

Recommendations, Decisions, Feedback Loops, and Maybe Saving the Planet

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May 23, 2019



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**People and
Information
Research
Team**

RecSys and me

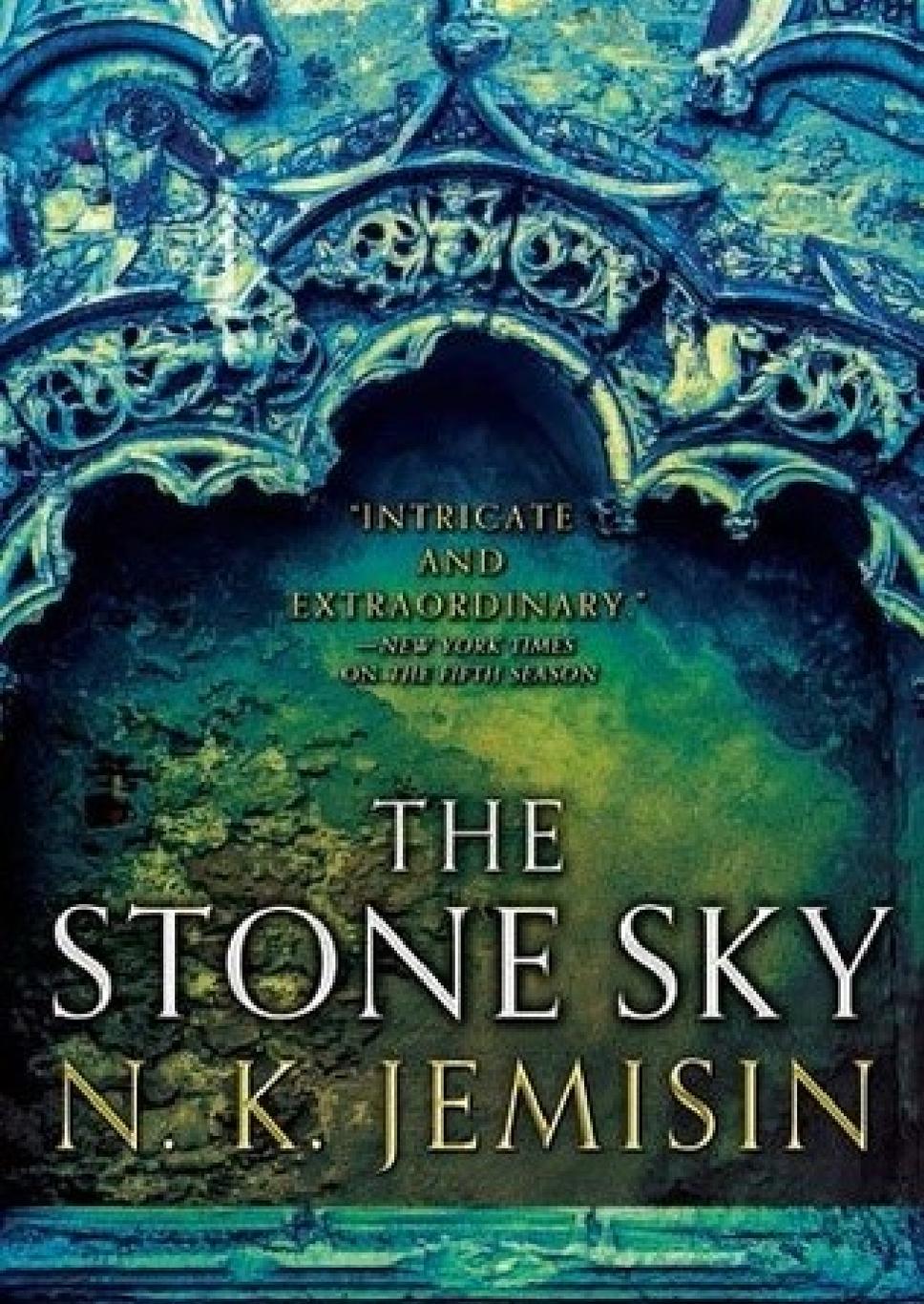
Recommender systems are **defined by application**:
recommend items to users

Involves:

- Human-computer interaction
- Information retrieval
- Machine learning
- Psychology
- Marketing

today

1. Warm-up problem
2. Intro & case study
3. What is a recommender system?
4. How do recommenders interact with decisions?
5. Promise & pitfalls
6. Roadblocks and guidance

