# how algorithmic confounding in recommendation systems increases homogeneity and decreases utility

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### interaction

# USER preference

### recommendation



# Simulation Setup



# Simulation Setup

### "world"



alternative realities content filtering social filtering matrix factorization popularity random ideal

## Jaccard Index





# $B = \bigotimes$











# Jaccard Index

















# Claim 1: The recommendation feedback loop causes **homogenization of user behavior**.



























# Claim 2: Users experience **losses in utility** due to homogenization effects; these losses are **distributed unequally**.



items ordered by popularity

## Gini Coefficient

# $G(A, B) = \frac{1}{A+B}$

(usually long tail)









items ordered by popularity

## Gini Coefficient

 $G(A, B) = \frac{1}{A+B}$ 

item popularity curve (usually long tail)

 $G \in [0, 1]$ 

maximal equality

maximal inequality









# Claim 3: The feedback loop amplifies the impact of recommendation systems on the distribution of item consumption.



better evaluation of recommendation systems



### better evaluation of recommendation systems

### understand the impacts on human behavior



design better systems to increase fairness and social welfare

better evaluation of recommendation systems

understand the impacts on human behavior

