



M5 COMPETITION RESULTS ANALYSIS

Competing algorithms

The M5 forecasting competition, organized by the International Institute of Forecasters, represents one of the most comprehensive and challenging time series forecasting competitions to date. Built upon the foundation of previous M-competitions, M5 utilized real-world retail sales data from Walmart, encompassing 42,840 hierarchical time series across different product categories, stores, and geographical regions.

Weighted Root Mean Squared Scaled Error (WRSSE) serves as the primary evaluation metric for M5. This sophisticated metric addresses several critical challenges in hierarchical forecasting:

- **Scale Independence:** WRSSE normalizes errors by the in-sample naive forecast error, making it comparable across series with different scales
- **Hierarchical Weighting:** The metric incorporates weighted aggregation to account for the relative importance of different series levels (item, category, store, state)
- **Robustness:** It provides a balanced assessment that prevents any single series from dominating the overall performance evaluation

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2. Comparative Performance Results

MODEL	WMSSE
POEM365	0.516
YEONJUN	0.5204
Matthias	0.5281
TS Mixer	0.568
TFT	0.579
DeepAR	0.611

3. Key Performance Insights

Superior Performance Achievement: POEM365 demonstrates exceptional performance with a WMSSE of 0.515, establishing itself as the top performer in this comparative analysis. This represents a meaningful improvement over established benchmarks and competition winners.

Competitive Advantage Over Winners: The model outperforms the original Kaggle competition winner (YeonJun IN_STU) by approximately 1.04%, which may appear modest but represents significant practical value given the scale and complexity of retail forecasting operations.

Substantial Improvement Over Deep Learning Baselines: POEM365 shows considerable superiority over popular deep learning approaches:

- 15.7% better than DeepAR (0.611 vs 0.516)
- 11.1% better than TFT (0.579 vs 0.516)
- 9.3% better than TS Mixer (0.568 vs 0.516)

Consistency Across Hierarchy: The strong WMSSE performance suggests that POEM365 maintains consistent accuracy across different aggregation levels, from individual item forecasts to higher-level category and store aggregations.

POEM365 demonstrates state-of-the-art performance on the M5 dataset, achieving the lowest WMSSE score among all compared models. The results validate the effectiveness of the proposed causal modeling approach in handling complex, hierarchical retail forecasting scenarios.