



Re-Livestock
RESILIENT FARMING SYSTEMS

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Re-Livestock Abstracts

**AI-DRIVEN EXPLORATION OF MOLECULAR DATA IN ANIMAL SCIENCE:
APPLICATIONS IN GENOMICS AND METABOLOMICS TO DISSECT THE ANIMAL
PHENOME.....2**

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AI-driven exploration of molecular data in animal science: applications in genomics and metabolomics to dissect the animal phenome

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Abstract

Artificial Intelligence (AI) provides powerful tools to extract biologically meaningful information from high-dimensional omics datasets. Here, we present the application of Boruta, a Random Forest-based feature selection algorithm, to genomic and metabolomic data in pigs, highlighting its value for dissecting complex phenotypes. Using high-density Single Nucleotide Polymorphism arrays from over than 1,000 pigs across local and commercial breeds. Boruta identified reduced subsets of informative markers capable of allocating pigs to their corresponding breeds with high accuracy. Additionally, Boruta was applied to metabolomics datasets derived from plasma, serum and urine samples across multiple pig and cattle cohorts to explore the molecular phenome in relation to complex traits, including breed differences, sexual dimorphism, heat stress, and variation in production traits. Machine learning enabled the identification of stable metabolomic signatures capturing metabolic shifts at different biological levels. Overall, AI-driven analysis of genomic and molecular phenomics data represents a practical strategy to identify robust biomarkers, supporting innovative breeding and precision feeding programs in the era of big data. Research funded by the European Union – NextGenerationEU under the National Recovery and Resilience Plan (PNRR) – FEEDTHEPIG, proposal code P2022FZMJ9 – CUP J53D23018310001 and the European Union’s Horizon Europe research and innovation programme under the grant agreement No. 101059609 (Re-Livestock).



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