Sequential Group Recommendation with SDAA

Method: Satisfaction and Disagreement Aware Aggregation

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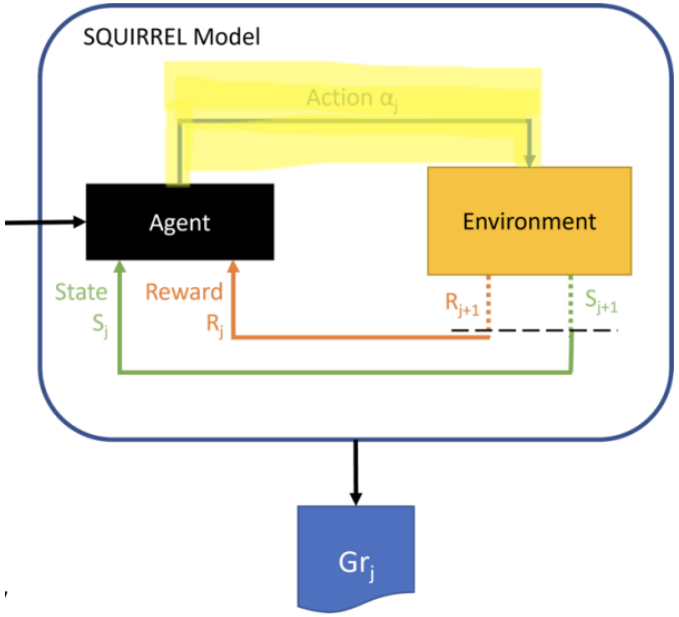


From Static to Dynamic Group Recommendations

Problems?

- Average: Treats all users equally every round
  → Minority users consistently unsatisfied

- Least Misery: Always focuses on least satisfied user
  → Lower overall group satisfaction

New challenge:

How to ensure fairness across MULTIPLE rounds without sacrificing quality?

SDAA Method Design (from SQUIRREL Framework)

1. Track cumulative satisfaction for each user $\mathrm{satO}(u, RS) = \frac{1}{\mu} \sum_{j=1}^{\mu} \mathrm{sat}(u, Gr_j)$

2. Calculate fairness weights $w(u) = 1 - \frac{\mathrm{satO}(u) - \min_u \mathrm{satO}(u)}{\max_u \mathrm{satO}(u) - \min_u \mathrm{satO}(u)}$ Lower satisfaction → Higher weight

3. Blend Average and Least Misery

$$\mathrm{score}(G, i, j) = (1 - \alpha_j) \cdot \mathrm{weighted\_avg}(G, i, j) + \alpha_j \cdot \mathrm{least}(G, i, j)$$ Here α = satisfaction disparity

4. Adapt dynamically each round with Reward Function

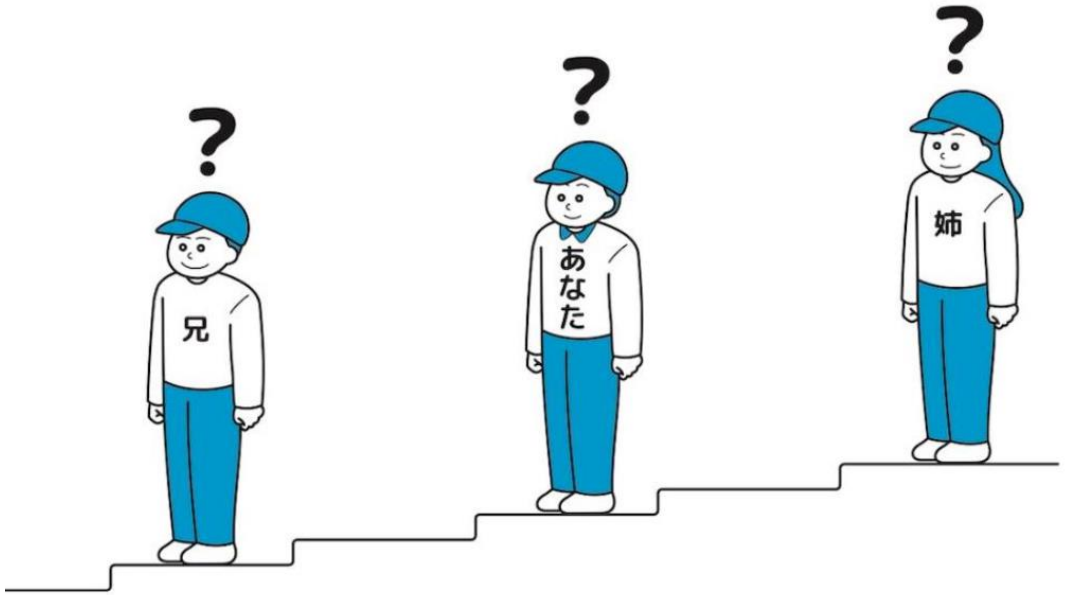
$$R_{sd}(RS_j) = \frac{2 \cdot \mathrm{groupSatO}(RS_j) \cdot (1 - \mathrm{groupDisO}(RS_j))}{\mathrm{groupSatO}(RS_j) + (1 - \mathrm{groupDisO}(RS_j))}$$

