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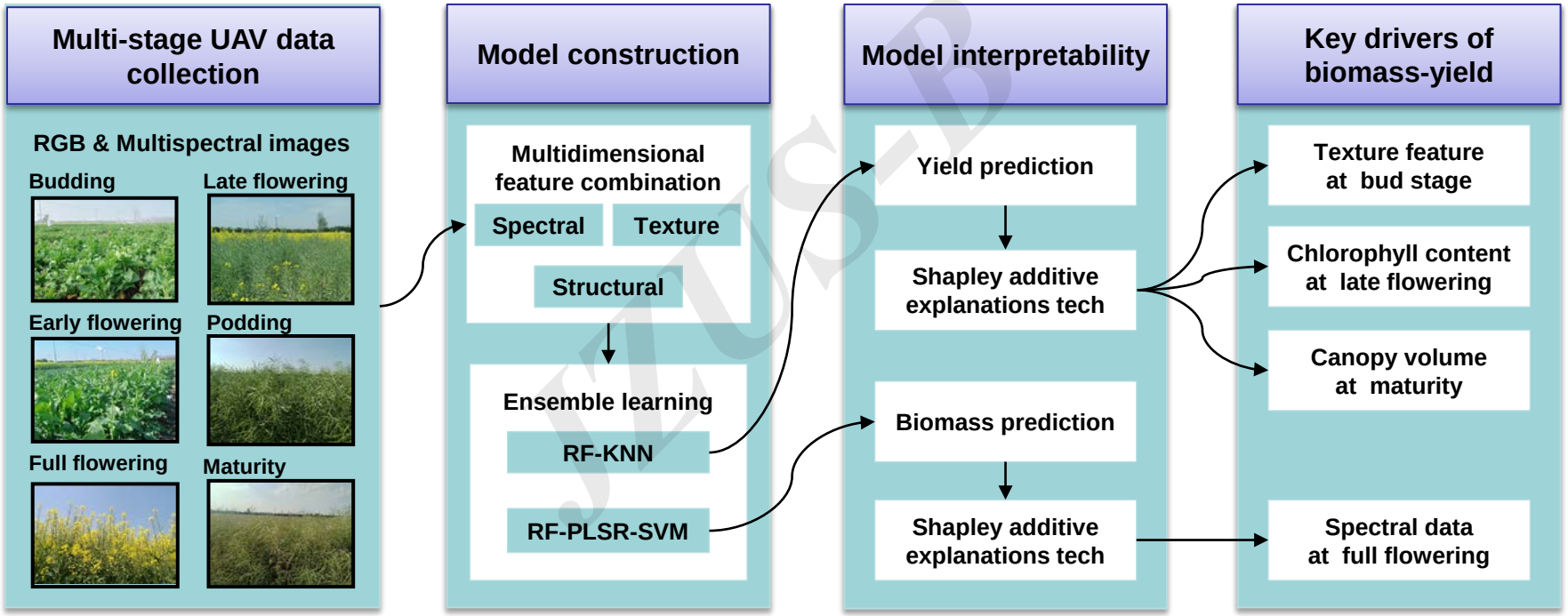
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Enhancing rapeseed biomass and yield estimation with ensemble learning and synergistic multidimensional features

Key words: Ensemble learning; Decision-making; Feature synergy; Temporal fit; Planting pattern

Graphical Abstract

Enhancing Rapeseed Biomass and Yield Estimation with Ensemble Learning and Synergistic Multidimensional Features



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Significance

The generated biomass and yield meter-scale maps offer critical spatial data for precision agriculture and intelligent harvesting

Research Summary

Context:

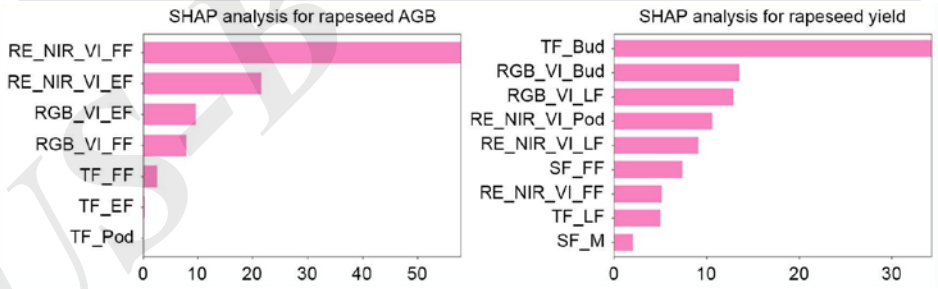
Accurate rapeseed yield and biomass estimation at the meter scale prior to harvest is crucial for precision harvesting.

High-techs:

Ensemble learning

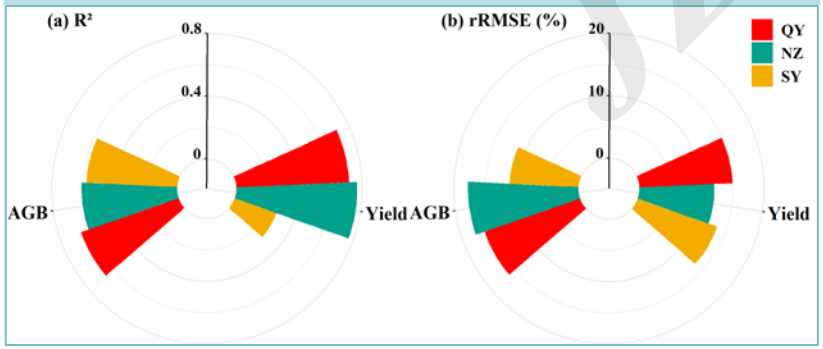
Ensemble Strategy for Yield	**KNN-RF**
RF-PLSR-SVM	**Ensemble Strategy for AGB**

SHAP-based model interpretability

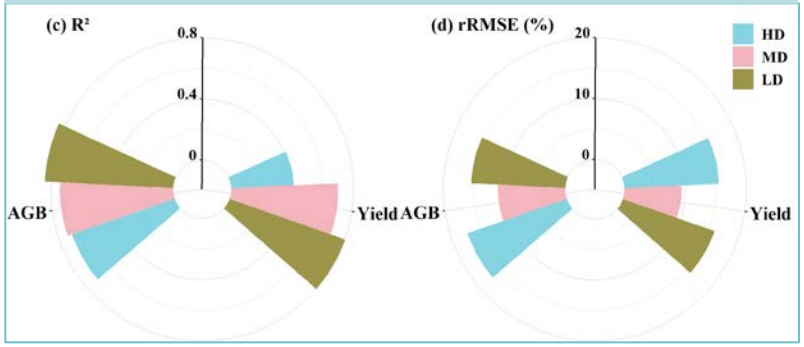


Results:

Performance for different variety scenario



Performance for different density scenario



Significance:

The generated meter-scale maps offer critical spatial data for precision agriculture and intelligent harvesting.

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Innovation points

Innovation 1

The spatiotemporal variability of spectra and the dataset dependence of machine learning limit the model's generality. To address these issues, this study utilized the synergy of multidimensional features and ensemble learning strategies to improve model stability and generality across different planting scenarios.

Innovation 2

This study employed Shapley additive explanations (SHAP) analysis to evaluate feature importance across different planting scenarios, enhancing model transparency and identifying key drivers of biomass accumulation and yield formation.

Significance

The generated meter-scale maps offer critical data for precision agriculture and intelligent harvesting.

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