

Deconstructing the Filter Bubble: User Decision-Making and Recommender Systems

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Summary & Goals

Recommender systems have increasingly come under focus for negative social consequences:

- **Filter Bubbles:** Individuals consume increasingly similar goods and are isolated from diversity of content
- **User Homogenization:** Individuals consume increasingly similar goods as each other

We explore two aspects of this:

- Are these effects driven by recommender systems or how users make decisions in these contexts?
- What implications does this have for recommender system design?

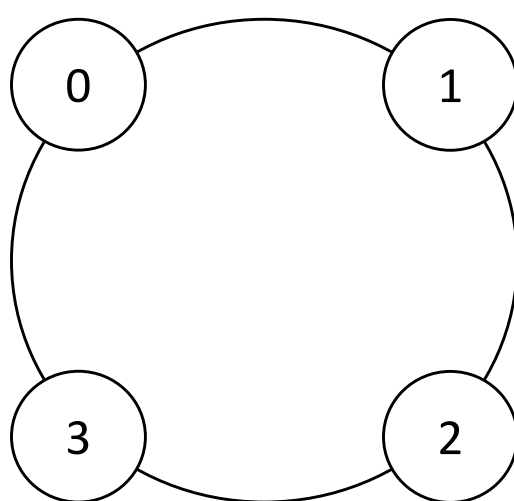
Model

User Decision-Making:

- N items, users sequentially consume T items
- Realized utility vectors for consumer i :
 $X_i = V_i + \beta V$, $V \sim N(0, \Sigma)$, $V_i \sim N(V, \Sigma_i)$
- Users have *beliefs* over the realized utilities and are *risk-averse*
- Assume myopic users: no purposeful exploration

Product Space: Products are evenly spaced on a circle

$$d(n, m) = \min\{|m-n|, N-|m-n|\}, m, n \text{ indices}$$



Learning:

- Users employ **similarity-based generalization**
- Observe realized utilities directly after consumption
- Spillovers: Bayesian update beliefs about other items, but more strongly about value of similar items than about dissimilar items
- Strength of updating controlled by ρ

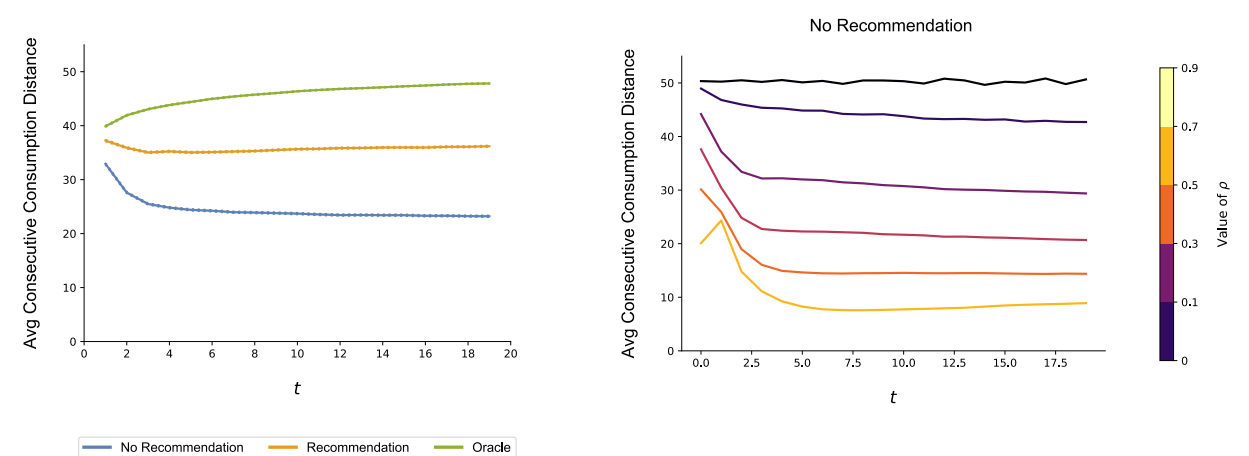
Recommendation Regimes:

- No Recommendation: users get no information
- Recommendation: information on V and combine with user beliefs
- Oracle: Ex-post (full information) optimal consumption path

