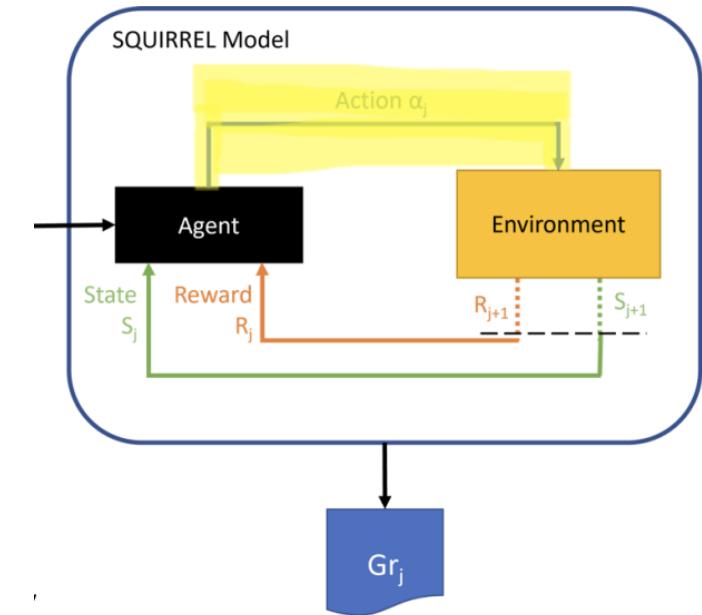


Sequential Group Recommendation with SDAA

Method: Satisfaction and Disagreement Aware Aggregation

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- Course: DATA.ML.360-2025-2026-1 Recommender Systems
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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

$$\text{satO}(u, RS) = \frac{1}{\mu} \sum_{j=1}^{\mu} \text{sat}(u, Gr_j)$$

2. Calculate fairness weights

$$w(u) = 1 - \frac{\text{satO}(u) - \min_u \text{satO}(u)}{\max_u \text{satO}(u) - \min_u \text{satO}(u)}$$

Lower satisfaction → Higher weight

3. Blend Average and Least Misery

$$\text{score}(G, i, j) = (1 - \alpha_j) \cdot \text{weighted_avg}(G, i, j) + \alpha_j \cdot \text{least}(G, i, j)$$

Here α = satisfaction disparity

4. Adapt dynamically each round with Reward Function

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

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)

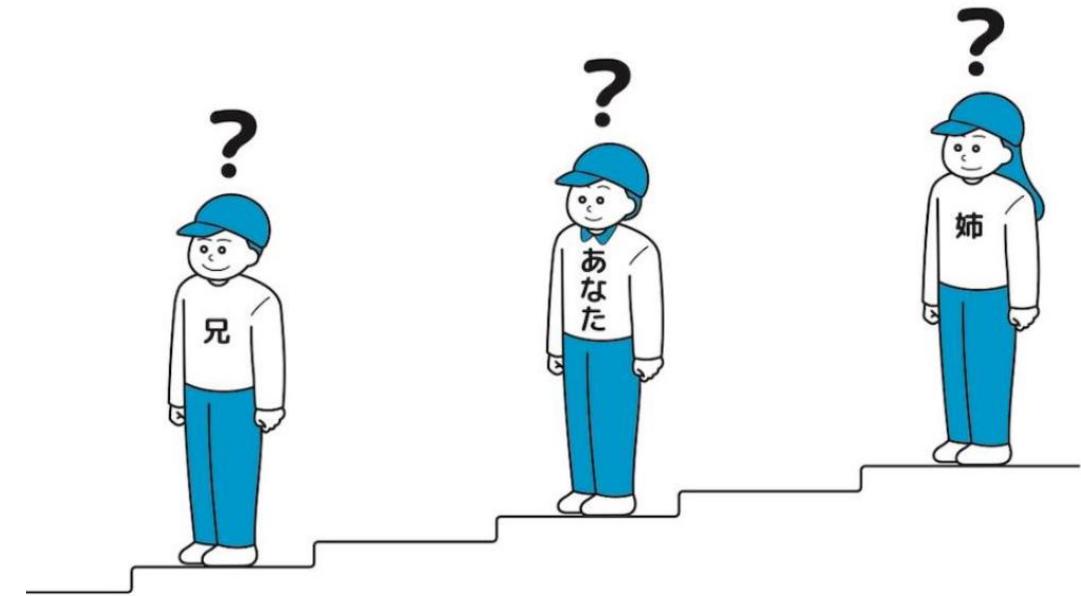
Round 2 - SDAA Response:

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 ↑

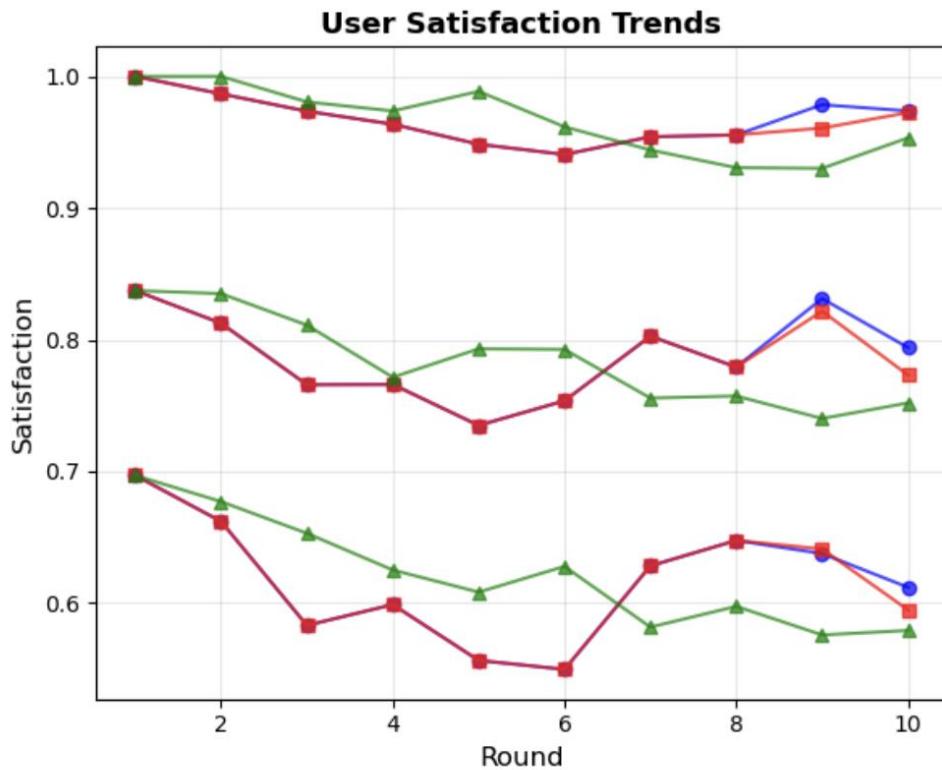


Interesting workflow:

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.