

Responsible Personalization & Recommendation: an Overview

Mehdi Elahi (WP2 Leader)

November 2022

sf **Research Centre for Responsible
Media Technology and Innovation**

Project number 309339



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(UiB)



WP Co-leader:
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(UiB)



Industry Leader:
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(Schibsted)

& more

Question

- How many hours of videos do you think is uploaded online, every minute?



Many Choices

- 500+ hours of videos on **YouTube**, per min
 - 300000+ posts on **Instagram**, per min
 - 350000+ tweets on **Twitter**, per min
-
- **Choice Overload**: difficulty of choosing among many options of media content.

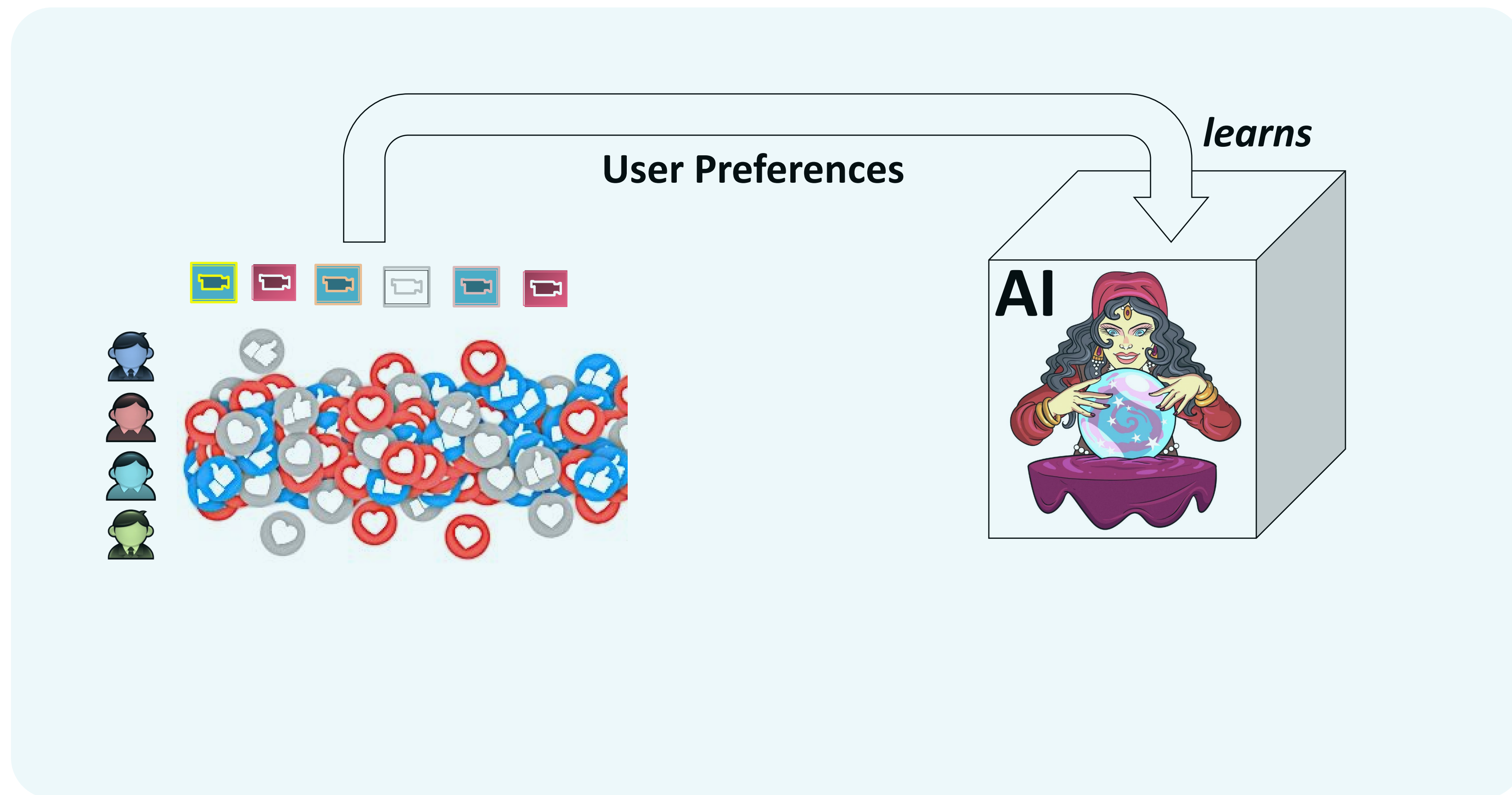


Recommendation & Personalization

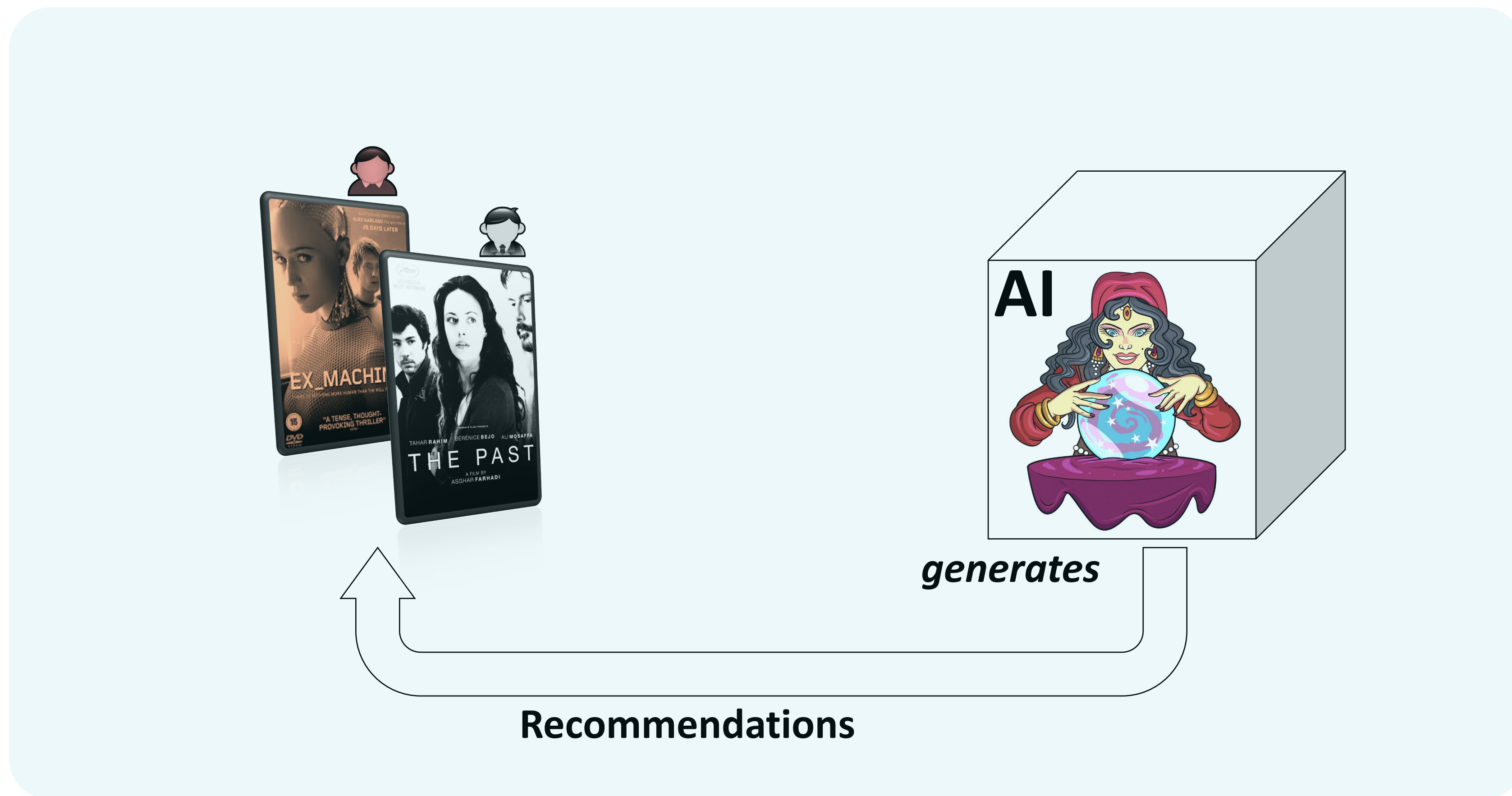
- **Recommender Systems:** tools that can tackle choice overload.
- They learn individual preferences and utilize AI algorithms to automatically generate **personalized suggestions** for consumers.



