS**

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

Lower MAPE obtained using scenarios SP with automatic weighting system + feeder for lysine (6.31%) and with feeder + activity sensors for energy (3.88%).

**CONCLUSION**

- Machine learning methods using sensor data and behavioural data can accurately predict the sows 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.