Comparative Analysis of Explainable Spectroscopic-Fusion Models for Avocado Leaf Nitrogen Prediction

Supplementary data:

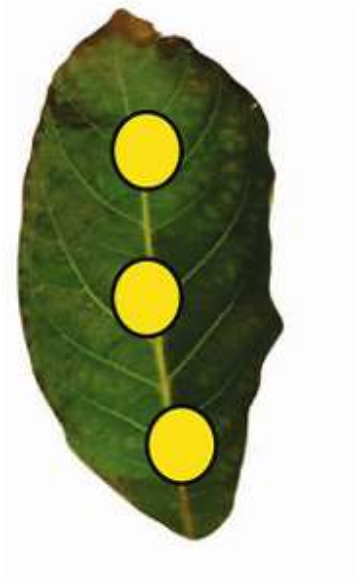


Figure S1. Approximate positions where the probe was located in each leaf to collect the measurements in the avocado (Estrada et al., 2025).

Table S1. Comparison of Prediction performance metrics alongside empirical 95% confidence intervals and Fisher Z-transformed R^2 intervals.

Model	Prediction R^2	Prediction R^2 (95% CI)	Prediction RMSE	Prediction RMSE (95% CI)	Prediction RPD	Prediction Fisher Z R^2 (95% CI)
PLSR	0.55	[0.13, 0.69]	1.17	[0.90, 1.46]	1.55	[0.21, 0.79]
1D-CNN	0.63	[0.49, 0.69]	1.07	[0.75, 1.40]	1.68	[0.30, 0.83]
Data Fusion PLSR	0.57	[0.16, 0.69]	1.15	[0.88, 1.40]	1.59	[0.23, 0.80]
Data Fusion 1D-CNN	0.73	[0.56, 0.78]	0.92	[0.72, 1.15]	1.95	[0.45, 0.88]
Weighted Fusion PLSR	0.48	[0.10, 0.64]	1.26	[0.91, 1.60]	1.43	[0.14, 0.75]
Weighted Fusion 1D-CNN	0.62	[0.46, 0.69]	1.08	[0.76, 1.42]	1.68	[0.29, 0.83]
Attention Fusion 1D-CNN	0.63	[0.46, 0.72]	1.07	[0.74, 1.45]	1.68	[0.31, 0.83]

Table S2. Comparison of supplementary calibration and regression parameters (mean ± standard deviation) across five-fold cross-validation.

Model Architecture	Calibration Bias	Calibration Slope	Calibration Intercept	Prediction Bias	Prediction Slope	Prediction Intercept
PLSR	-0.00 ± 0.00	0.69 ± 0.06	5.23 ± 1.20	0.13 ± 0.11	0.59 ± 0.10	7.20 ± 1.81
1D-CNN	-0.03 ± 0.35	0.50 ± 0.10	8.44 ± 1.85	-0.03 ± 0.21	0.45 ± 0.07	9.40 ± 1.31
Data Fusion PLSR	-0.00 ± 0.00	0.74 ± 0.09	4.47 ± 1.65	0.16 ± 0.09	0.61 ± 0.12	6.89 ± 2.14
Data Fusion 1D-CNN	0.04 ± 0.17	0.68 ± 0.10	5.40 ± 1.75	-0.02 ± 0.15	0.59 ± 0.09	6.99 ± 1.70
Weighted Fusion PLSR	-0.00 ± 0.00	0.59 ± 0.07	6.90 ± 1.29	0.16 ± 0.11	0.53 ± 0.06	8.18 ± 1.06
Weighted Fusion 1D-CNN	-0.11 ± 0.40	0.53 ± 0.13	7.97 ± 2.15	-0.15 ± 0.23	0.46 ± 0.08	9.12 ± 1.28
Attention Fusion 1D-CNN	-0.08 ± 0.23	0.56 ± 0.06	7.42 ± 1.14	-0.15 ± 0.23	0.50 ± 0.07	8.44 ± 1.18

Table S3: Performance evaluation across 10 seeds (Mean ± SD).

Model	Calibration R^2	Calibration RMSE	Prediction R^2	Prediction RMSE	Prediction RPD	Prediction RPIQ	Prediction r^2	Prediction Bias	Prediction Slope	Prediction Intercept
1D-CNN	0.62 ± 0.03	1.21± 0.05	0.60 ± 0.04	1.12 ± 0.05	1.61 ± 0.06	2.04 ± 0.08	0.73 ± 0.02	-0.02 ± 0.04	0.43 ± 0.03	9.69 ± 0.57
Data Fusion 1D-CNN	0.80 ± 0.05	0.86 ± 0.12	0.70 ± 0.01	0.96 ± 0.02	1.87 ± 0.05	2.37 ± 0.06	0.77 ± 0.01	-0.01 ± 0.07	0.56 ± 0.02	7.53 ± 0.44
Weighted Fusion 1D-CNN	0.65 ± 0.02	1.16 ± 0.05	0.60 ± 0.02	1.11 ± 0.03	1.62 ± 0.03	2.05 ± 0.04	0.75 ± 0.01	-0.05 ± 0.05	0.43 ± 0.01	9.68 ± 0.34
Attention Fusion 1D-CNN	0.70 ± 0.01	1.08 ± 0.03	0.61 ± 0.01	1.10 ± 0.02	1.62 ± 0.04	2.05 ± 0.05	0.73 ± 0.02	-0.05 ± 0.09	0.45 ± 0.01	9.39 ± 0.31