AI Algorithms



AI Algorithms



Benefits for Business

- Impact of **recommendation**:
 - **Increased** revenue and profit
 - **Increased** visit frequency
 - **Increased** loyalty

accenture

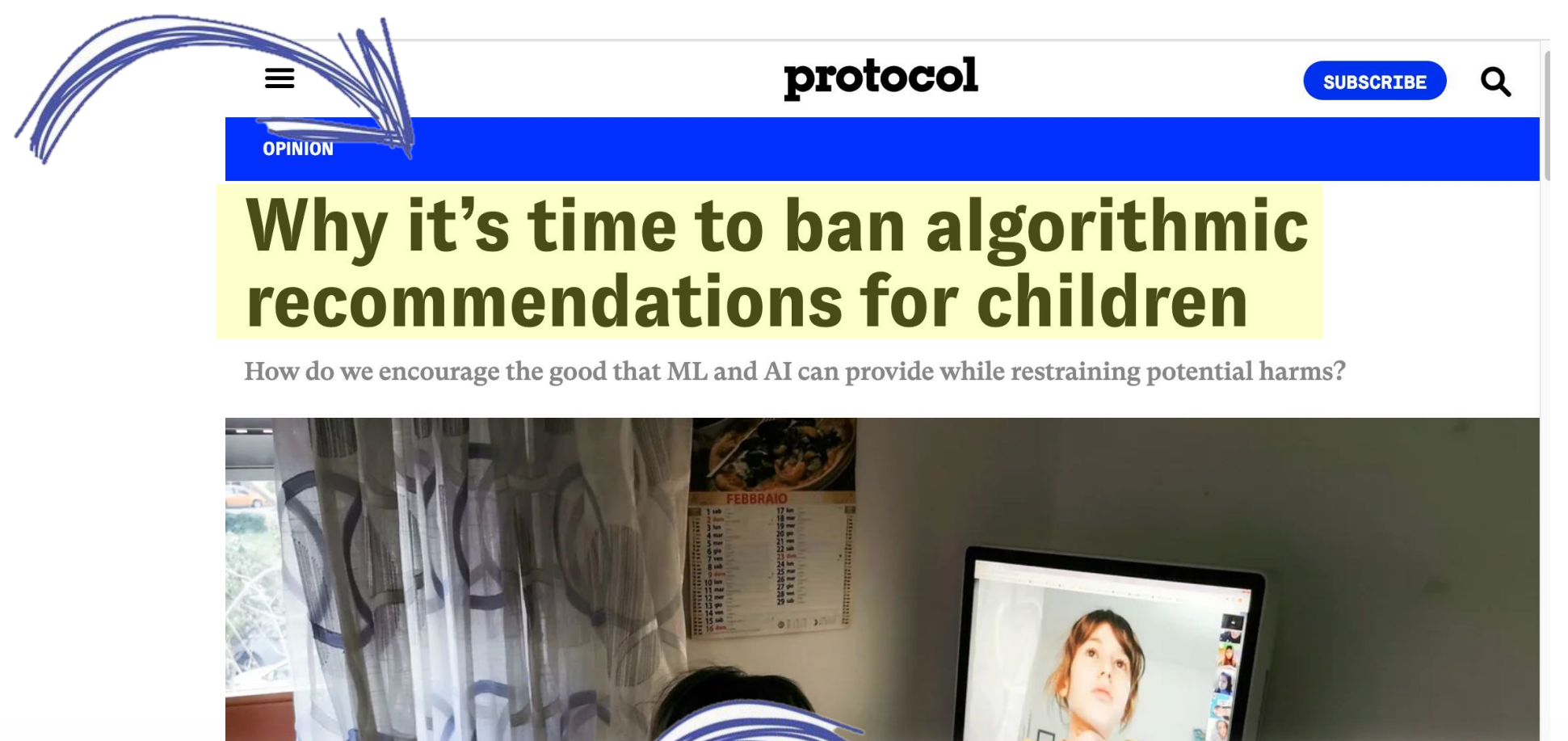


1 Million \$ Prize!



Improving **quality** of recommendation by **10%**

Undesired Effects

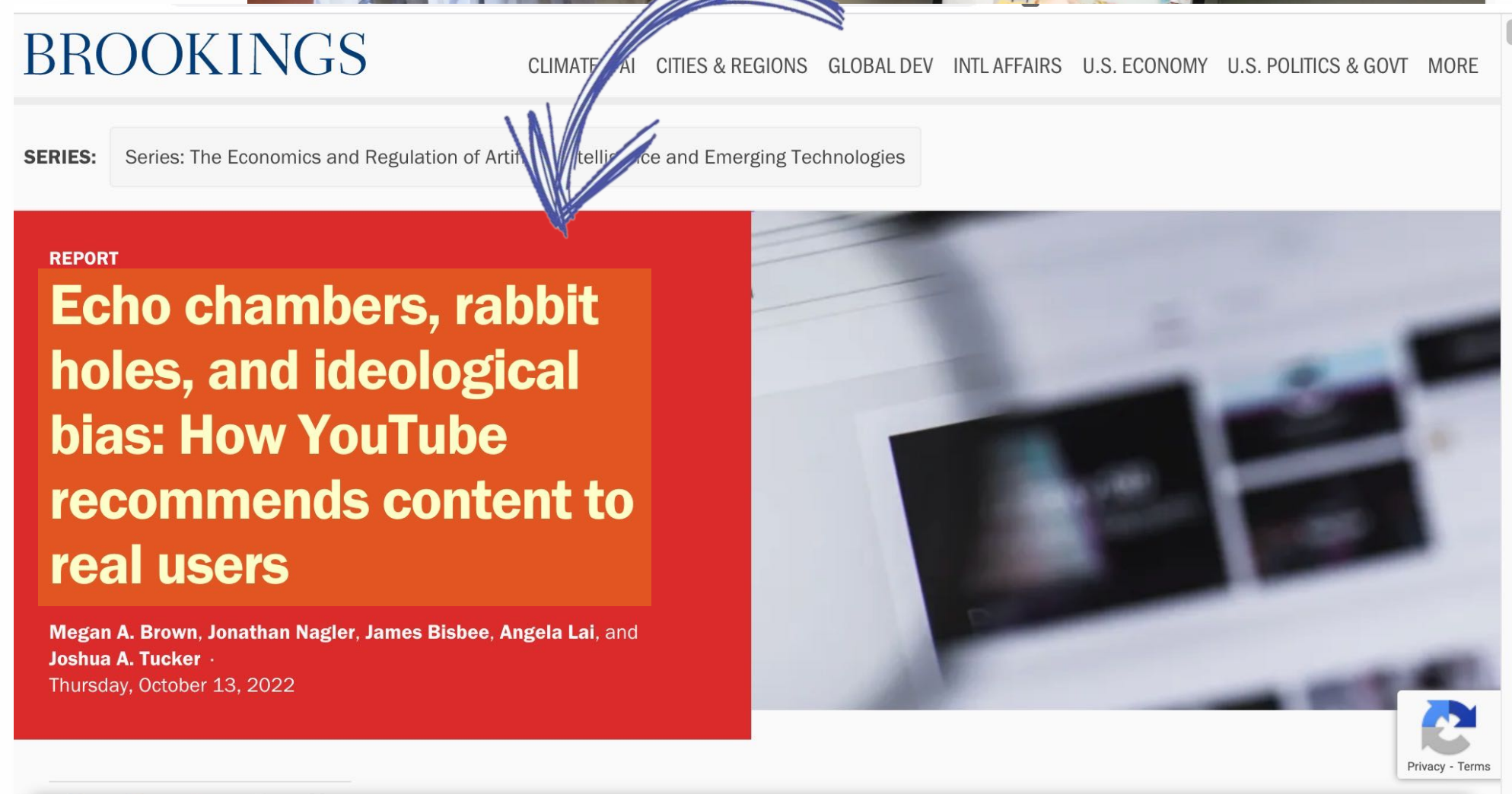
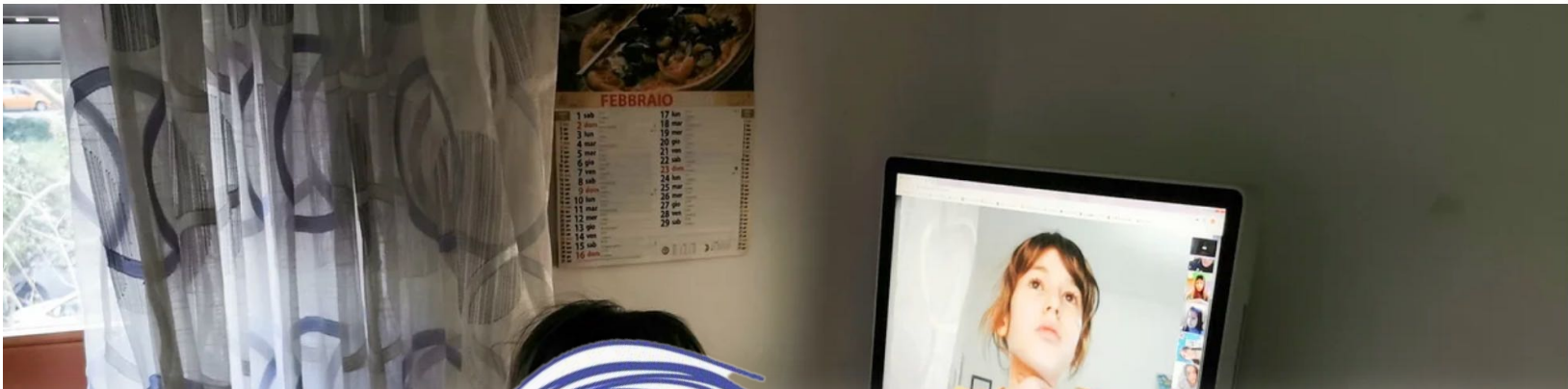


protocol

OPINION

Why it's time to ban algorithmic recommendations for children

How do we encourage the good that ML and AI can provide while restraining potential harms?