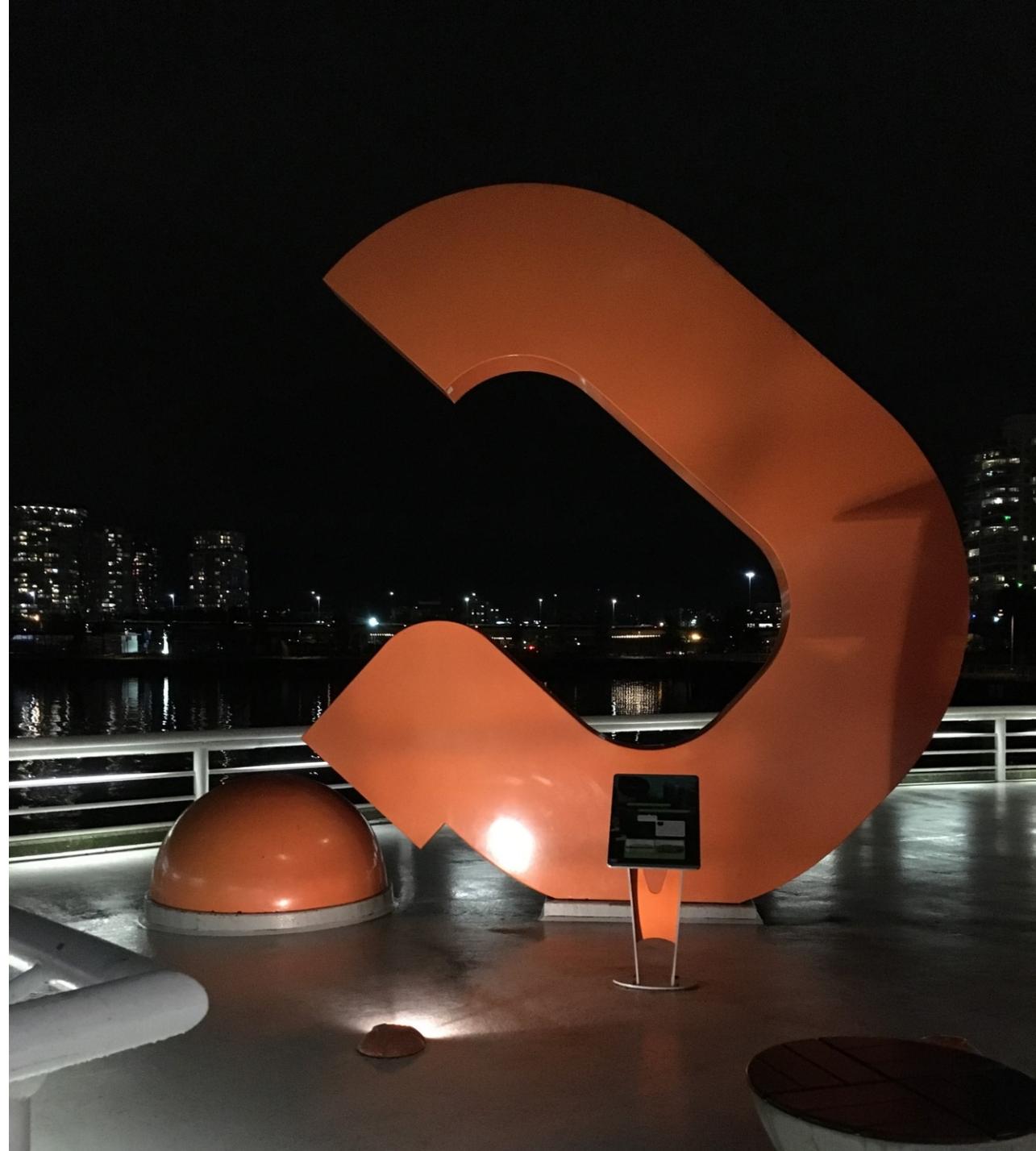


Diversity and Representation in Book Authorship

2015 CWILA COUNT REVIEWS: IN ENGLISH	BY WOMEN	BY MEN	BY NON-BINARY REVIEWERS	BY MIXED GENDER CO-REVIEWERS	BY ANONYMOUS REVIEWERS
	TOTAL COUNTED: 4462	2104 (55.21%)	1607 (42.17%)	5 (0.13%)	11 (0.29 %)
OF BOOKS BY WOMEN	55.32%	29.31%	40.00%	27.27%	45.24%
CANADIAN	35.93%	18.79%	20.00%	18.18%	32.14%
NON-CANADIAN	19.39%	10.52%	0.2	9.09%	13.10%
OF BOOKS BY MEN	38.78%	64.28%	40.00%	63.64%	46.43%
CANADIAN	22.43%	35.53%	20.00%	36.36%	33.33%
NON-CANADIAN	16.35%	28.75%	20.00%	27.27%	13.10%
OF BOOKS BY NON-BINARY AUTHORS	0.19%	-	20.00%	-	-
CANADIAN	0.10%	-	-	-	-
NON-CANADIAN	0.10%	-	20.00%	-	-
OF BOOKS BY MIXED GENDER CO-AUTHORS	5.47%	6.16%	-	-	8.33%
CANADIAN	3.80%	3.24%	-	-	8.33%
NON-CANADIAN	1.66%	2.92%	-	-	-
OF BOOKS BY VARIOUS/UNKNOWN	0.24%	0.25%	-	9.09%	-

Source: Canadian Women in the Literary Arts. <http://cwila.com/2015-cwila-count-methods-results/>

How do recommender systems interact with these efforts?

