Quantifying Echo-Chamber Formation in Personalized News Feeds

6.3950/6.3952 AIDMS : Final Project

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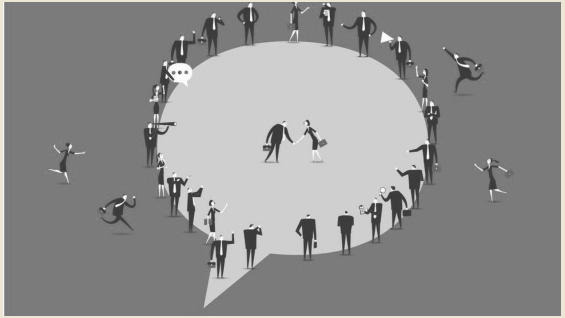
Motivation

Problem	Personalized feeds reinforce user preferences, creating echo chambers.
Impact	Increased polarization and reduced exposure to diverse viewpoints.
Goal	Quantify how echo chambers form across personalization strategies and domains



3 Commonly Studied Recommendation Algorithms

Pure Relevance

Recommend topics purely **by similarity** to a user's past

Calibrated Diversity

Balance preferred topics with contrasting perspectives

Serendipity-Aware

Deliberately **include** a few unexpected or cross-ideological pieces

Methods

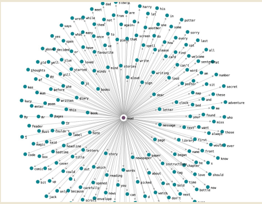
- ❑ MIND dataset of user **click behavior** and **click history** on news articles
- ❑ Algorithms **recommend articles** to **users** based on each user's past news clicks.
- ❑ Track echo chamber formation with chosen **evaluation methods**.

Pre-existing Evaluation Methods	Our Selected Methods

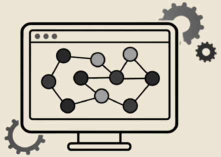
Homophily

Hartmann et al. (2024)