BROOKINGS

CLIMATE AI CITIES & REGIONS GLOBAL DEV INTL AFFAIRS U.S. ECONOMY U.S. POLITICS & GOVT MORE

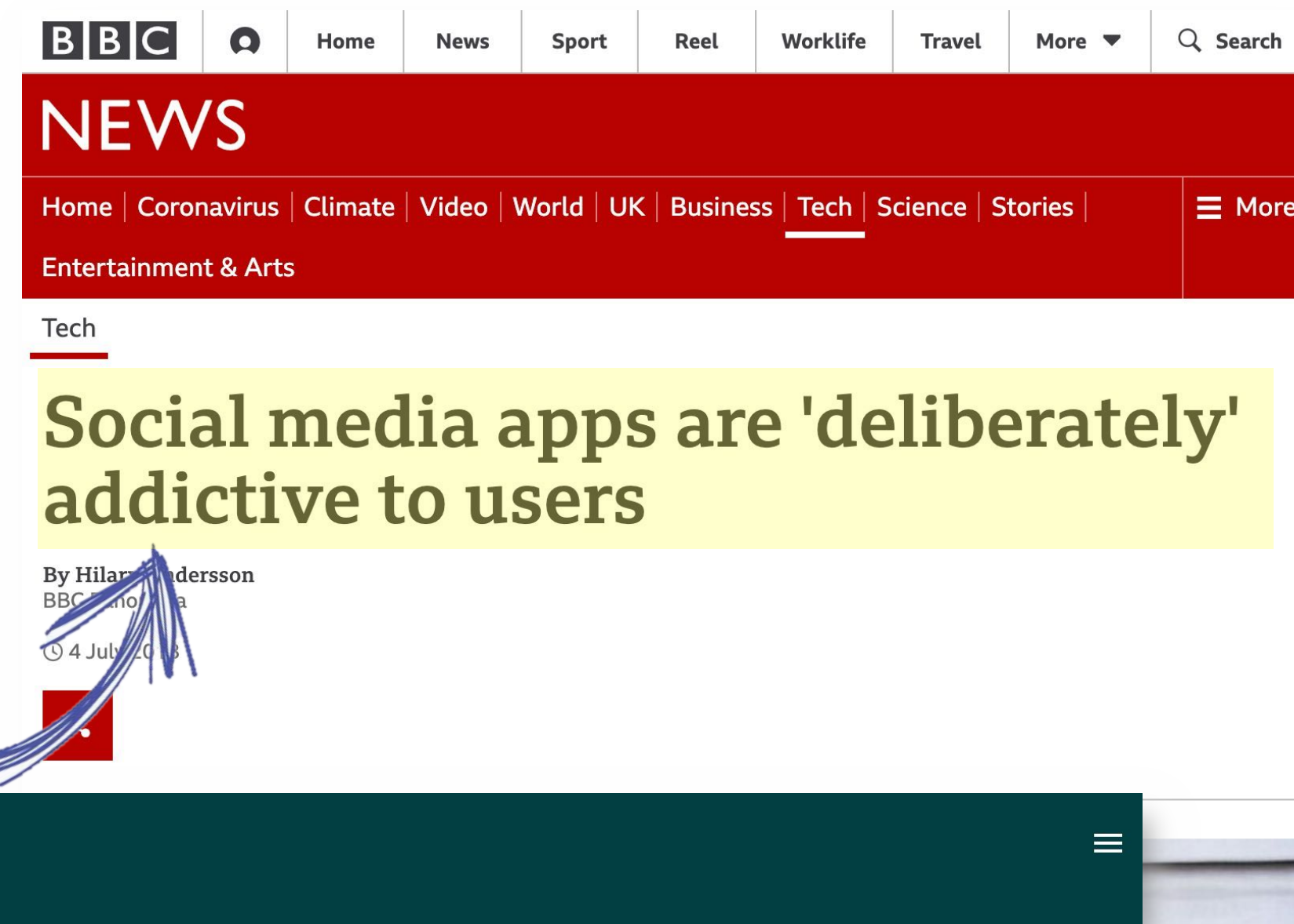
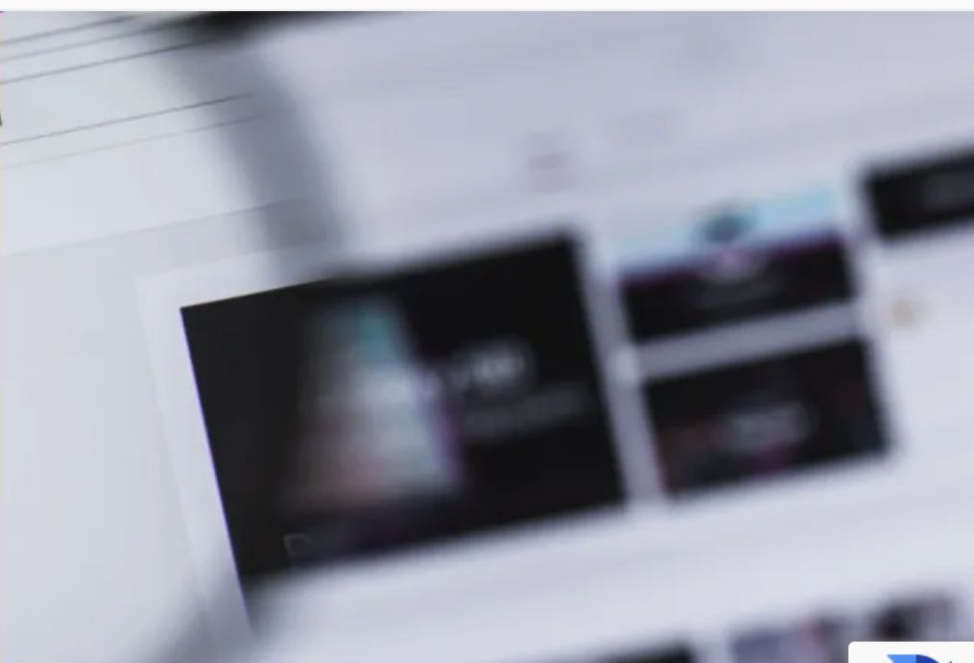
SERIES: Series: The Economics and Regulation of Artificial Intelligence and Emerging Technologies

REPORT

Echo chambers, rabbit holes, and ideological bias: How YouTube recommends content to real users

Megan A. Brown, Jonathan Nagler, James Bisbee, Angela Lai, and Joshua A. Tucker

Thursday, October 13, 2022



BBC

Home News Sport Reel Worklife Travel More Search

NEWS

Home Coronavirus Climate Video World UK Business Tech Science Stories More


Entertainment & Arts

Tech

Social media apps are 'deliberately' addictive to users

By Hilary Anderson
BBC News

4 July 2020



VB

The Machine
Making sense of AI

Researchers find evidence of bias in recommender systems

Kyle Wiggers
@Kyle_L_Wiggers

July 29, 2020 12:35 PM

f t in





BIAS AND MITIGATIONS IN RECOMMENDATIONS FOR BBC SOUNDS

PRESENTATIONS 01 Jun 2022

RESEARCH & DEVELOPMENT

BIAS AND MITIGATION IN RECOMMENDATIONS FOR BBC SOUNDS
ALGORITHMIC RECOMMENDATIONS

Recommendations are a *ranking* problem:

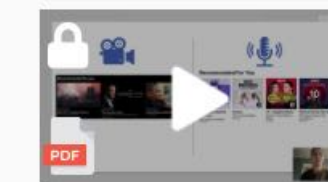
- For every user, generate personalised scores for available items (programmes)
- Select the top n scores as recommended items

Typically, use historical user behaviours and item metadata as inputs to scoring algorithm

Recommended For You

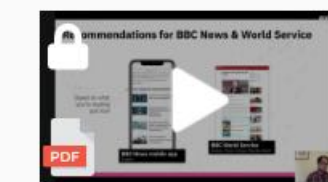
- Artist Icons Collection
- Pressed
- It's... Wagatha Christie
- Match of the Day: Top 10

RECOMMENDED



MDN 2022 Online Conference

Graph-powered recommendations at the BBC



MDN 2022 Online Conference

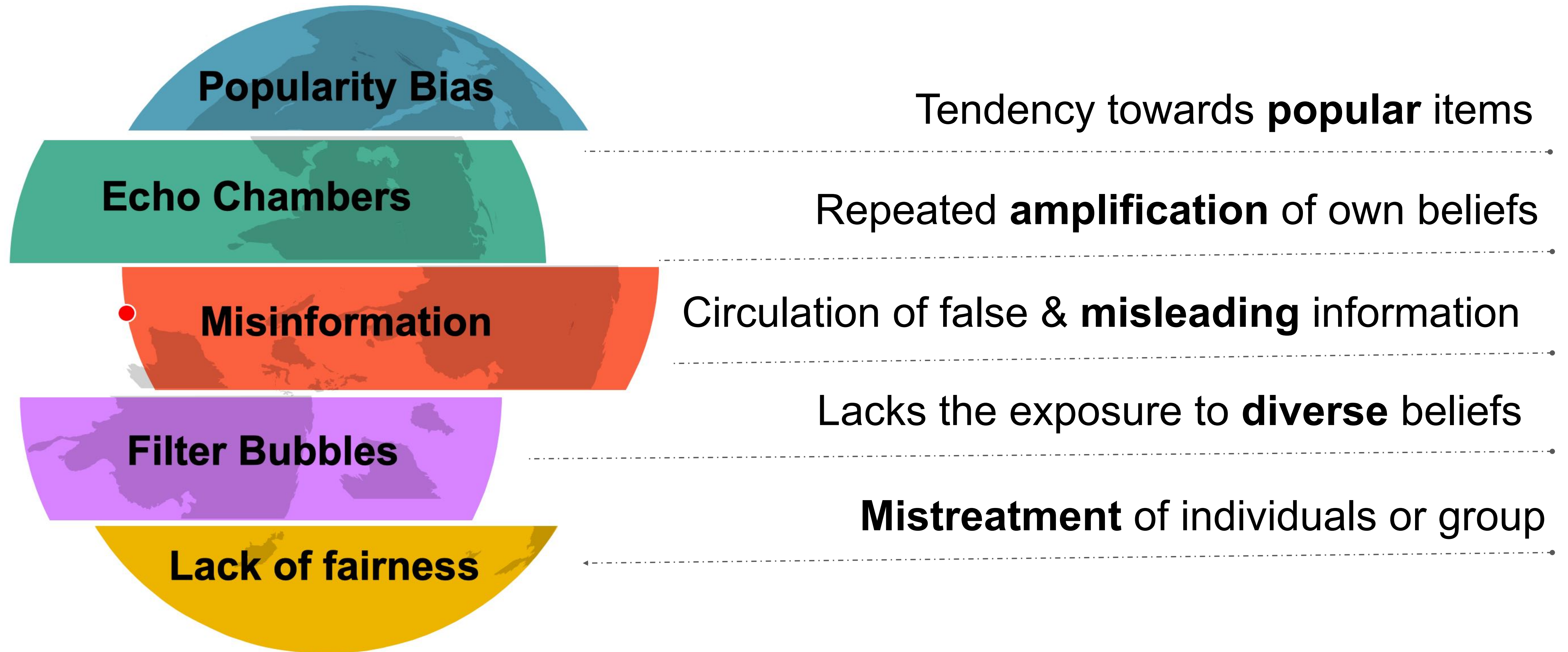
Building editorial values into recommenders