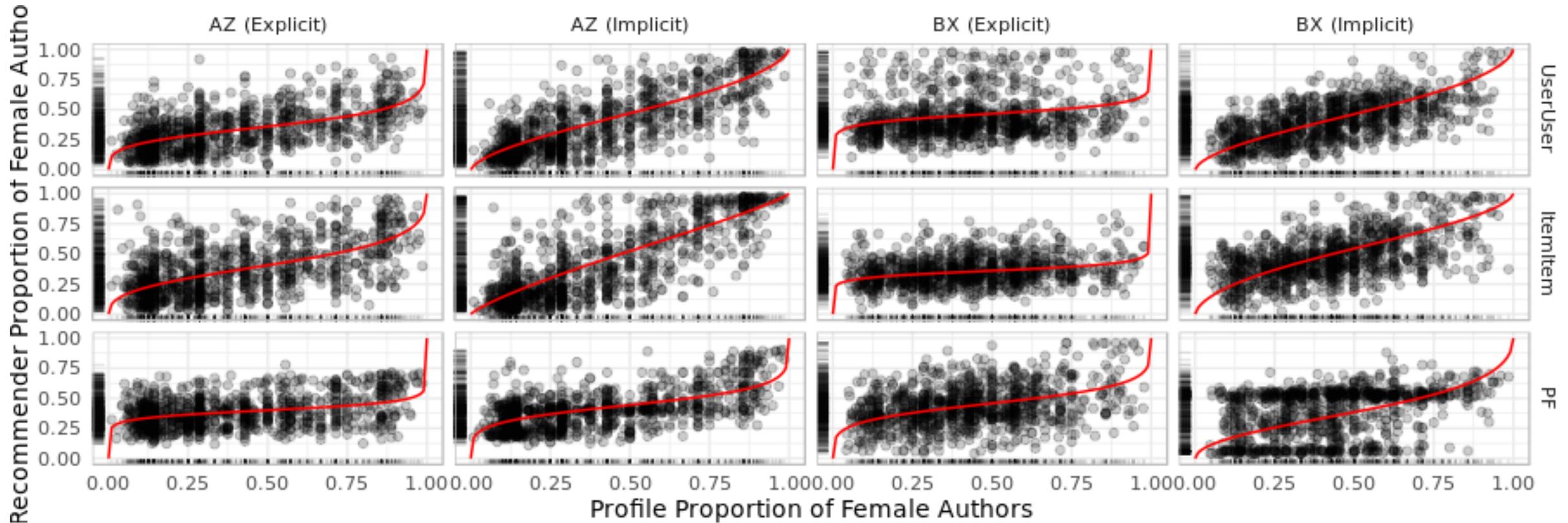




Hurdles by Ragnar Singaas, used under CC-BY-SA 2.0. <https://flic.kr/p/5jgjJP>

recommendation list response

[Ekstrand et al., RecSys 2018]



Input balance propagates, though extent varies

how?

- Reify existing choice patterns (this paper)
- Transport content stereotypes [Speer 2017]
- ...

questions

- How do humans interpret and make use of recommendations?
- When is it acceptable to use knowledge of human decision-making?
 - **Individual** or **global**?

we are nudging

Recommender systems nudge, at the very least

- How?
- Towards what?
- With what accountability?

Not addressing this means we **don't know what our nudges are**, not that we aren't making them.

case study: energy savings [Starke et al., RecSys 2017]

Goal: encourage citizens to adopt energy-saving measures

System: web portal for exploring energy saving measures

Method: model difficulty & user ability on a Rasch scale, recommend measures based on user ability

Findings: increased user satisfaction, increased adoption (4 weeks out)

Besparingshulp

Kies maatregelen die u nog niet toepast maar wel wilt gaan toepassen.

Wanneer u klaar bent gaat u naar uw winkelwagen. Controleer uw keuzes en klik op 'bevestigen'.

Basis **Aanbevolen** Uitdagend Ga ik doen (0)



Dag-nachttarief MATCH 97%

Een dag-nachttarief meter plaatsen kan veel geld besparen wanneer er tijdens de daltarieven energie verbruikt wordt voor bijvoorbeeld wassen of drogen.

BESPARING	BESPARING	INVESTERING
0 kWh/j	€ 0,- p.j.	€ 103,-

Ga ik doen



Geiser schoon houden MATCH 96%

Een geiser verbrandt gas om water te verwarmen. Als de geiser van binnen vies is (roet) wordt het gas minder efficiënt verbrand en het is schadelijk voor mensen. Eén keer per jaar schoonmaken kan dit al verhelpen.

BESPARING	BESPARING	INVESTERING
120 kWh/j	€ 25,- p.j.	€ 0,-

Ga ik doen

Klaar?

From Starke, A., Willemsen, M.C. and Snijders, C. 2017. Effective User Interface Designs to Increase Energy-efficient Behavior in a Rasch-based Energy Recommender System. In Proc. ACM RecSys 2017.

WHAT IS A DECISION?*

SAMUEL EILON

Imperial College of Science and Technology

The decision process is described as a series of steps, starting with information output and analysis and culminating in resolution, namely a **selection from several available alternatives**. Various aspects of rationality in decision making are reviewed and the concept of personalistic versus impersonalistic choice is discussed. It is suggested that with time management control tends to involve an increasing number of formal procedures and thereby to become more impersonalistic in character.





