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Supplementary Material
Metric-Aligned Cross-Phase Attention for LI-RADS Categorization

This supplement provides the full corrected-label ablation and statistical analyses requested in review, expanding the summary figures in the main paper. All numbers use the official composite metric $0.85 \cdot \mathrm{QWK}_{\mathrm{adj}} + 0.15 \cdot \mathrm{SCR}$ on the corrected 519-case release under the same 5-fold out-of-fold protocol; $\pm$ values are case-level bootstrap standard deviations (1000 resamples).

S1. Component ablation on the corrected 519-case labels

Table 1 answers the reviewer request for the key-component ablation computed on the *corrected* labels (Table 1 in the main paper is on the preliminary release and is a relative component reference only). Both the architecture choice and the radiomics fusion are evaluated with the identical recipe (CDW-CE, α=2, class-balanced sampling, feature-guided heads).

Table 1. Corrected 519-case, matched 3-seed out-of-fold. Paired case-level bootstrap (2000 resamples, identical folds): cross-phase attention vs. channel-stack Δ=+0.053 (95% CI $[-0.09, +0.20]$, $P(\Delta{>}0)$=0.77); ordinal-head radiomics fusion Δ=+0.075 (95% CI $[+0.02, +0.13]$, $p{\approx}0.005$). The architecture advantage is directional but noise-limited on corrected labels; the radiomics-fusion gain is statistically significant.

Configuration (corrected 519)	Composite	Adj-QWK	SCR
Channel-stack + CDW-CE(α=2) + balanced + feature-guided	0.386 ± 0.09	0.365	0.506
Cross-phase attention (same recipe), our encoder	0.442 ± 0.10	0.426	0.532
Cross-phase attention + ordinal radiomics fusion (submitted)	$\mathbf{0.501 \pm 0.09}$	**0.491**	0.553

S2. Which radiomics features drive the ordinal-fusion gain

Table 2 decomposes the 46 hand-crafted radiomics features by group and reports the fused composite when only that group is fused into the ordinal head (corrected 519-case OOF). The gain is driven by per-phase enhancement-magnitude statistics; shape/size and cross-phase differences contribute only in combination. This indicates the radiomics supplies complementary *quantitative enhancement* signal, consistent with the clinical role of enhancement magnitude in LI-RADS.

Table 2. Radiomics feature-group ablation (corrected 519-case OOF, fused ordinal composite).

Radiomics group fused into the ordinal head	Composite
deep-only (no radiomics)	0.424
per-phase intensity / enhancement statistics (36 feats)	0.475
cross-phase enhancement differences / ratios (7 feats)	0.351
shape / lesion-size (3 feats)	0.313
all 46 features (submitted)	**0.504**

S3. Stability of the fusion weight

Across 10 seeds × 5 folds (50 independent CV selections), the composite-optimal ordinal-fusion weight is $w = 0.52 \pm 0.04$ (median 0.50, range $[0.4, 0.6]$), and the composite is flat over $w \in [0.4, 0.7]$ (main-paper Fig. 2c). The deployed w=0.6 lies within this stable range, so the final result is not sensitive to the exact locked value.

S4. Negative-result detail

Table 3 gives the composite scores summarised in Section 5 of the main paper. Corrected-label entries are compared against the 0.47 from-scratch cross-phase baseline; the MedicalNet entry is on the preliminary-label release (against the 0.676 preliminary from-scratch ensemble). Every entry under-performs the from-scratch model, and none survived nested-CV confirmation.

Table 3. Negative results (composite). Rows show the best configuration of each family.

Configuration	Composite	Labels
From-scratch cross-phase ensemble (reference)	0.47	corrected
FMCIB frozen SimCLR 3D ResNet-50 encoder	0.37	corrected
Radiomics-alone (HistGradientBoosting)	0.41	corrected
In-domain masked cross-phase pretraining	0.29	corrected
2D ImageNet backbone (2.5D, slice-wise)	0.26	corrected
Squared-EMD / LDAM / logit-adjust / Balanced-MixUp	0.20–0.42	corrected
From-scratch cross-phase ensemble (reference)	0.676	preliminary
MedicalNet-pretrained 3D ResNet	0.582	preliminary