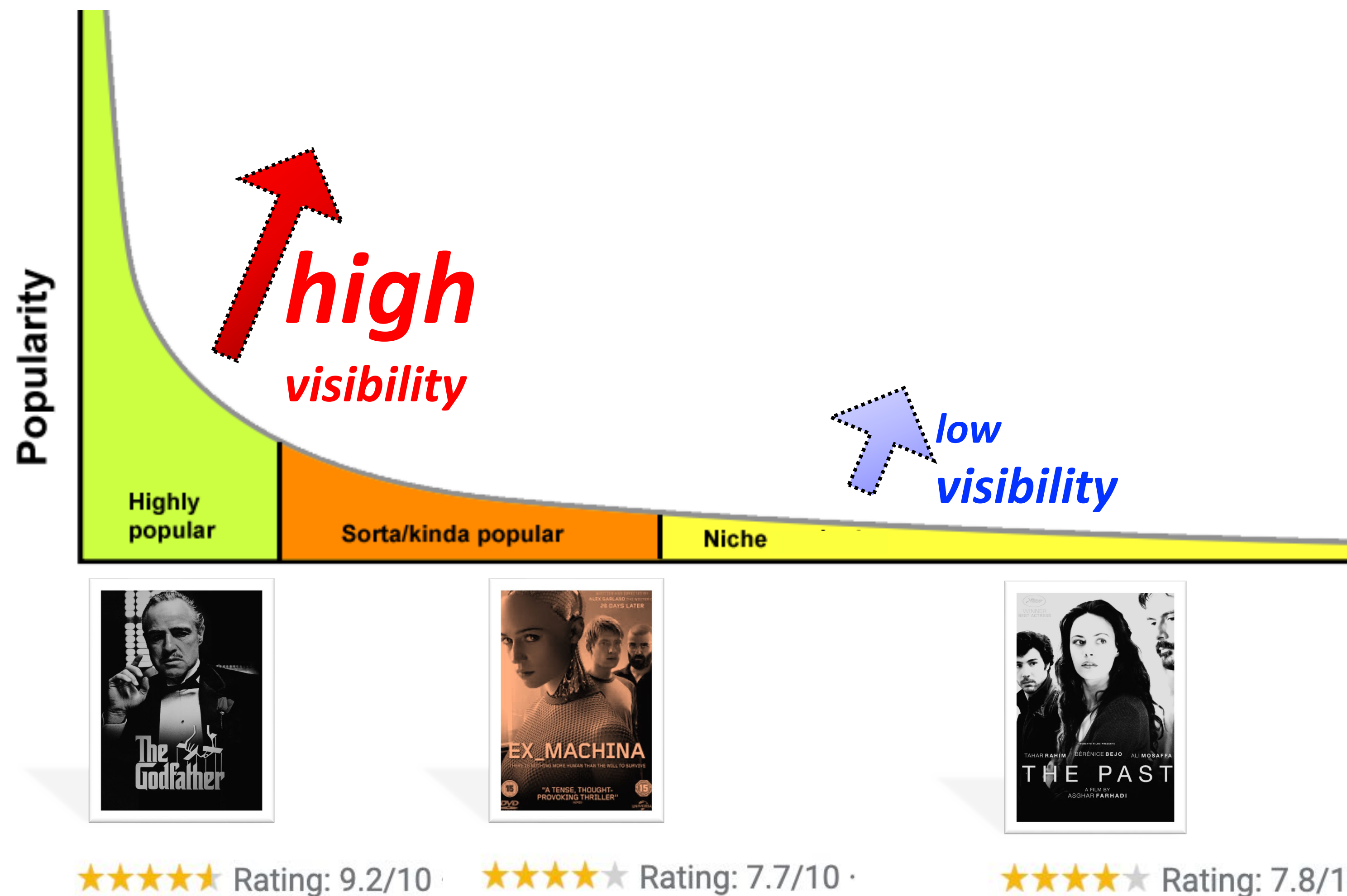
MDN Workshop 2021

France TV data governance for better programme exploitation

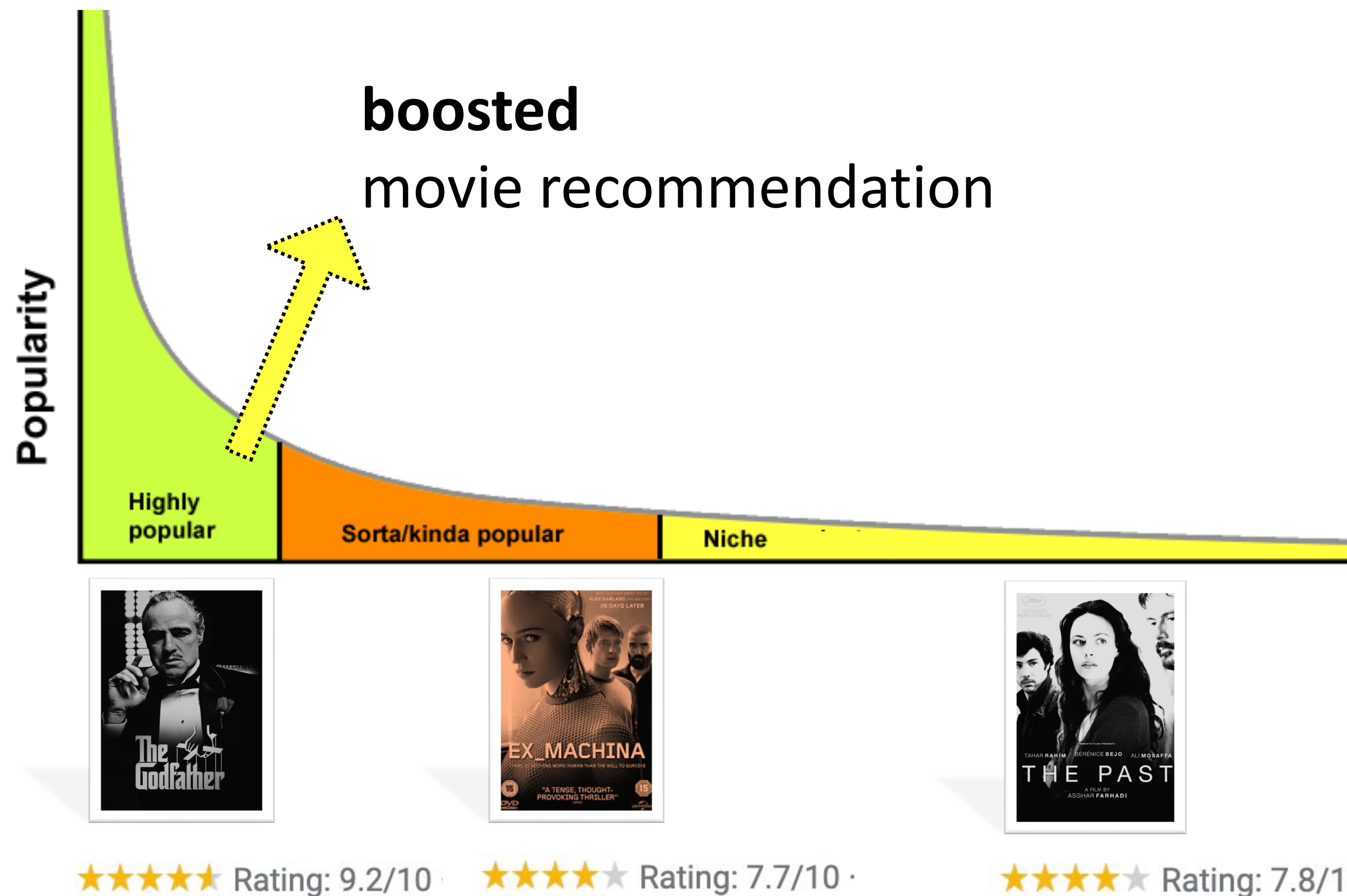
Undesired Effects of Recommendation



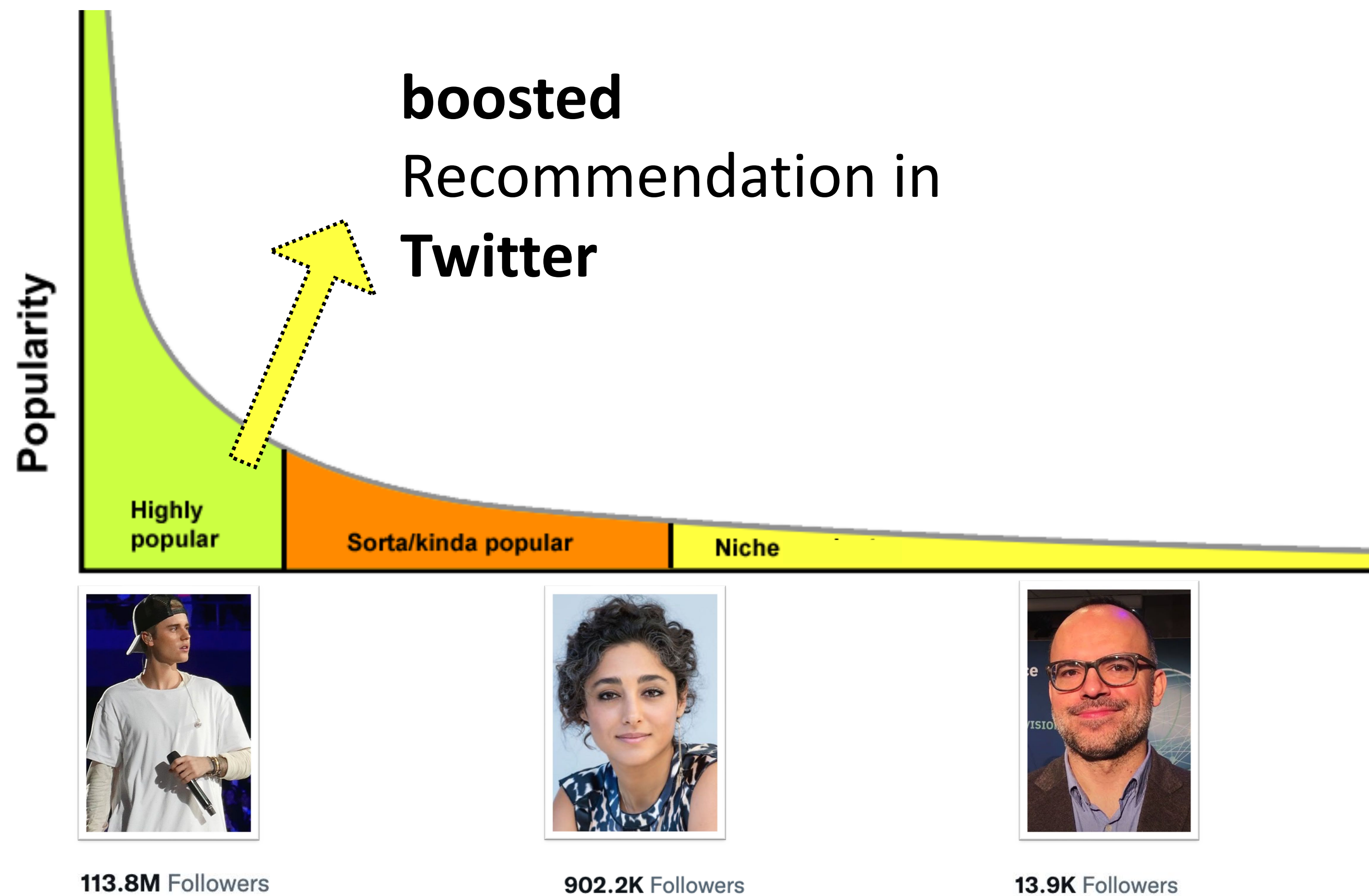
Undesired Effects: Popularity Bias



Undesired Effects: Popularity Bias