On The Way
To Work

Damien
Hirst

Gordon
Burn



SUSAN BRIGHT ART PHOTOGRAPHY NOW



ANDY WARHOL
"GIANT"
SIZE



recommender vocabulary

Items  are the things we recommend

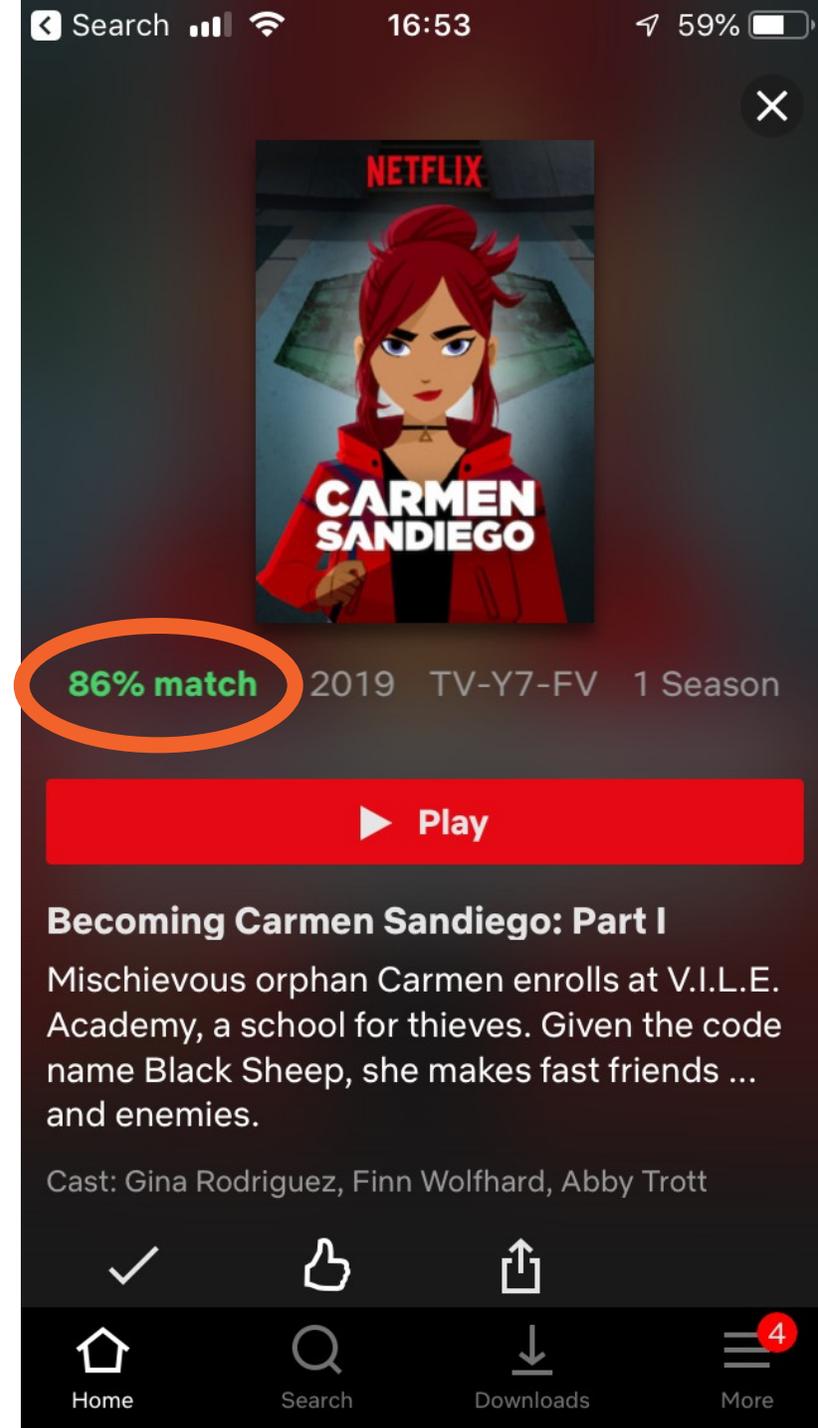
Users  receive & act on recommendations
provide input used for recommendation

