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

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Introduction

Consequences of RS on user consumption choices?

Within user: Filter Bubbles

Users consume items in increasingly narrow portion of product space

Across users: Homogenization

Users consume increasingly similar items

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This paper

Economic model to explain empirically observed dynamics

RS's influence on decisions and its implications for design

Our Model

1. Users **sequentially** consume **small set of items from large choice set**
2. Users are **uncertain** about item's true valuations
   - Users have *beliefs* about items they haven't consumed yet
   - Users potentially *risk-averse*

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   - Draws from distinct Gaussian distributions
   - RS reveals the common-value component

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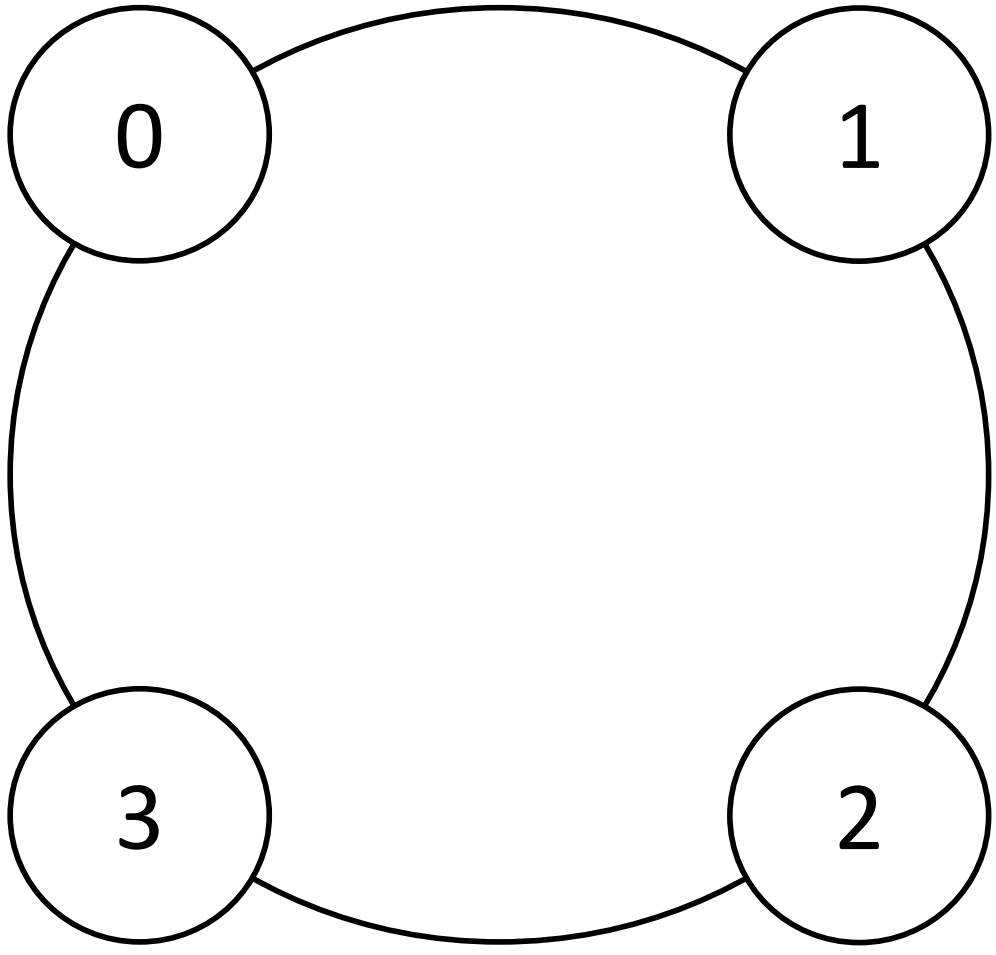
Evaluate model via simulation over grid of parameters

Illustrative Example



Illustrative Example

$$\mu = \begin{pmatrix} \mathbb{E}[x_0] \\ \mathbb{E}[x_1] \\ \mathbb{E}[x_2] \\ \mathbb{E}[x_3] \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \Sigma = \sigma^2 \begin{pmatrix} \rho^0 & \rho^1 & \rho^2 & \rho^0 \\ \rho^1 & \rho^0 & \rho^1 & \rho^2 \\ \rho^2 & \rho^1 & \rho^0 & \rho^1 \\ \rho^1 & \rho^2 & \rho^1 & \rho^0 \end{pmatrix}$$