Undesired Effects: Popularity Bias

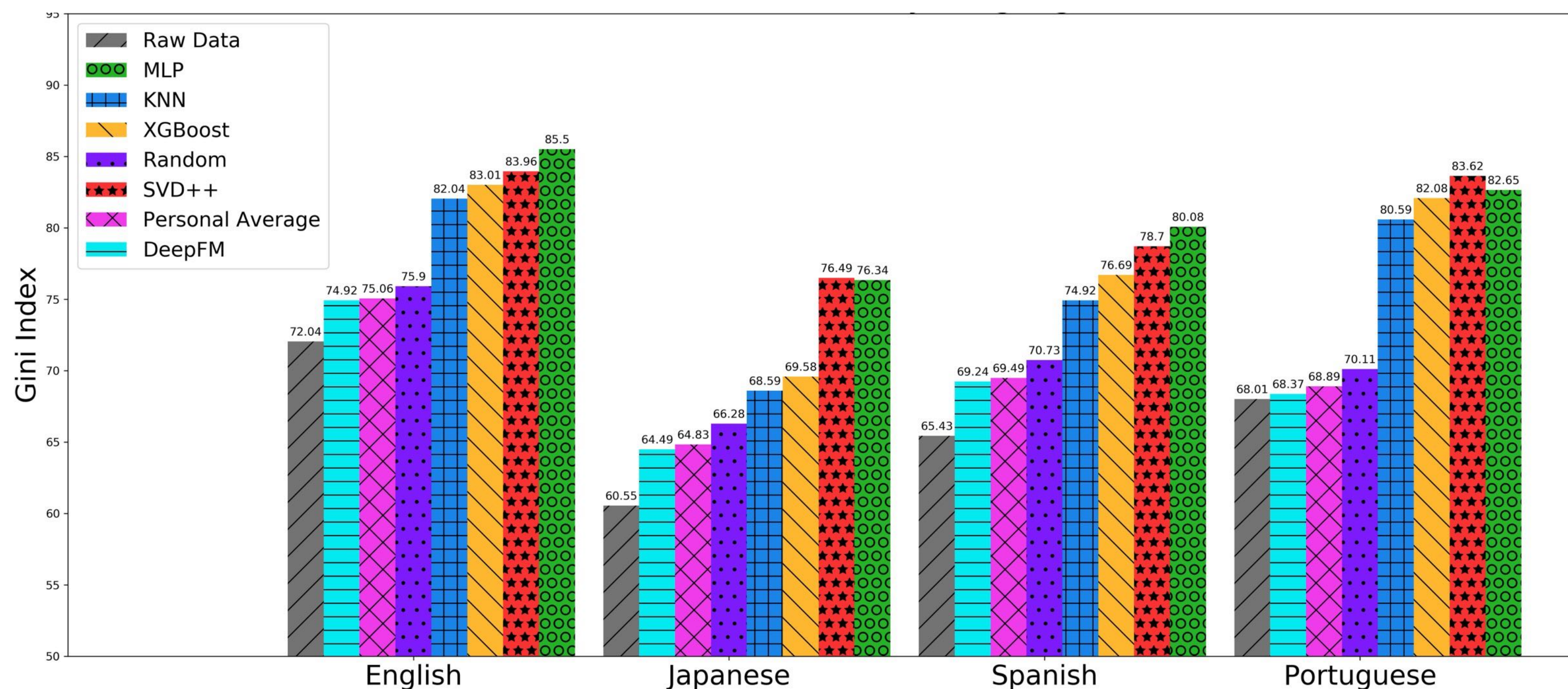


Undesired Effects: Popularity Bias



Source: Elahi, Mehdi, et al. "Investigating the impact of recommender systems on user-based and item-based popularity bias." *Information Processing & Management* 58.5 (2021): 102655.