Semantic Diversity



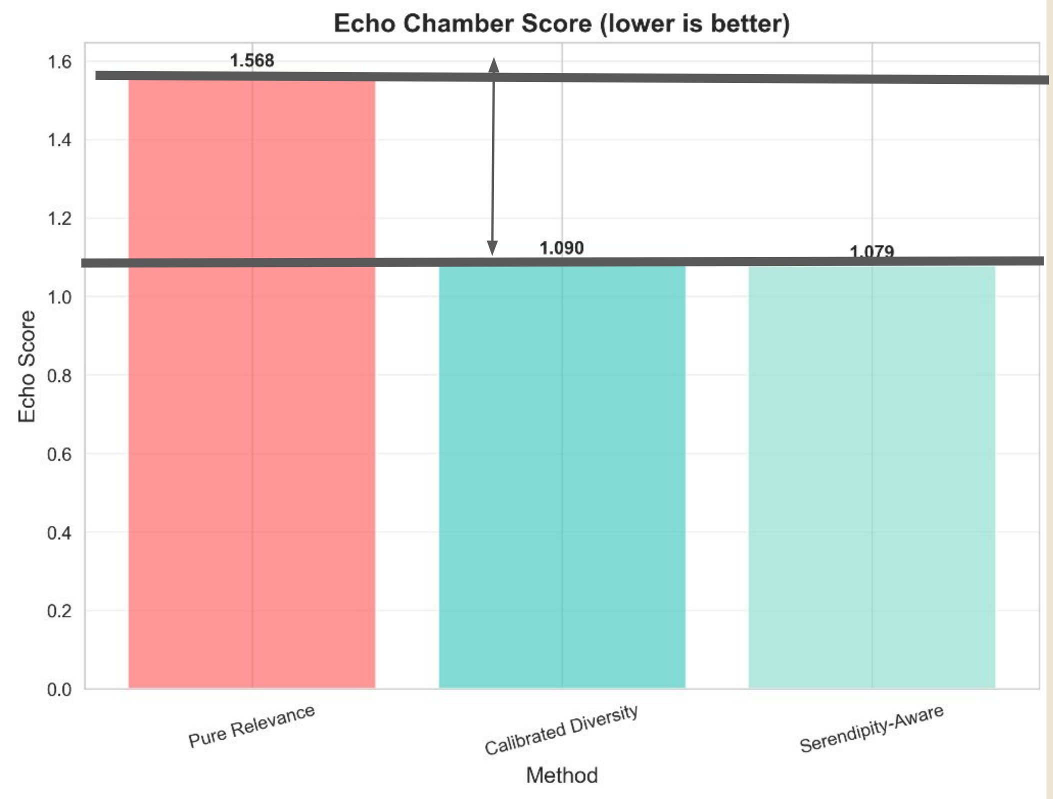
Centroid Distance



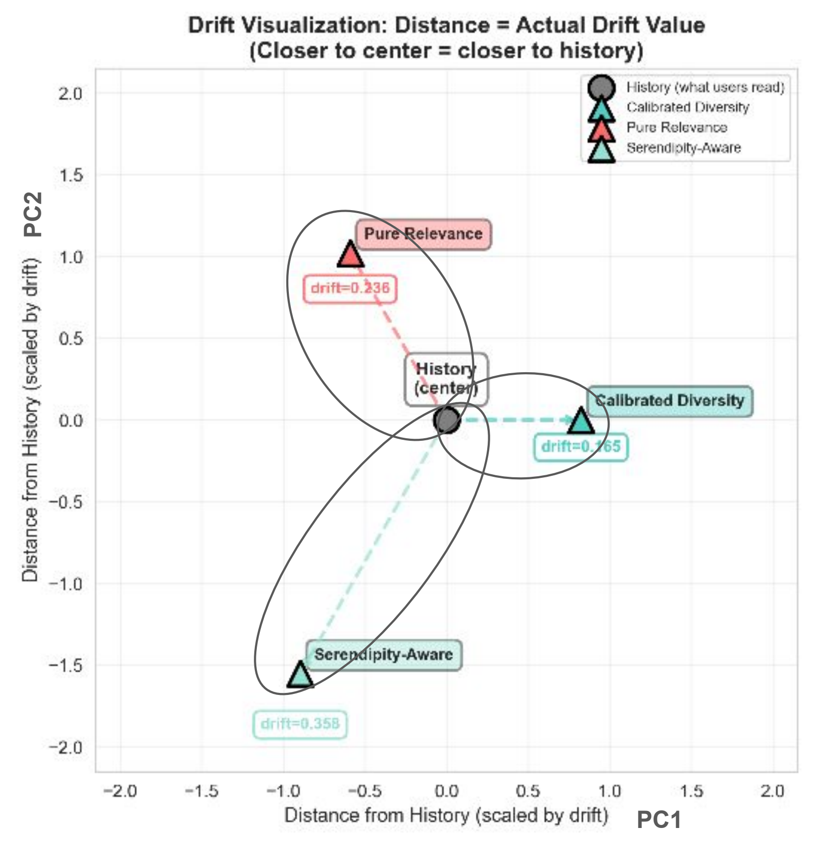
LLM Evaluation

Findings - 1. Semantic Diversity

$$\text{Echo Score} = \frac{\text{History Diversity}}{\text{Recommendation Diversity}}$$



Findings - 2. Centroid Distance

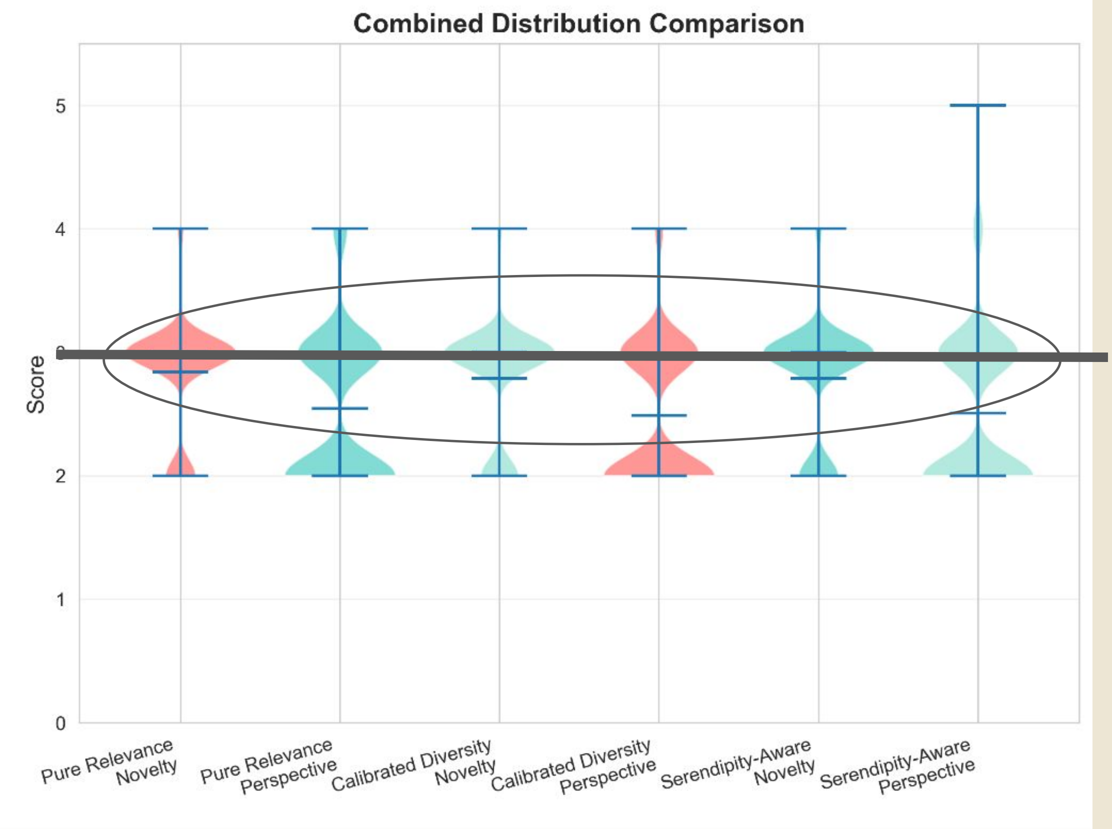


Serendipity-Aware: 0.358

Pure-Relevance: 0.236

Calibrated Diversity: 0.165

Findings - 3. LLM Evaluation (Microsoft Phi-2)



Novelty:

1 = same topics as history

5 = very different topics

Perspective:

1 = same viewpoint as history

5 = diverse viewpoints

Conclusion

Metrics

- **Pure relevance** leads to the **highest** echo-chamber effects, while **serendipity-aware** is **best at mitigating** echo-chamber effects.

Future Work

- Testing **political bias classifier** on politically charged datasets (Twitter, partisan news).
- **Fine-tune LLMs** for echo-chamber detection.

Key Takeaway:
Embedding-based metrics outperform LLM-based metrics.

Thank you for your time!

Any questions?