Evaluation: Characterization via simulation over populations of users and a grid of relevant parameter values. Results here reported for $N = 200$, $T = 20$

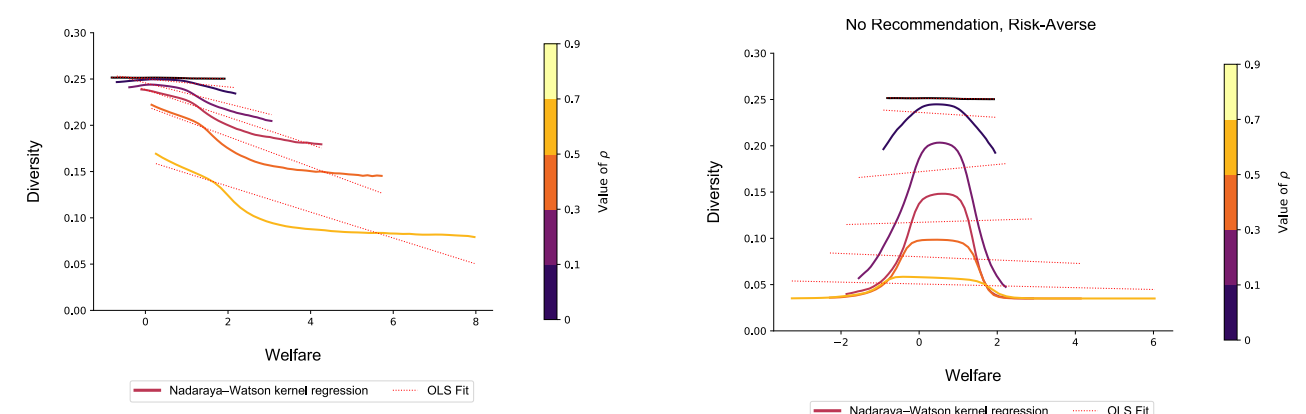
Filter Bubble Effect

- Track average consumption distance across t
- Empirical work (Nguyen, et. al 2014 WWW) has found that filter bubble effects arise **without recommendation**
- Spillovers lead to a natural “narrowing” effect



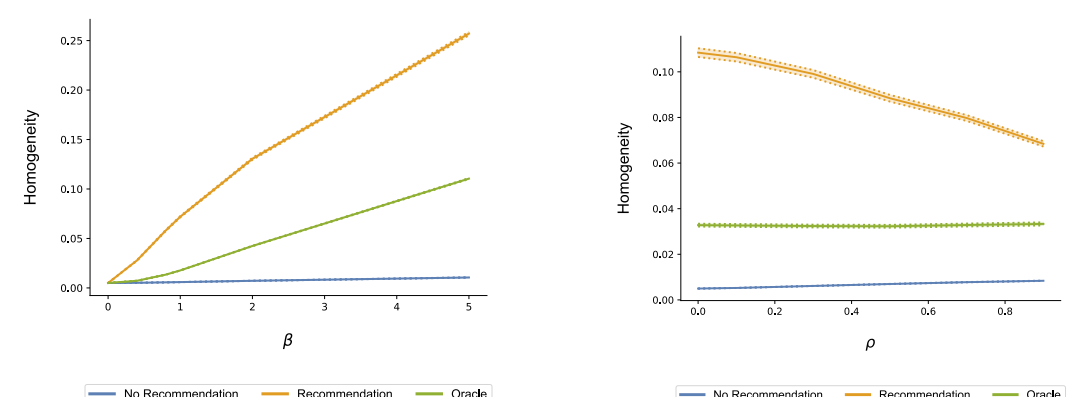
Welfare and Content Diversity

- Diversity = average normalized pairwise distance between consumed products
- Does higher “content diversity” imply higher welfare?
 - Low diversity can come from consumption of many similar high utility goods
 - High diversity can come from consumption of many different low utility goods



User Homogeneity

- Homogeneity = Jaccard index across consumption sets
- Recommendation “coordinates” individuals in similar portions of the product space
- Without recommendation, no coordination leads to low homogeneity



Recommender System Design

- Accurate recommendations may not be useful precisely because they ignore user beliefs and the inferences users make
- Explicitly incorporate user beliefs and compute which recommendations provide users with the largest marginal utility gains relative to no recommendation