

Uniboost: Global Coordination with Value Alignment for Fair and Efficient Traffic Allocation

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Abstract

We propose **Uniboost**, a unified traffic allocation framework for the recommendation blending stage. It introduces **posterior value alignment** to calibrate abstract model scores to anchor metrics with explicit business semantics, and employs **independent linear boosting** to decouple complex weighting schemes for precise attribution. Online A/B tests on a large-scale industrial platform show that Uniboost improves allocation efficiency at the micro level and provides macro-level guidance for system iteration.

1 Background & Challenges

The Blending stage merges candidates from diverse sources (ads, organic, cold-start) and allocates traffic via weighting mechanisms. Existing approaches suffer from three core problems:

- Score Inflation** — accumulated PID and Boost weights make scores explode, losing physical semantics and interpretability
- Plan Coupling** — multiple allocation plans (guaranteed delivery, cold-start, promotions) interfere with each other, making optimisation intractable
- No Attribution** — individual plan cost and contribution cannot be isolated, blocking data-driven decisions

Our Solutions

- Posterior Value Alignment** — identify Effective Completion Rate as anchor metric, turning abstract scores into business-semantic values without altering ranking order
- Unified Boosting Paradigm** — independent linear boosting with bias, covering existing schemes while keeping every weighted score interpretable
- Precise Attribution** — linear aggregation quantifies each plan's contribution, enabling ROI-based macro guidance

2 Uniboost Method

2.1 Value Alignment

Raw scores y'_v lack business semantics. We map them into anchor-metric space:

$$y_v = y'_v \cdot \mu_{\text{anchor}} / \mu_{\text{score}}$$

Eq. 1 — calibrates scores to expected Effective Completion Rate

2.2 Independent Boosting

$$s_{p,v} = \mathbb{1}_p(v) \cdot (w_p \cdot y_v + b_p)$$

Eq. 2 — each plan computed independently with learnable w_p, b_p

2.3 Linear Aggregation

$$r_v = y_v + \sum_{p \in S} s_{p,v}$$

Eq. 3 — additive composition ensures full attributability

Backward Compatibility

$w_{ad}=0, b_{ad}=PID \rightarrow$ original guaranteed delivery is preserved.

$w_{cs} \neq 0, b_{cs}=0 \rightarrow$ conventional cold-start Boost. Unified with zero disruption.