Undesired Effects: Popularity Bias

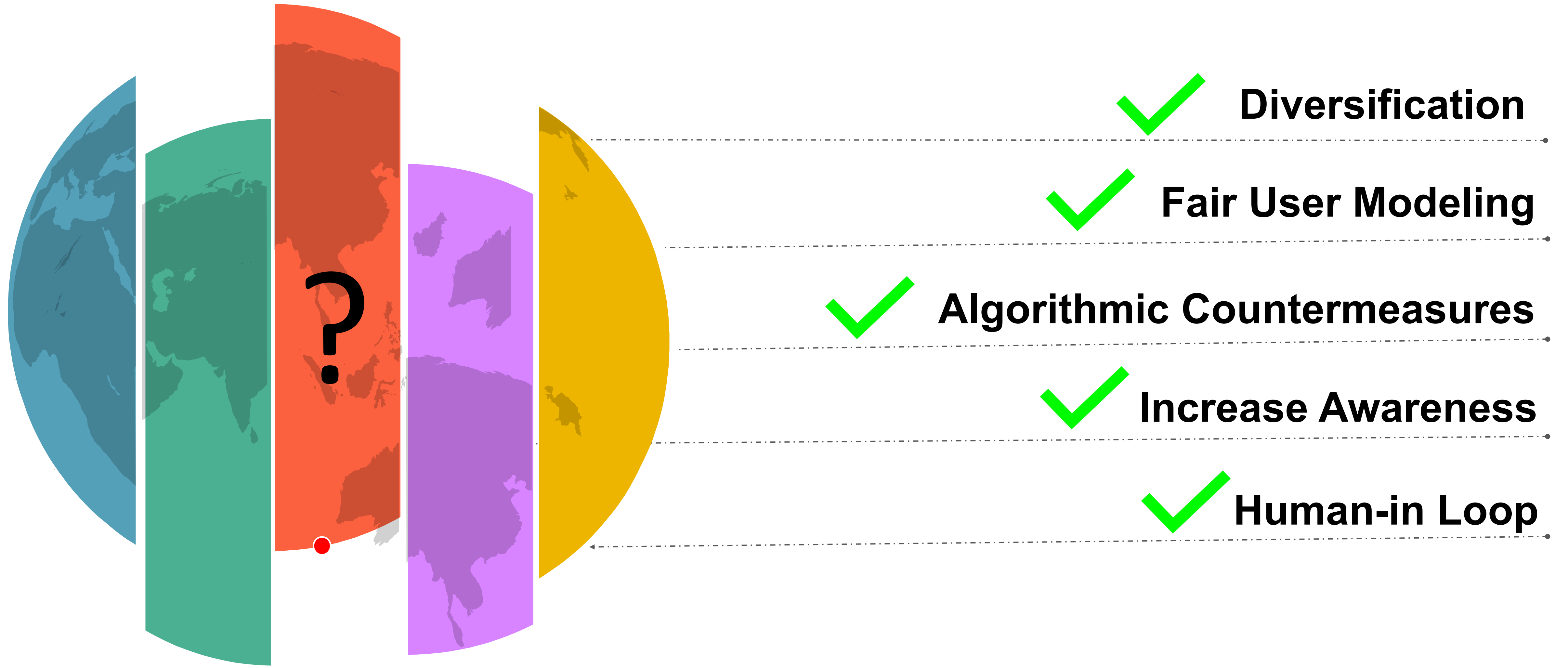


Tweets data in
different Languages



Source: Elahi, Mehdi, et al. "Investigating the impact of recommender systems on user-based and item-based popularity bias." *Information Processing & Management* 58.5 (2021): 102655.

Responsible Recommendation



Technical Approaches: Re-ranking

The image shows a YouTube interface with a video player on the left and a list of recommended videos on the right. The video player displays a video titled "What is Bitcoin? Bitcoin Explained Simply for Dummies" by the channel "99Bitcoins". The video player shows a play button, progress bar, and volume controls. The channel name "99Bitcoins" and subscriber count "711K subscribers" are visible below the video player. The recommended videos list includes:

- "But how does bitcoin actually work?" by 3Blue1Brown (14M views, 5 years ago)
- "What is Bitcoin Mining? (In Plain English)" by 99Bitcoins (3.3M views, 4 years ago)
- "Bitcoin explained made simple" by The Guardian (2.3M views, ago)
- "How Cryptocurrency ACTUALLY works." by Mrwhose (7.4M views, ago)
- "The Complete Beginner's Crypto Crash Course" by 99Bitcoins
- "How the blockchain is changing money and business | Don..." by TED (4.8M views, 6 years ago)

A diagram on the right side of the image illustrates the re-ranking process. A box labeled "AI" contains a cartoon illustration of a fortune teller. Blue arrows point from the "AI" box to a video titled "Warren Buffett: Bitcoin Is An Asset That Creates Nothing |..." by CNBC (1.2M views, 4 years ago). This video is highlighted in a pink box, indicating it is the re-ranked recommendation output.