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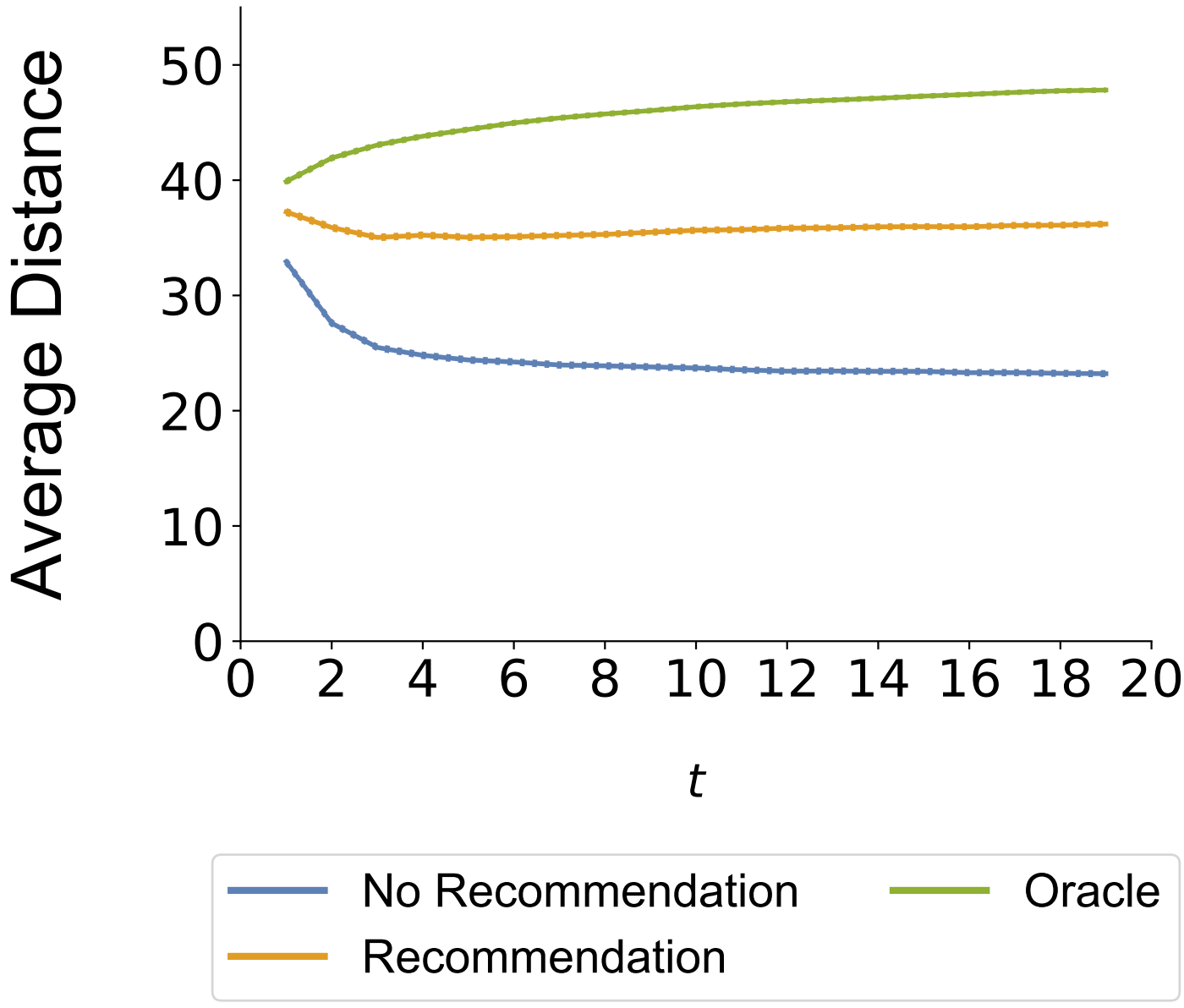
Realization of utility for item 0 is y, then updated beliefs are:

$$(\mu \mid x_0 = y) = \begin{pmatrix} \rho y \\ \rho^2 y \\ \rho y \end{pmatrix}, (\Sigma \mid x_0 = y) = \begin{pmatrix} \frac{3}{4} & \frac{3}{8} & 0 \\ \frac{3}{8} & \frac{15}{16} & \frac{3}{8} \\ 0 & \frac{3}{8} & \frac{3}{4} \end{pmatrix}$$

