Social Recommender Systems

Scott Sanner

Suvash Sedhain
Lexing Xie, Darius Braziunas, Jordan Christensen, Riley Kidd, Khoi-Nguyen Tran, Peter Christen
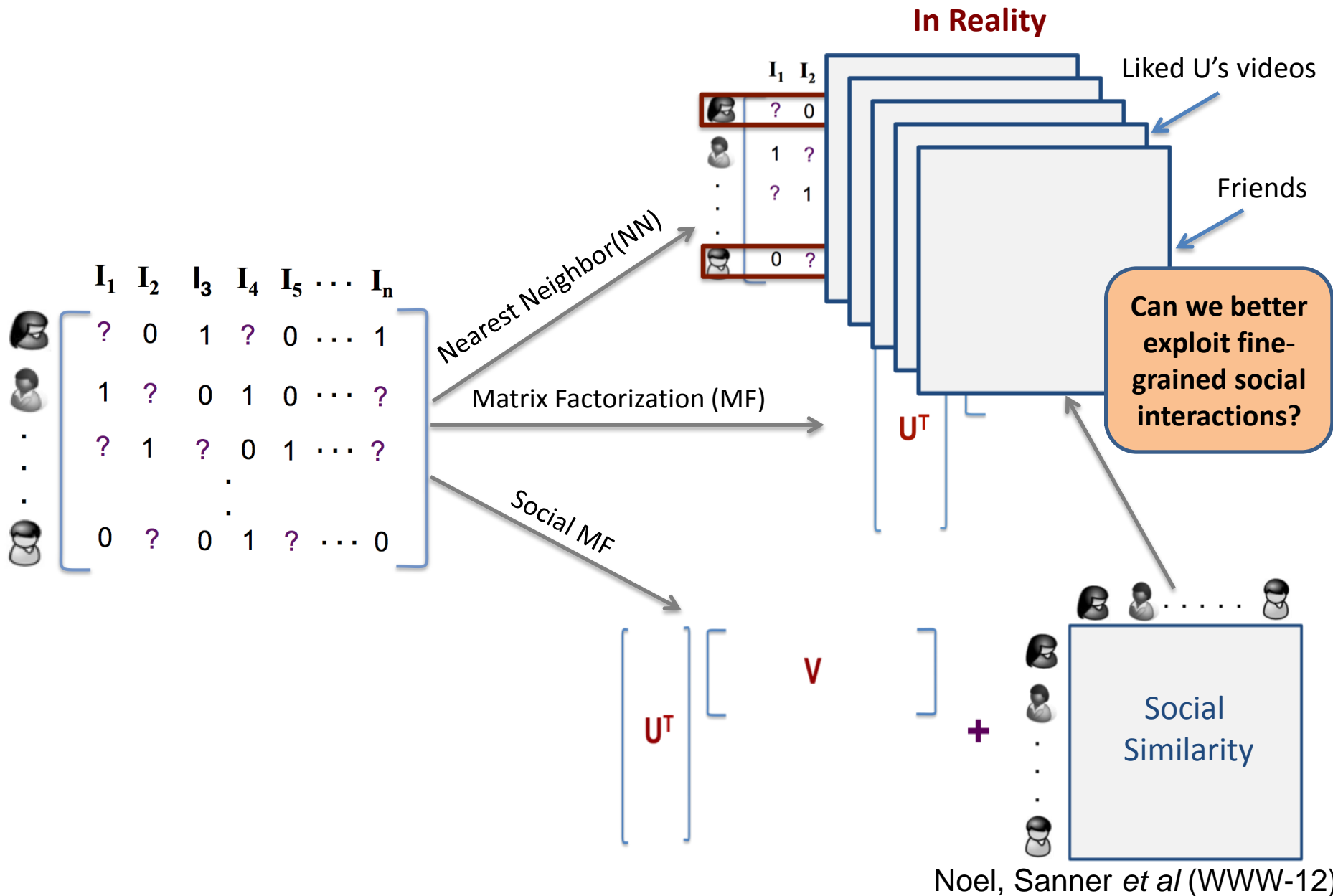
Social Recommendation on Facebook