Ratings  encode user preference for items

Recommender Tasks

Predict

estimate how much 🧐 likes 📺
can be: predicted rating
purchase probability
score



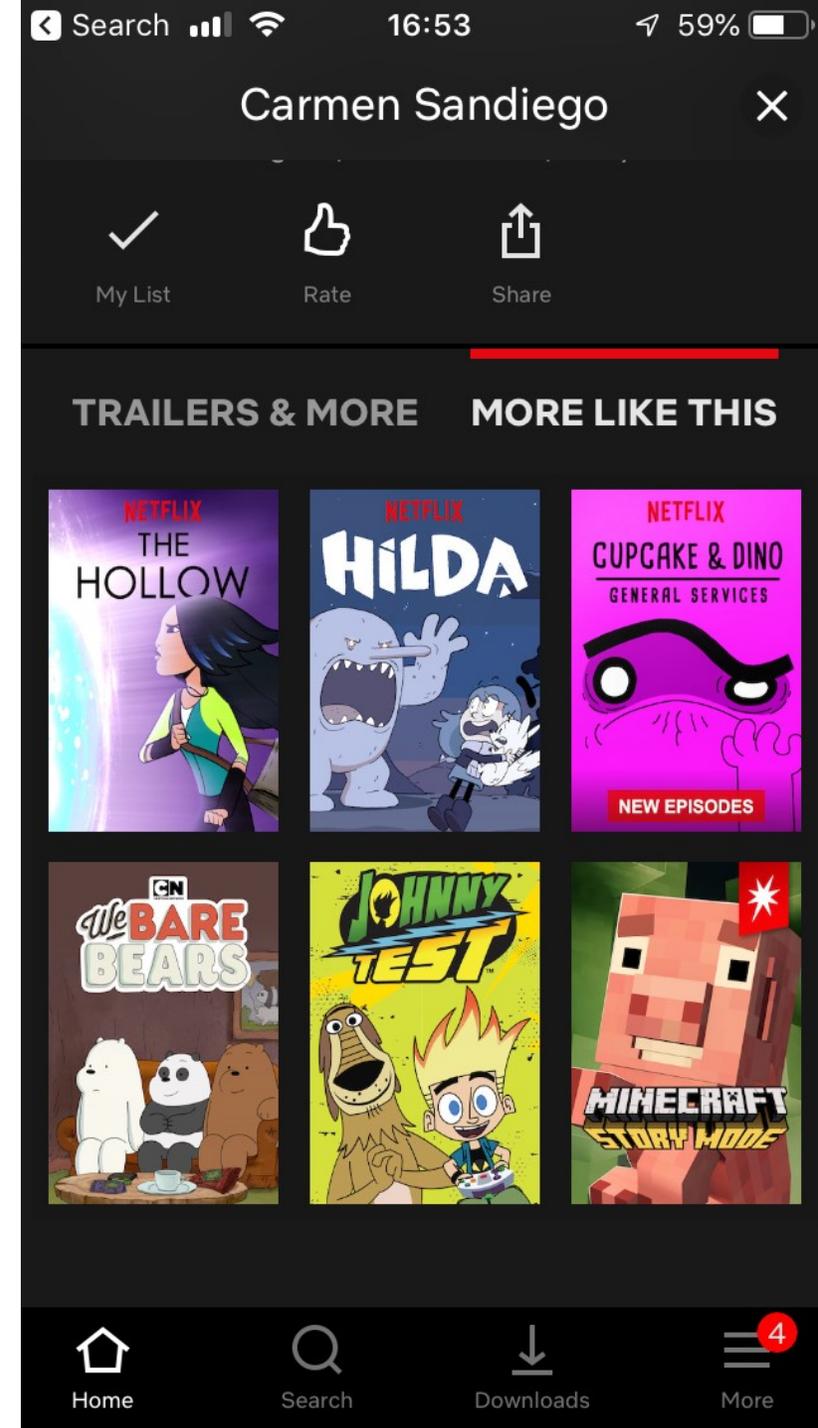
recommender tasks

Predict

estimate how much  likes 
can be: predicted rating
purchase probability
score

Recommend

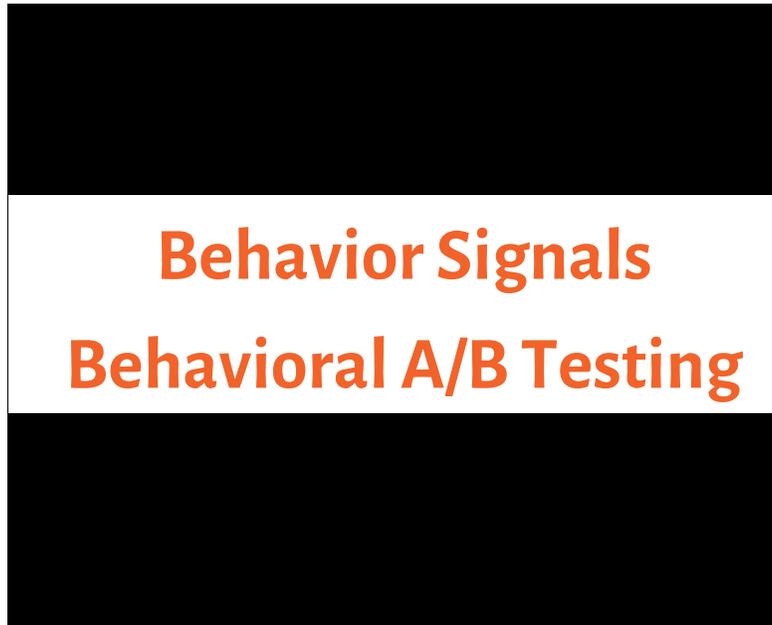
identify items that  may like
maybe a  ?