Re-ranking recommendation output

Technical Approaches: Re-ranking



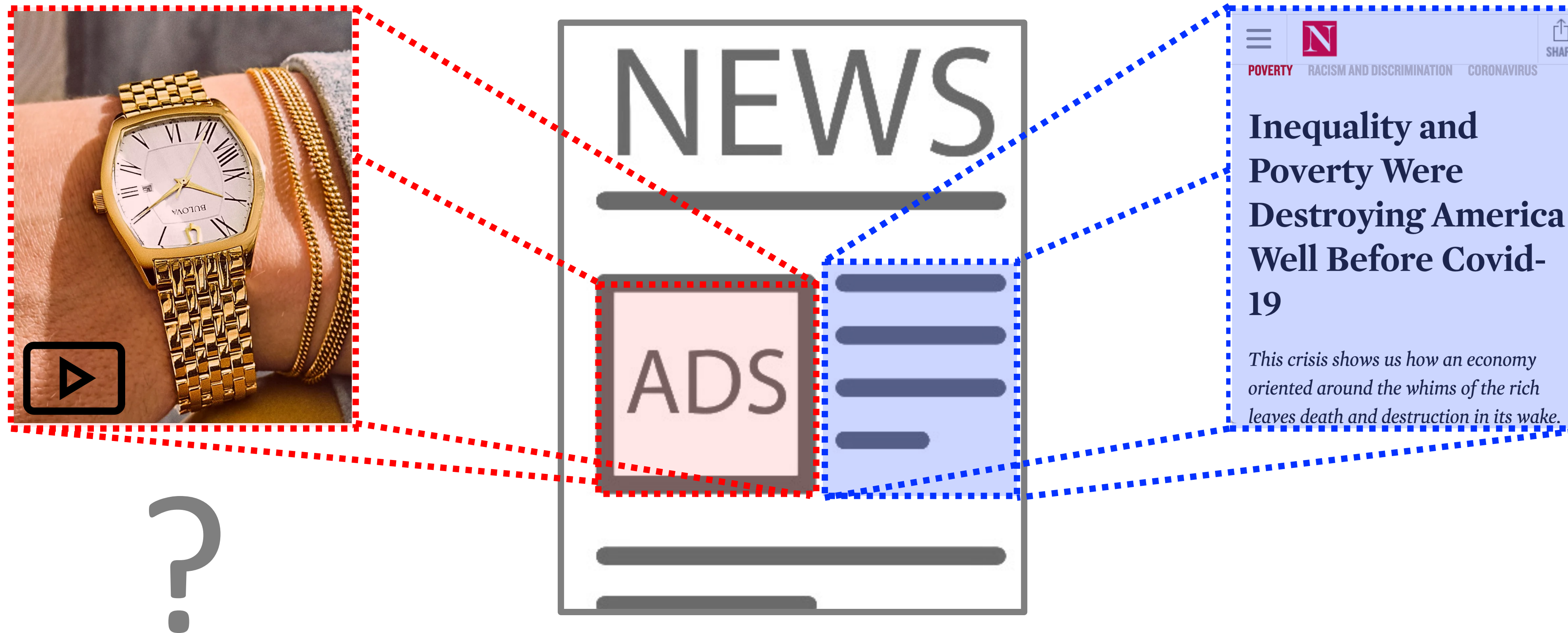
Movie recs Se alle

Popularity bias experiment

Re-ranking recommendation output

Re-ranking
recommendation
output

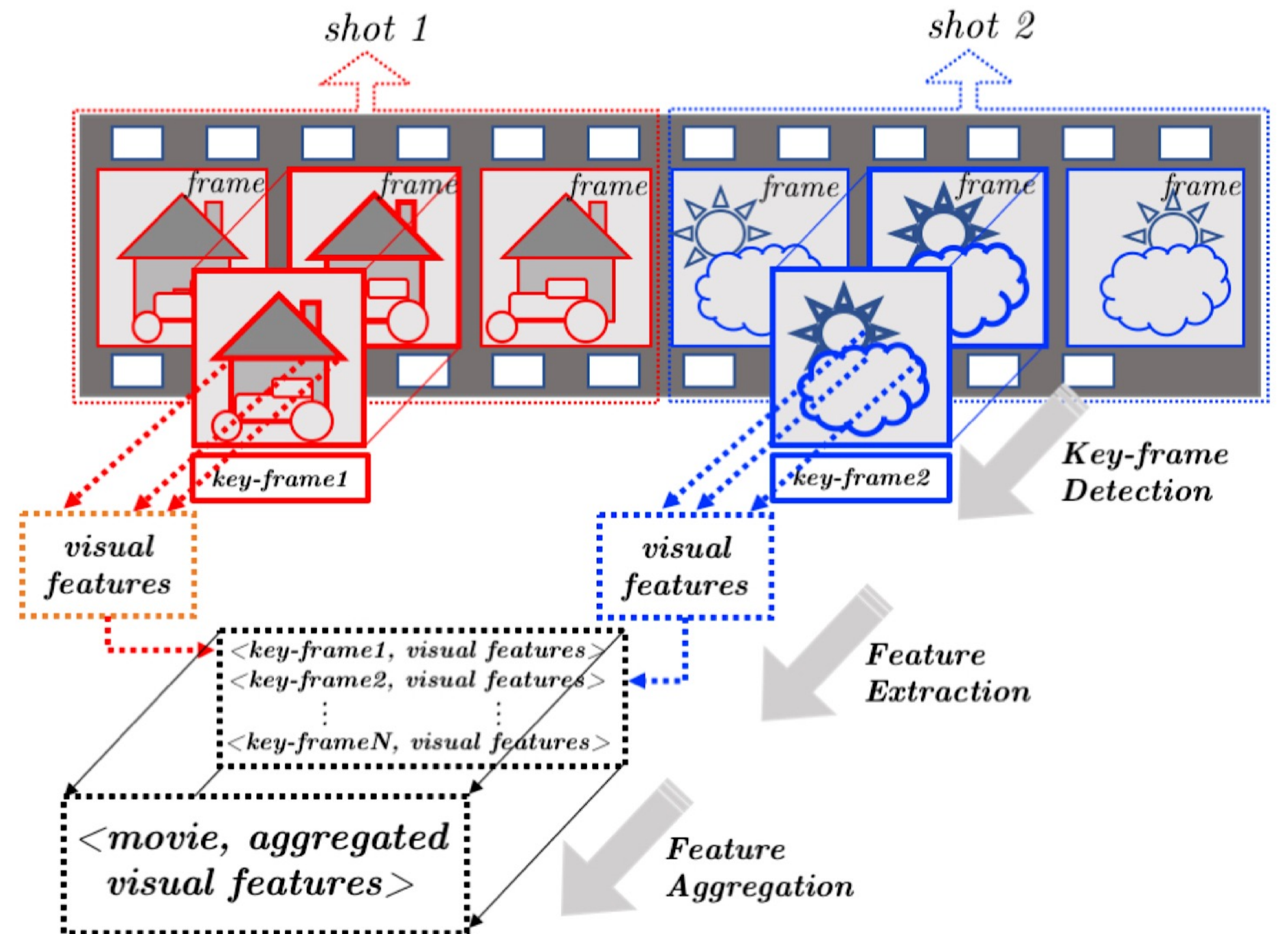
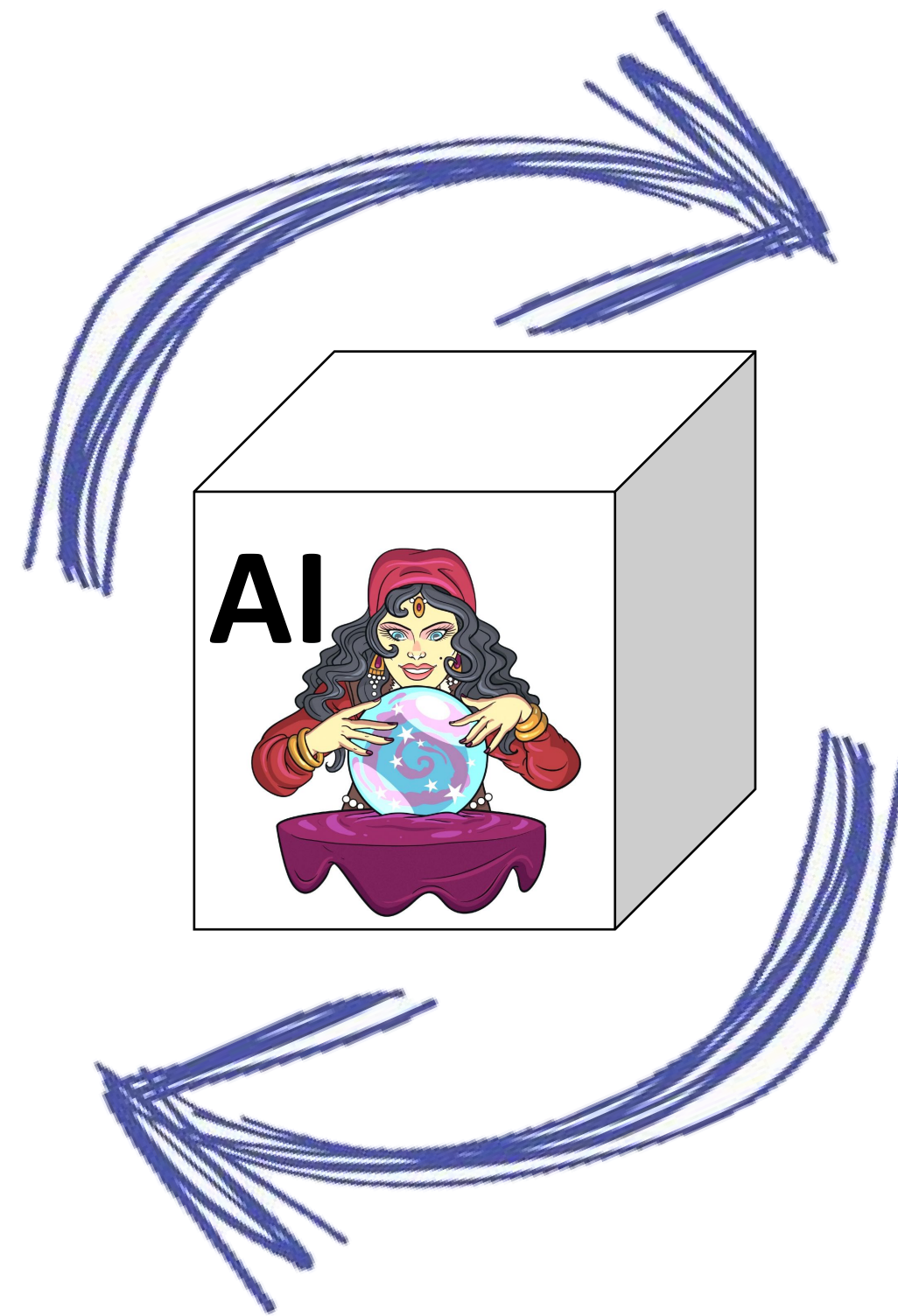
Advertisement: News Domain



Advertisement: News Domain



#Watch (99%)
#Luxury (80%)
#Fashion (70%)
...



Collaboration



Schibsted



amedia

VIMOND



What Is Done: Publications

- ✓ 5+ Journal Publications
- ✓ Including Elsevier IPM (Level 2)
- ✓ 10+ Conference & Workshop Publications
- ✓ Including RecSys (Topmost conference)
- ✓ + several demos, prototypes, & datasets

Information Processing and Management 58 (2021) 102655

Contents lists available at ScienceDirect

ELSEVIER Information Processing and Management

Journal homepage: www.elsevier.com/locate/ipm

Investigating the impact of recommender systems on user-based and item-based popularity bias

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ARTICLE INFO ABSTRACT

Keywords: Recommender systems, Popularity bias, Personalization, Twitter, Social media

Recommender Systems are decision support tools that adopt advanced algorithms in order to help users to find less-explored items that can be interesting for them. While recommender systems may offer a range of attractive benefits, they may also intensify undesired effects, such as the Popularity Bias, where a few popular users/items get more popular and many unpopular users/items get more unpopular. In this paper, we study the impact of different recommender algorithms on the popularity bias in different application domains and recommendation scenarios. We have designed a comprehensive evaluation methodology by considering two different recommendation scenarios, i.e., the user-based scenario (e.g., recommending users to users to follow), and the item-based scenario (e.g., recommending items to users to consume). We have used two large datasets, Twitter and MovieLens, and compared a wide range of classical and modern recommender algorithms by considering a diverse range of metrics, such as PR-AUC, RCE, Gini index, and Entropy Score. The results have shown a substantial difference between different scenarios and different recommendation domains. According to our observations, while the recommendation of users to users may increase the popularity bias in the system, the recommendation of items to users may indeed decrease it. Moreover, while we have measured a different level of popularity bias in different languages (i.e., English, Spanish, Portuguese, and Japanese), the above-noted phenomena has been consistently observed in all of these languages.

1. Introduction

The spread of recommender systems in the daily life of users is causing that more and more decisions are affected by recommendations (Karimi, Jannach, & Jugovac, 2018; Pera & Ng, 2013). Recommender systems adopt a wide range of algorithms (Guo, Tang, Ye, Li, & He, 2017; He et al., 2020) in order to learn from the user preferences, elicited in various forms (Elahi, Braunhofer, Gurbanov, & Ricci, 2018), and to generate a small set of recommended items, which have high utility for a user, from a larger set of items (the input dataset) (Margaris, Vassilakis, & Spiliotopoulos, 2020; Ricci, Rokach, & Shapira, 2015). The recommended set of

Al and Ethics (2022) 2:10
<https://doi.org/10.1007/>

REVIEW

Towards res...

Mehdi Elahi¹ · Di Øyvind Holmstad² · Loek Vredenberg³

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Abstract Reading or viewing recommendations is now discover relevant recommendations may lead of filter bubbles or mechanisms for research note, we research note, and we out

Keywords Recomm...

OPEN A...

Frontiers in Artificial Intelligence

Received: 16 October 2021
Accepted: 27 December 2021
Published: 02 February 2022

Citation: Elahi M, Starke A, El Sari N, Lambrix AA and Trattner C (2022) Developing and Evaluating a University Recommender System. Front. Artif. Intell. 4:796268. doi: 10.3389/rai.2021.796268