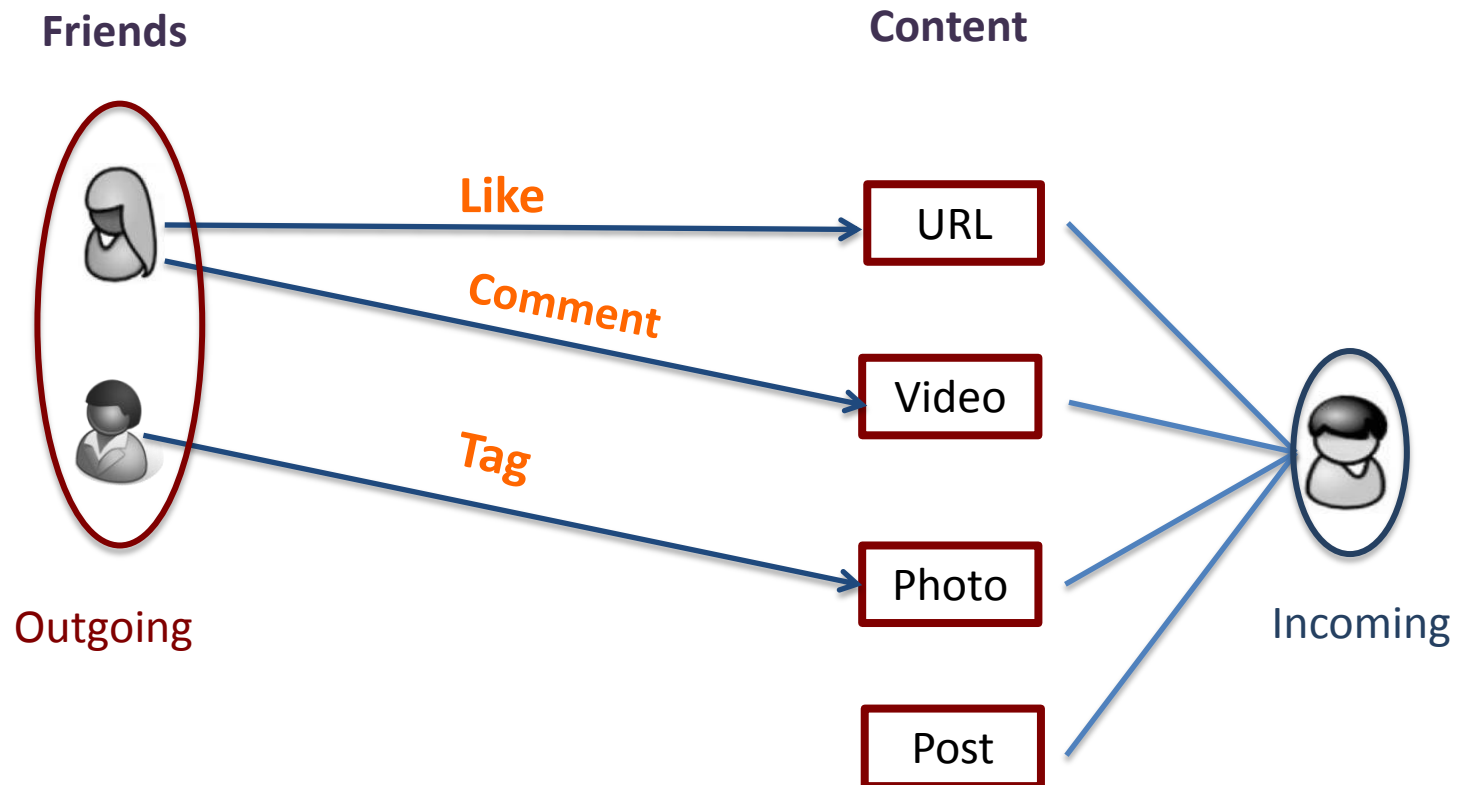# State-of-the-art (Social) Recommendation

Noel, Sanner *et al* (WWW-12)

What Social Interactions and Activities are Possible on Facebook?

Facebook Interactions

{link, post, photo, video} × {like, tag, comment} × {incoming, outgoing}

23 interactions

Friends   **Content**

Outgoing — Like → URL — Comment → Video — Tag → Photo — Post — Incoming

Facebook Activities
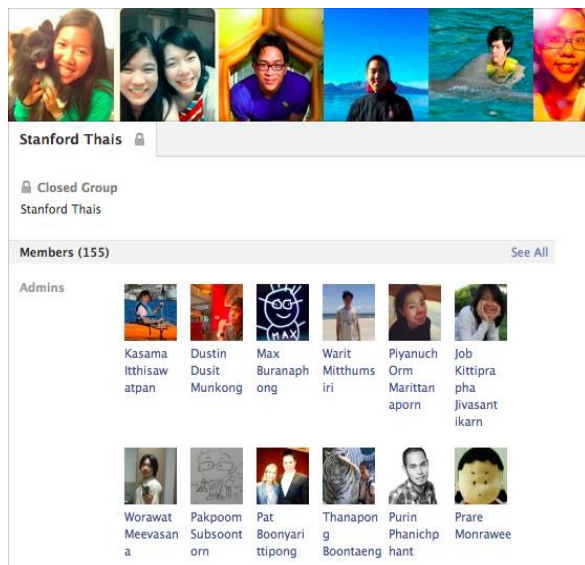
Groups

Pages

Favorites

Social Feature Analysis

U

Like/Dislike?