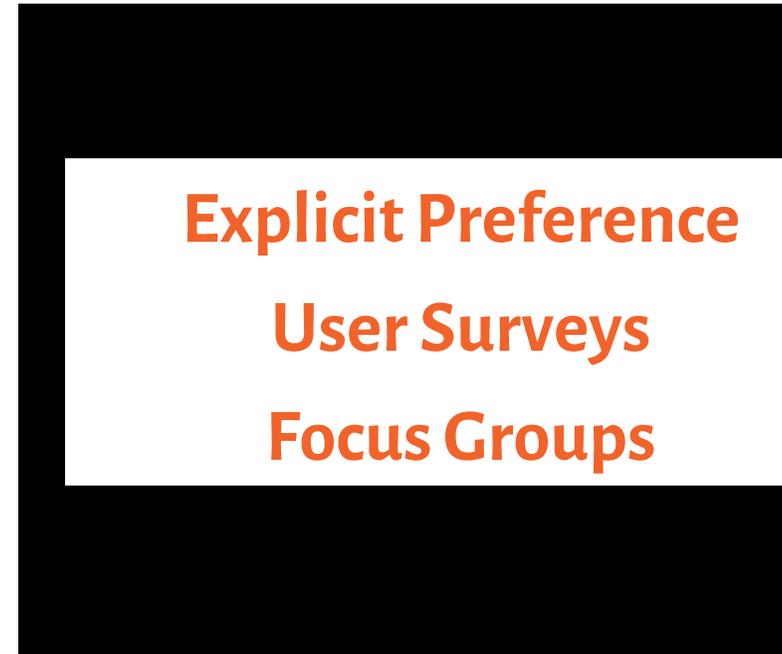
learning about users

[Ekstrand and Willemsen 2014]

Look at what they do



Listen to what they say



objective functions for modeling users

Score item i (or set I^*) for user u with need h in context x :

$$s(i|u, h, x)$$
$$s(I^*|u, h, x)$$

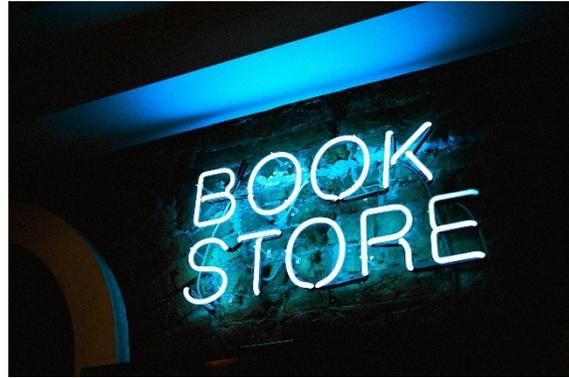
Optimize to predict:

- Rating ($r_{ui} - s(i|u)$)
- Consumption probability ($P(i|u) = \text{logit}^{-1}s(i|u)$)
- Relative order ($i \succ_u j \Leftrightarrow s(i|u) > s(j|u)$)
- Regret (e.g. $P(I \cap G_u = \emptyset)$)

objective functions for evaluating recsys

- Any of the previous!
- Improve KPI in online deployment
 - Engagement (e.g. time on site)
 - Revenues
 - Sales
 - Information access welfare function? [Fish et al., 2019]

but who all is affected?



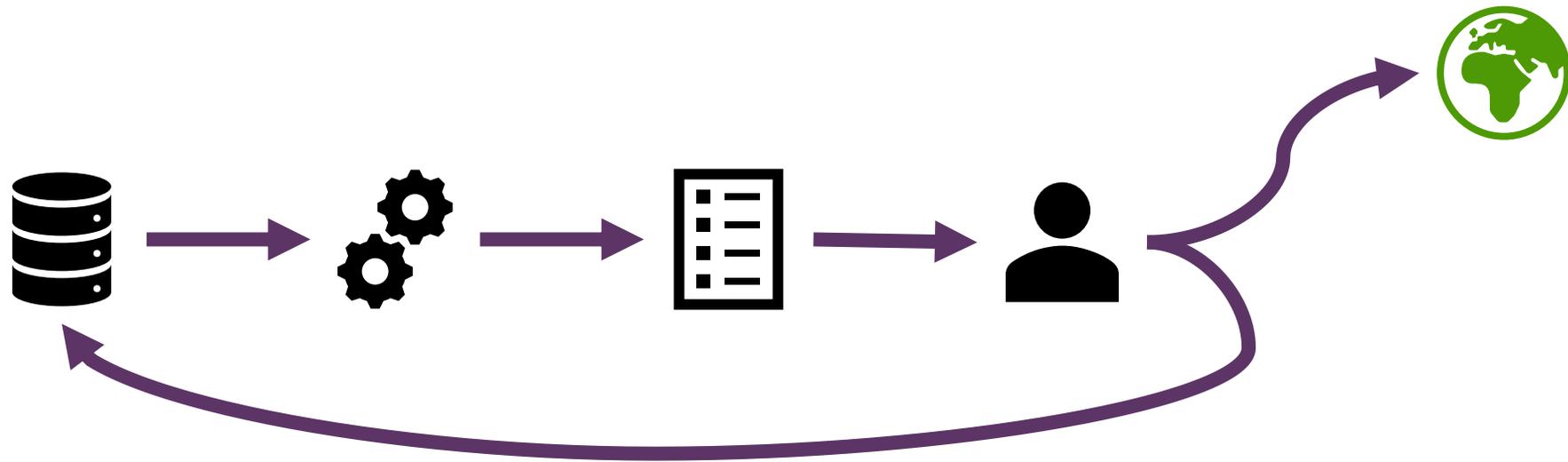
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recommendations in context