Testing users [1, 414, 599]

Round 1 Results:
User 1: Satisfaction = 1.00 (very satisfied)
User 414: Satisfaction = 0.84
User 599: Satisfaction = 0.70 (least satisfied)

Round 2 - SDAA Response:
Adjusted Weights: {1: 0.00, 414: 0.35, 599: 0.65}
→ User 599 gets 65% influence on recommendations

Round 2 Results:
User 599: Satisfaction improved to 0.68 ↑

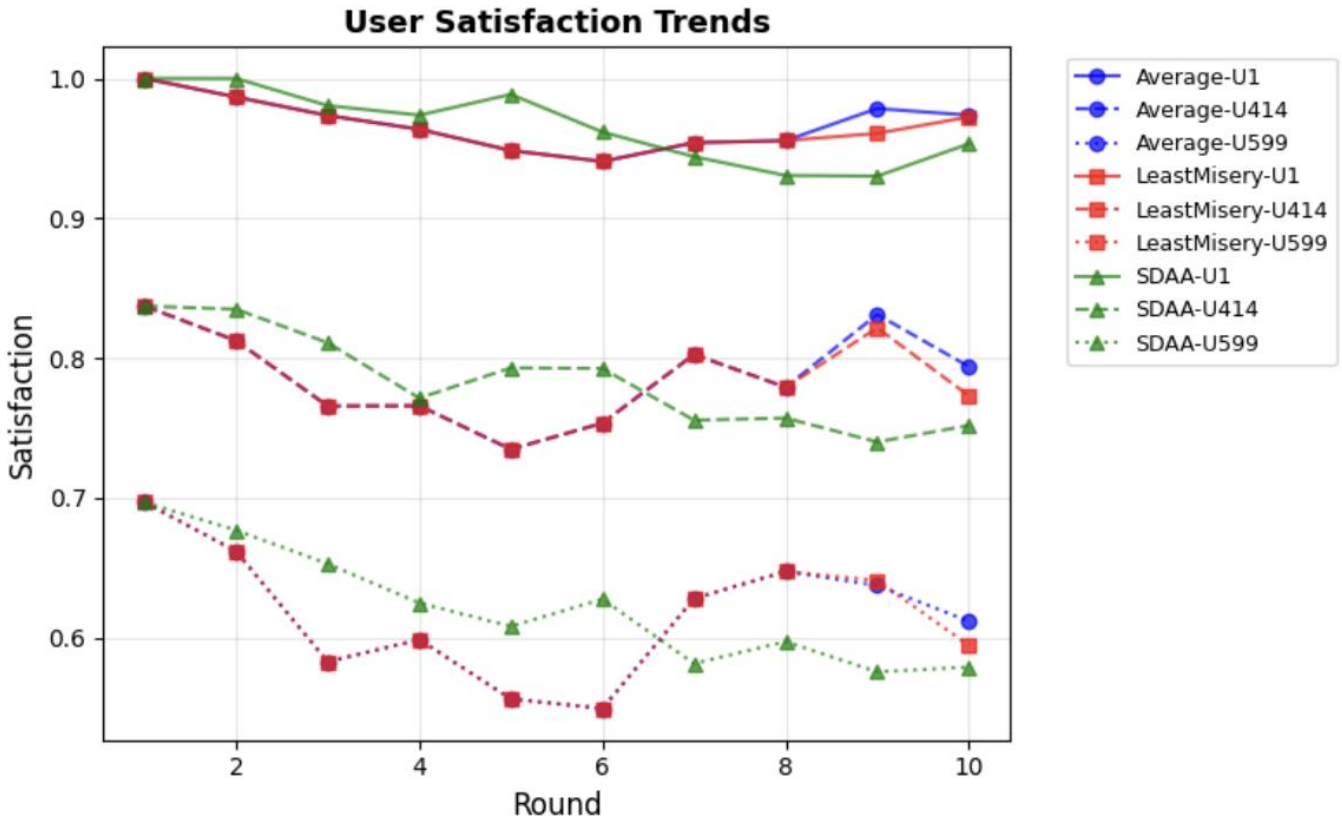


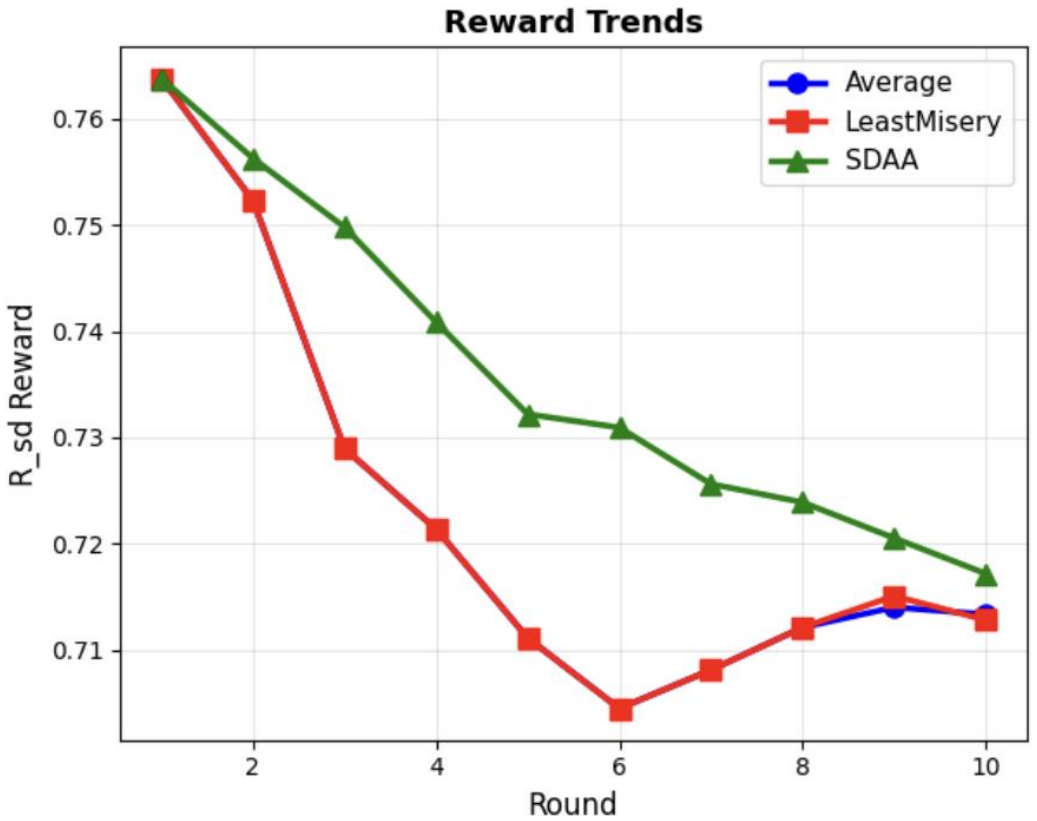
Interesting workflow:
SDAA remembers who was dissatisfied and gives them priority in future rounds, ensuring long-term fairness.

Comparison

Three Methods from SQUIRREL

Metric	Average	LeastMisery	SDAA
Group Satisfaction	0.791	0.789	**0.791**
Group Disagreement	0.350	0.350	**0.344**
Average Reward	0.723	0.723	**0.736**





Why SDAA good?

Results Summary:

- Same satisfaction as Average (0.791)
- Lower disagreement (-1.7%)
- Highest reward (+1.8%)

Among the three SQUIRREL methods we implemented:

⭐ SDAA achieves best balance

- Memory: Tracks cumulative satisfaction
- Adaptive: Dynamic weight adjustment
- Balanced: Fairness + Quality

SDAA outperforms both Average and Least Misery in terms of reward and disagreement reduction.