## (a) Performance Metrics Heatmap (Hierarchically Clustered) - 1.5 1.2 -1.7 1.4 -1.7 -1.4 Conformer-lite --1.7 1.7 - 1.0 Standardized Score 5 5 0 0 1 0.5 0.7 0.8 1.4 0.6 -0.7 -0.9 0.2 Enhanced 0.0 -1.0 CNN 0.7 -0.8 -0.4 0.3 0.5 0.1 -1.0-1.1 0.5 BiLSTM -0.6 0.6 1.0 0.5 -0.1 -1.5(b) Model Comparison Radar Chart LORO F1 the state of the s 1050 kj (c) Metric Correlation Matrix LOSO\_F1 -LORO\_F1 - -0.69 8.0 Cross\_Domain\_Gap - -0.99 0.67 0.5 0.6 0.2 0.4 Stability Index LOSO F1 0.0 Stability\_Index - 0.98 -0.59 -0.99 ECE - -0.83 0.31 0.76 -0.77 Efficiency\_Ratio - 0.94 -0.85 -0.96 0.92 -0.60 LOSO FIL LORO FIL LOR Deployment\_Readiness - 0.83 -0.17 -0.84 0.89 -0.83 (e) Performance by Model (LOSO vs LORO) Efficiency Ratio Deployment Readiness (d) Overall Model Ranking (Composite Score) 1.0 Enhanced -0.75 8.0 CNN · 0.701 0.6 Wac L1 4.0 Wac L1 4.0 BiLSTM 0.689 0.2 LOSO F1 Conformer-lite 0.486 LORO F1 0.0 0.0 0.2 0.3 0.5 0.7 0.1 0.4 0.6 Composite Performance Score

Model