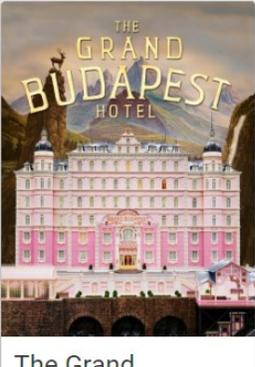
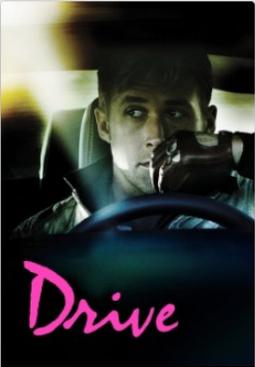
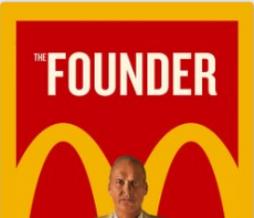
prioritize the alternatives

movieLens ☰ Q 347 ☆ 🔔 👤

MovieLens recommends these movies

top picks

found 65918 movies. sort by: recommended ▾

 <p>Coco ★ 4.7</p>	 <p>Nightcrawler ★ 4.8</p>	 <p>The Grand Budapest Hotel ★ 4.6</p>	 <p>Drive ★ 4.6</p>	 <p>Get Out ★ 4.5</p>	 <p>Room ★ 4.6</p>	 <p>Avengers: Endgame ★ 4.6</p>
						

expand the alternatives

The screenshot shows a Spotify interface for a playlist titled 'Discover Weekly'. At the top, there is a search bar, an 'UPGRADE' button, and a user profile icon for 'mdekstrand'. The playlist cover art features a pink and blue gradient with the text 'Your Discover Weekly'. Below the cover, it says 'MADE FOR MDEKSTRAND' and 'Discover Weekly' in large white text. A description follows: 'Your weekly mixtape of fresh music. Enjoy new discoveries and deep cuts chosen just for you. Updated every Monday, so save yo...'. Below this, it states 'Made for mdekstrand by Spotify • 30 songs, 1 hr 54 min'. There are three action buttons: a green 'PLAY' button, a heart icon, and a three-dot menu icon. Below these are a 'Filter' search bar and a 'Download' toggle switch. The main content is a list of songs with columns for 'TITLE' and 'ARTIST'. Each song has a heart icon on the left and a minus sign on the right.

	TITLE	ARTIST	
♥	Never Look Away	Vienna Teng	⊖
♥	Mile In These Shoes	Jennifer Lopez	
♥	Push the Button	Amy Lee	
♥	Chasing Shadows	Shakira	
♥	Agony	Paloma Faith	

constrain the alternatives

Browse Cambridge by Food

See all



Italian (314)



Chinese (158)



Mexican (122)



Seafood (127)



Pizza (274)



Middle Eastern (70)



Indian (44)



Steakhouse (36)

Moderately Priced

See all



Puritan & Company

★★★★☆ 178 Reviews

\$\$ - \$\$\$, American, Wine Bar



Veggie Galaxy

★★★★☆ 287 Reviews

\$\$ - \$\$\$, Diner, American
Cambridge



Dali Restaurant & Tapas ...

★★★★☆ 376 Reviews

\$\$ - \$\$\$, Mediterranean, European...
Somerville .7 mi away



Cafe Luna

★★★★☆ 230 Reviews

\$\$ - \$\$\$, American, Cafe
Cambridge

explain the alternatives

BASED ON YOUR READ SHELF



updated: Apr 18, 2019 07:56AM

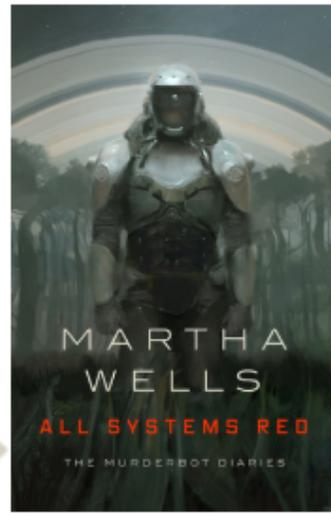


All Systems Red (The Murderbot Diaries, #1)

by Martha Wells*

★★★★★ 4.15 avg rating — 33,578 ratings — published 2017

In a corporate-dominated spacefaring future, planetary missions must be approved and supplied by the Company. Exploratory teams are accompanied by Company-supplied security androids, for their own safety. But in a society where contracts are awarded to the lowest bidder, safety isn't a primary conce ...more



Want to Read



Not interested

Because you added...



Want to Read



Not interested

[More for this shelf »](#)

postpone the alternatives

A screenshot of a YouTube video player interface. The background is a dark blue gradient. At the top left, there is a white 'X' icon and the text 'Midwest Rap'. The main video area shows a close-up of a woman's face in profile, looking upwards, with the text 'DESSA A BADLY BROKEN CODE' overlaid. To the right of the video, the title 'The Crow' is displayed in white, followed by the artist name 'Dessa' and the album title 'A Badly Broken Code'. Below the title is a white downward-pointing chevron icon. At the bottom of the player, there is a white volume icon and a progress bar on the left, and icons for dislike, play/pause, next, and like on the right. The timestamp '0:02 / 3:37' is shown in the bottom right corner of the player.