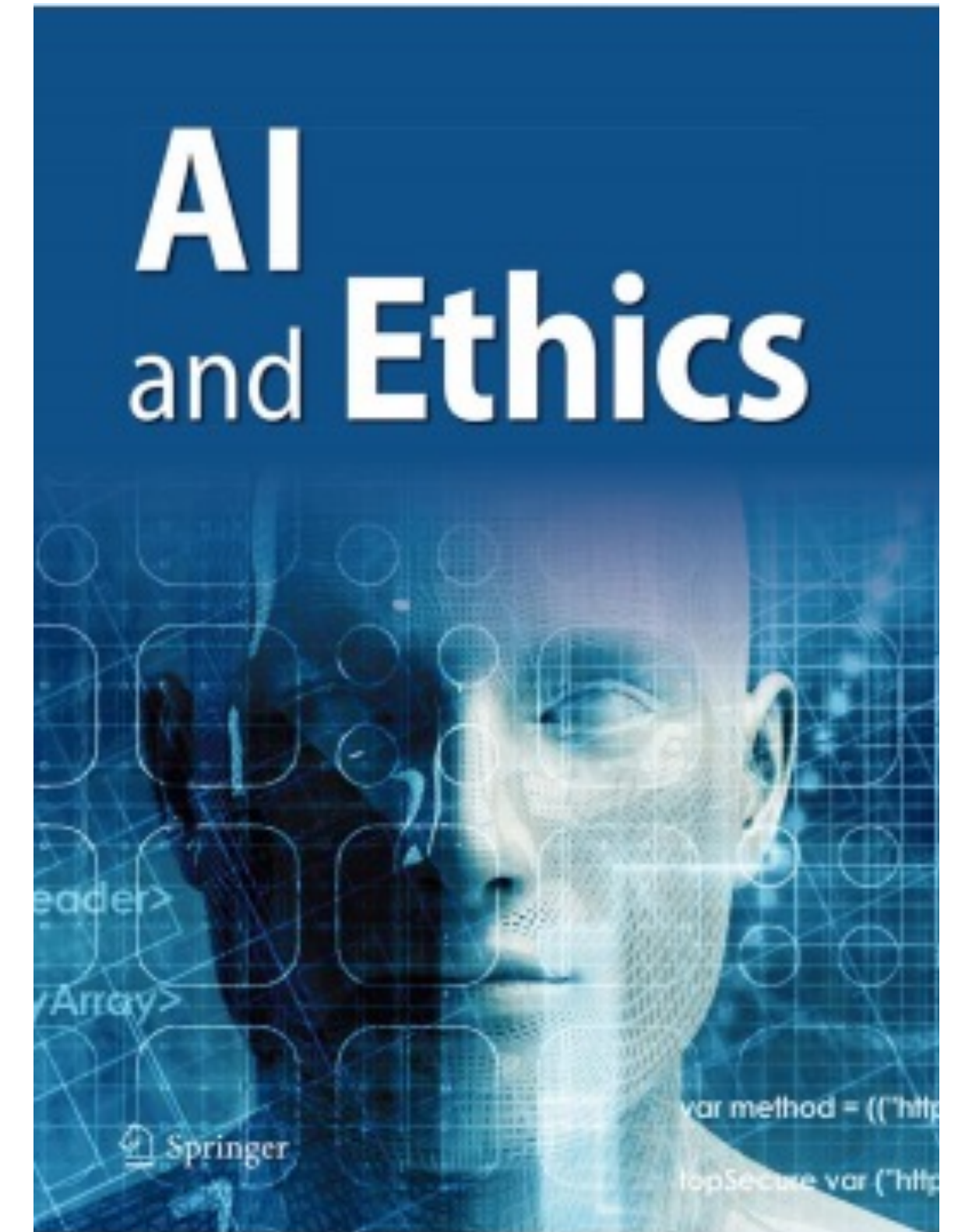
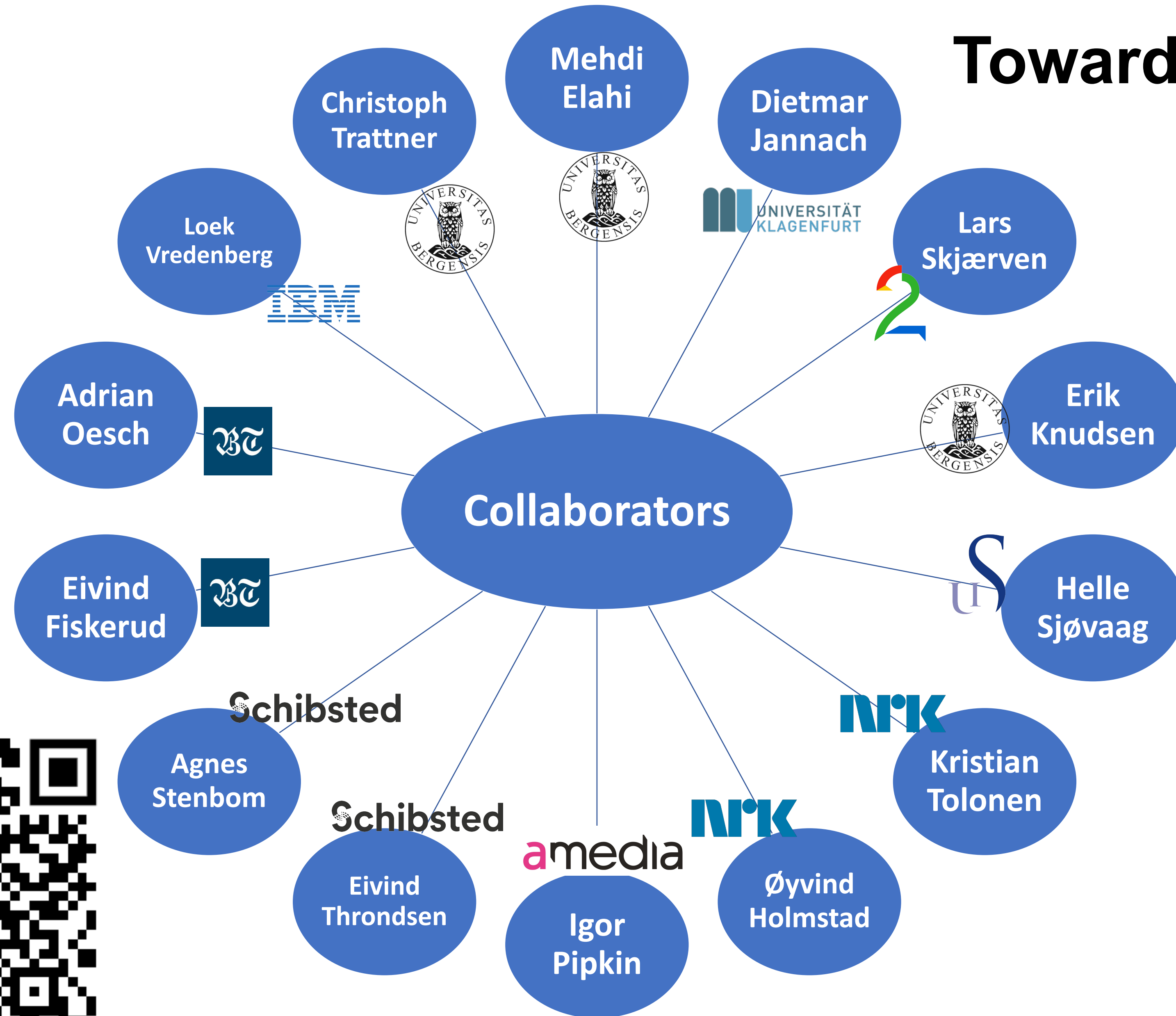
recommender systems that promote healthy foods or suggestions for real estate (Yuan et al., 2013; Starke and Trattner, 2021; Starke et al., 2021b). A domain with high-stake decisions and a large potential choice set is university education. This applies to choices one can make while attending higher education, such as what college major to take and what electives to follow (Dwivedi and Roshni, 2017; Khoja and Shetty, 2017; Obeid et al., 2018), as well as to the decision of attending a university or another higher education institution. Whereas the former has been the topic of various recommender system and learning analytics approaches (cf., Hasan et al. (2016)), universities are rarely featured in personalized approaches (Rivera et al., 2018). This is arguably surprising, because a significant proportion of students attending higher education in G20 countries is not native to those countries (OECD, 2013) – even though most prospective students opt for institutions that are close to home, thus based on

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3 TV2, Bergen, Norway
4 University of Stavanger, Stavanger, Norway
5 NRK, Oslo, Norway
6 Amedia, Oslo, Norway
7 Schibsted, Oslo, Norway
8 Bergens Tidende, Bergen, Norway
9 IBM, Oslo, Norway

Springer

Towards Responsible Media Recommendation




Journal of AI and Ethics




Public Outreach: 6 Seminars


MediaFutures Seminar: Fairness—Are algorithms a burden or a solution? Dr. Christine Bauer, Assistant Professor at Utrecht University
April 21 @ 13:00 - 14:00




MediaFutures Seminar: Detecting Fake News by Using Weakly Supervised Learning. Assoc. Prof. Özlem Özgöbek
March 17 @ 13:00 - 14:00




MediaFutures Seminar: Translating Educational Data into Meaningful Practical Insights from the field of Learning Analytics
Mohammad Khalil.
25 November, 2021 @ 12:00 - 13:00



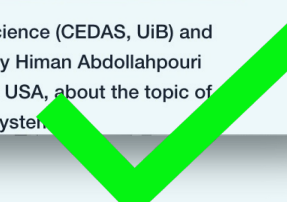
Seminar: Computational Psychology in Recommender Systems, Marko Tkalčič, University of Primorska (Slovenia).
June 8 @ 11:00 - 12:00




Seminar: User-centered Investigation of Popularity Bias in Recommender Systems
May 6 @ 14:15 - 15:00




Please join the Center for Data Science (CEDAS, UIB) and MediaFutures for an invited talk by Himan Abdollahpour from the Northwestern University, USA, about the topic of popularity bias in recommender systems.



Seminar: Reflections of Ourselves – Mobile Psychological Assessment with Smartphones.
Clemens Stachl, Stanford University
April 20 @ 14:00 - 15:00



Public Outreach: 2 International Workshops



The screenshot shows a web browser displaying the organization page for the 2nd Workshop on Multi-Objective Recommender Systems (MORS@RecSys2022) in Seattle, USA, from September 18th to 23rd, 2022. The page features a purple navigation bar with the MORS logo and links for Home, Call for papers, Organization, Program, and Important dates. Below the navigation bar, the workshop title and location are prominently displayed. A grid of seven circular profile pictures is shown, each with the name and affiliation of a participant or organizer listed below it.

Name	Affiliation
Himan Abdollahpouri	Spotify USA
Shaghayegh Sahebi	SUNY USA
Mehdi Elahi	University of Bergen Norway
Masoud Mansoury	University of Amsterdam Netherlands
Babak Loni	ING Group Netherlands
Zahra Nazari	Spotify USA
Maria Dimakopoulou	Spotify USA



90+ Participants

RecSys 2022, & 2021

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**Media
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Thank you
for your attention

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