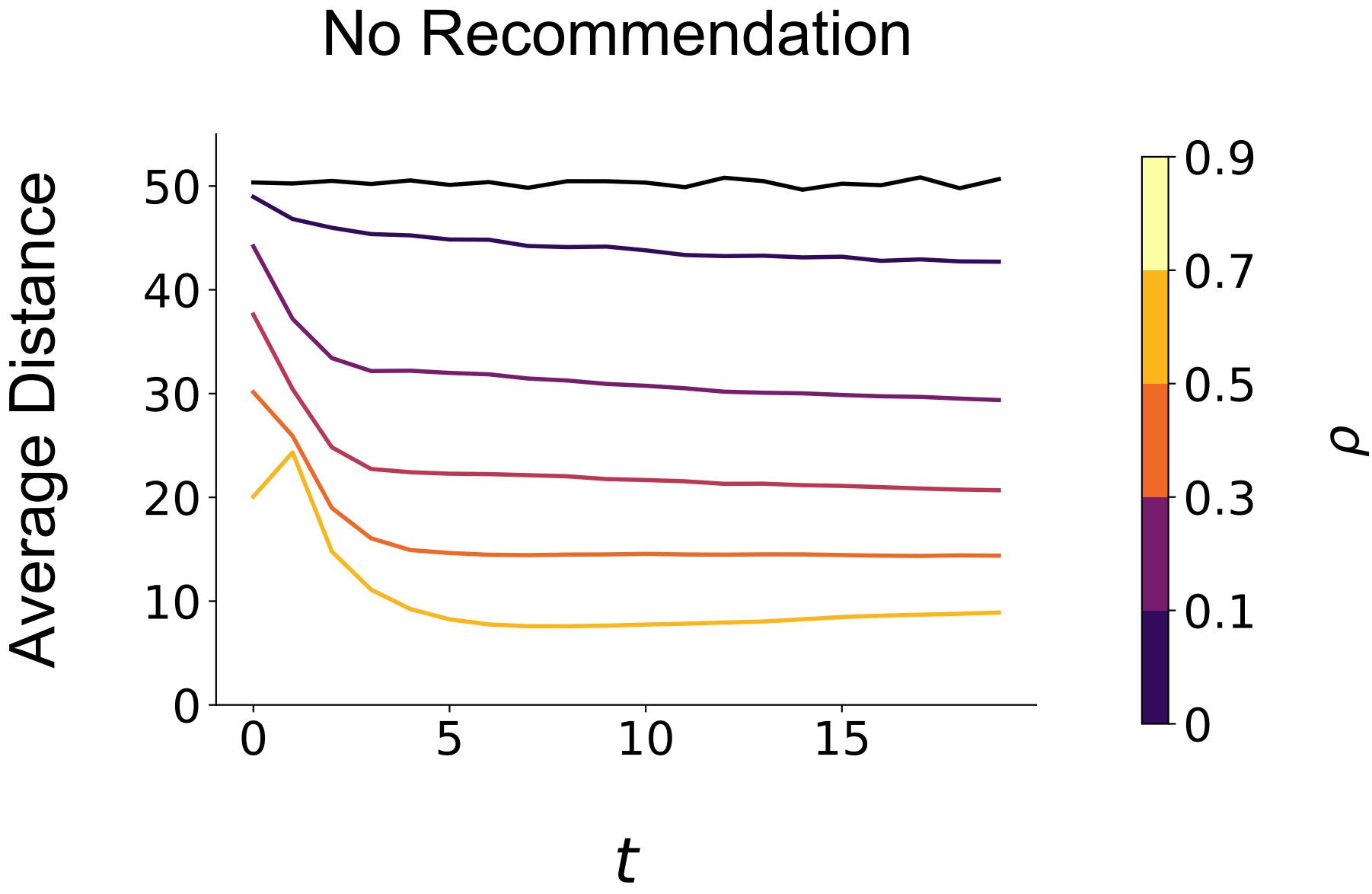
If $y > 0$, then always consumes item 1 or 3

If $y < 0$, then consumes item 2 unless sufficiently risk-averse

Filter Bubble Effects



Informational Spillovers Lead to Filter Bubble Effects



Additional Results

RS increases homogeneity

Coordination around high common value component items

Filter bubble effects amplified by risk aversion

Spillover reduces uncertainty

Diversity vs. Welfare

Without RS, diversity and welfare negatively correlated

With RS, diversity and welfare uncorrelated

Welfare Gains from RS

Decreases as correlation between valuations increases

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Our approach:

Goal: pairing prediction with valuable information

Valuable information: steering user behavior towards better choices

Implications: Collect data not only on post-consumption ratings but also on pre-consumption *beliefs*