Midwest Rap

DESSA
A BADLY BROKEN CODE

The Crow
Dessa
A Badly Broken Code

0:02 / 3:37

scores and users

- Scores bias user ratings [Cosley et al., 2003]
 - For both seen and unseen movies
 - Users may sense this
- Scores + decisions may exacerbate unfairness [Green & Chen 2019]
- People are reluctant to incorporate algorithmic inputs [Yeomans et al. 2019]

explanations and users

Explanations can ...

- ... improve system adoption [Herlocker et al, 2000]
- ... skew expectation of quality [Bilgic & Mooney 2005]
- ... improve score adoption [Yeomans et al. 2019]

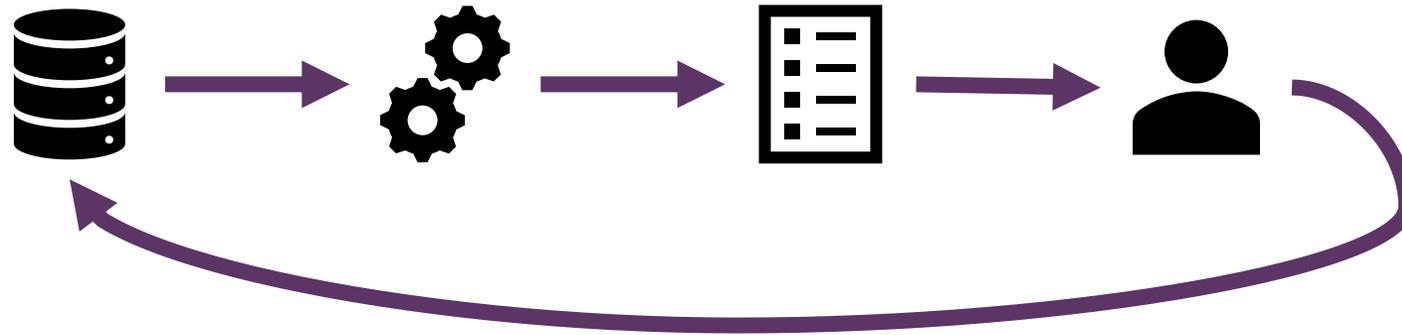
Prediction is not explanation

Explanation != justification

recommendations and users

- Affects decrease choice difficulty [Willemssen et al. 2016]
- Increases / decreases likelihood of awareness
- Influence product selection [Senecal and Nantel 2004]
 - Calling them recommendations increases this effect
- Captivate our attention [Seaver 2018]

the feedback loop



- Homogenizes user behavior [Chaney et al. 2018]
- Can decrease overall diversity, rich get richer [Fleder & Hosanagar 2009]
- Filter bubbles? Not so much. [Hosanagar et al. 2013, Nguyen et al. 2014, Möller et al. 2018]

recommendations and fairness

Fair recommendations ...

- ... serve all users [Ekstrand et al., FAT* 2018]
- ... fairly allocate exposure or attention [Biega et al. 2018]
- ... promote group representation [Ekstrand et al., RecSys 2018; Sapiezynski et al. 2019]
- ... fairly orders item pairs [Beutel et al. 2019]
- ... what else?

nudge to what?

The user's goal's [Ekstrand & Willemsen 2016, Yang et al. 2019]
Counterexample in Levy

Social good

- Energy savings [Starke et al. 2017]
- Sustainability [Tomkins et al. 2018]
- Fairness?

Profit

nudging or shoving?

Recommender systems' behavior-targeting capabilities provide **incredible power** and **substantial risk**.

We can identify nudges users are *more likely* to adopt.

open questions

How do people respond? Much still unknown.

- In fairness-relevant settings?
- What drives different kinds of adoptions?
- What kind of adherence is needed?
- When & how to restrict autonomy?

How do we elicit user goals for nudging?

opportunities for recommenders

If we know a user's **goals** *and* their **behavior**, maybe the recommender can help!

- Find 'baby steps' that are:
 - Likely to be adopted (behavior helps here!)
 - Closer to user's goals (their input necessary here!)
- Persuasive computing has **how**, but recsys can do more for **what**.

giving users a voice

Example: Twitter and the algorithmic feed

- Good reasons to involve filtering!
- But: it changes how the service is used
 - Existing users feel unheard

Participatory design provides a framework for incorporating user voices into the design process.

Transparency lets users know whose voices are being incorporated and how.

moral framework impedance

VIRTUE



Our intentions were good / not bad.

DEONTOLOGY



We followed the rules.

NIHILISM



Why should we care?

CONSEQUENTIALISM



What is the impact?

power analysis



Anyone in a position to act on these questions probably has much more power than those the answers will affect.

what to do?

- Look for applications to clearly do good
- Involve affected stakeholders
 - Users directly
 - Stakeholder groups (participatory design helpful but insufficient)
- Involve disciplinary expertise
 - Domain – the devil is in domain details
 - Normative analysis
- Acknowledge & explore moral frame(s)
- Study widely, reflect, interrogate

Thank You
Questions?



<https://purl.org/mde/FairEcon>