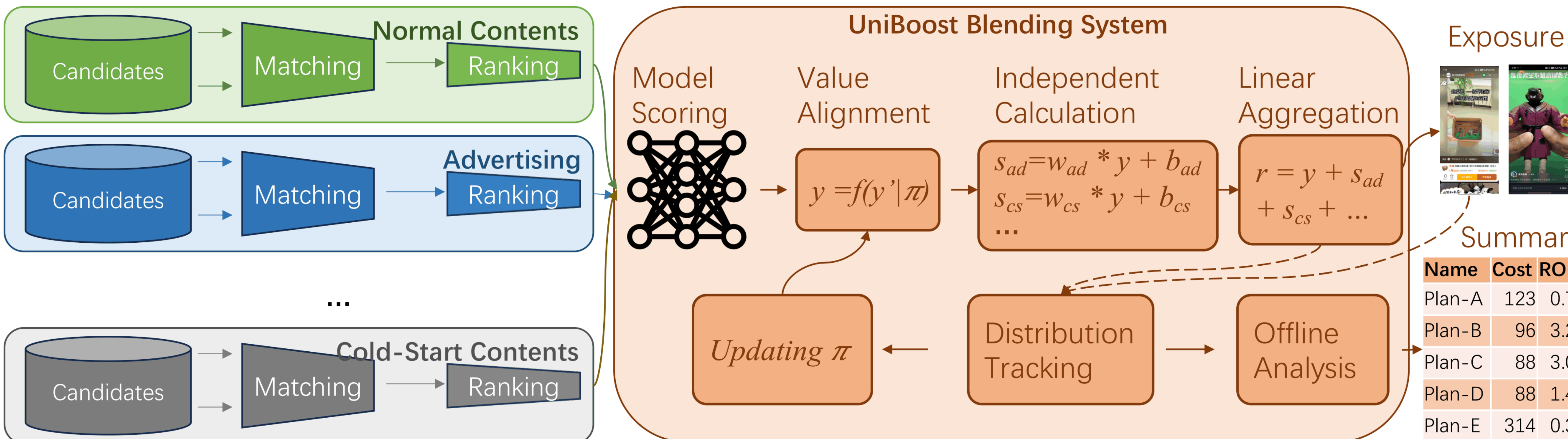


Figure 1: Uniboost system overview — candidates flow through Model Scoring → Value Alignment → Independent Boost Calculation → Linear Aggregation → Exposure. A near-line/offline subsystem performs Distribution Tracking and ROI Analysis for closed-loop optimisation.

3 Experiments & Results

Large-scale online A/B test on Taobao Content Feeds. Control: original pipeline (align after weighting). Treatment: Uniboost with Effective Completion as anchor.

+1.69%VV
(impressions)**+3.07%**Valued VV
(played > 3s)**+0.65%**Duration
(total watch time)**+2.54%**Valued Score
(composite UX)

RQ1 Micro-level Efficiency



Weighting magnitudes drop by more than 90% while exposure shares stay stable — decoupled plans do not sacrifice delivery.

Insight: shrinking weighted-score magnitude removes unintended cross-plan interference, yielding measurably more efficient micro-level allocation.

RQ2 Macro-level Guidance

ROI-based offline analysis quantifies each plan's cost against its benefit:

$$ROI_p^{VV} = \Delta VV_p / Cost_p$$

Plan-A was flagged as lowest ROI; the ablation confirms it:

Setting	VV	Valued VV	Duration	Valued Score
w/o Plan-A	+0.95%	+2.83%	+3.49%	+4.13%

Insight: per-plan cost/benefit dashboards turn traffic governance into a data-driven loop, accelerating strategy iteration.

4 RQ3 Anchor Metric Selection

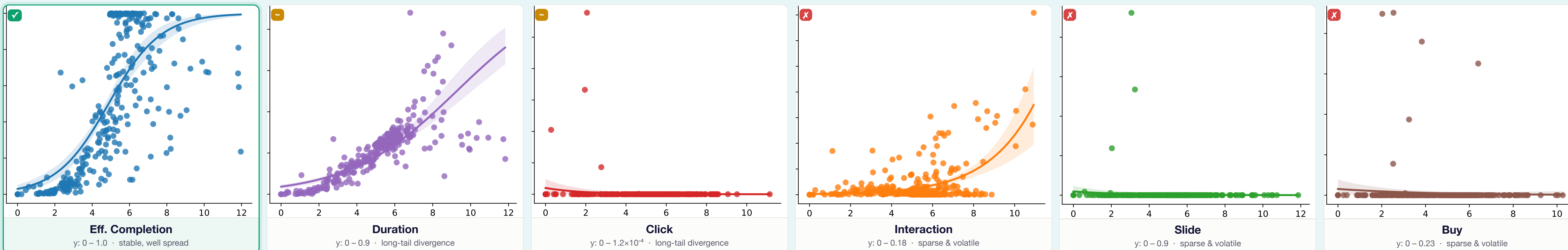
A usable anchor must satisfy **two principles**. We screen six posterior metrics against the blending score (x axis: model score; each panel shares the same plot geometry):

Principle 1 Stability

Values stay uniformly distributed across every model-score interval — no score-dependent divergence or bias.

Principle 2 Low Calibration Error

Calibration error remains low and flat across all score intervals, so alignment introduces no systematic bias.



Insight: Interaction, Slide and Buy are too sparse and volatile; Click and Duration diverge in the long-tail (high-score) region. Only **Effective Completion** satisfies both principles, making it a robust and cheaply obtainable anchor for content recommendation pipelines.

Conclusion

Uniboost turns abstract model scores into interpretable business values through **posterior value alignment**, replaces coupled boosting with **independent linear boosting**, and delivers both micro-level efficiency gains and macro-level strategic guidance via ROI attribution. **Fully deployed** in Taobao Content Feeds as the core traffic allocation system, serving hundreds of millions of users daily.