URL

Friends

Liked U's Video

Justin Bieber Fan
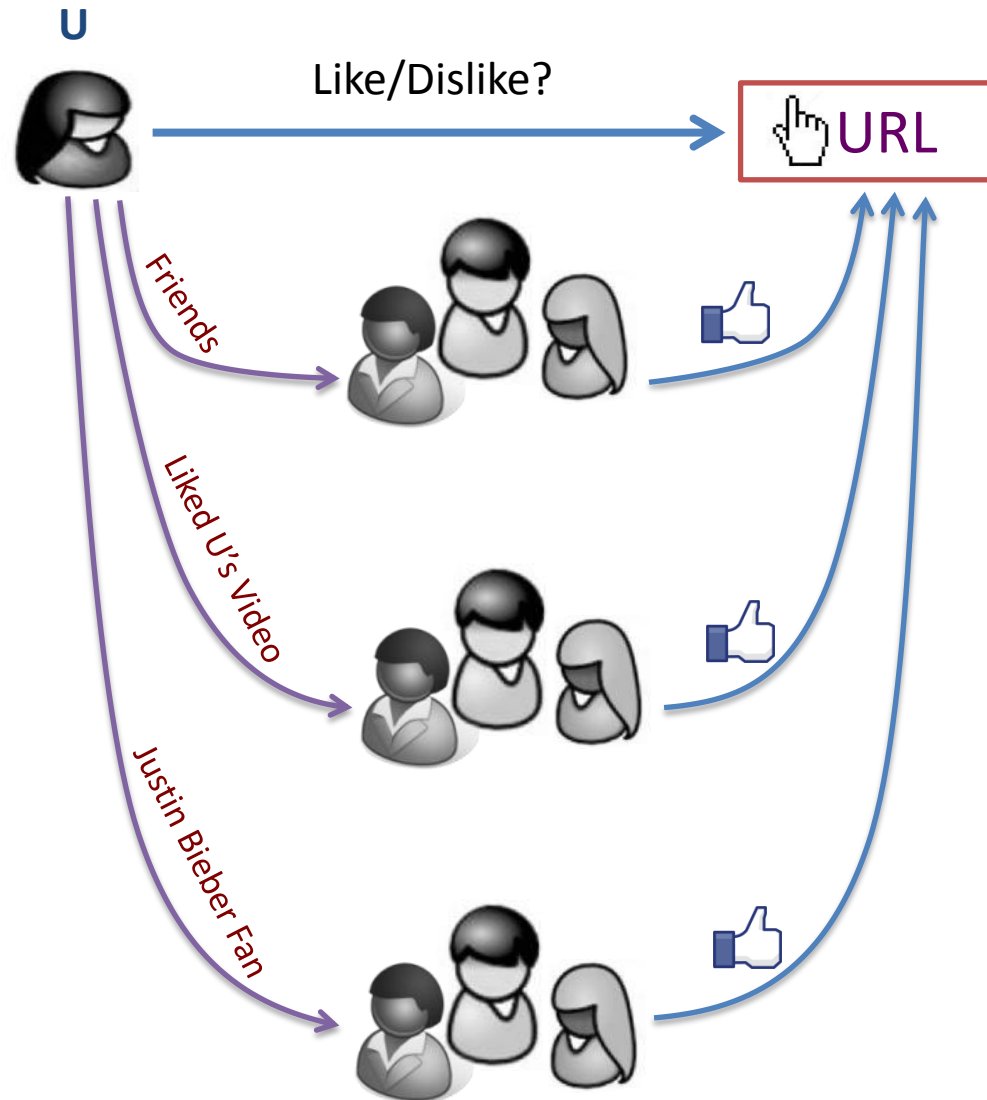
Compute conditional entropy of likes/dislikes for each feature group

Data Description

Google Grant to build a Facebook Recommendation App

- 119 users
- 37,872 friends
- Data on 2,700,000+ users!

- Ran for 6 months, 3 links recommended per day
    - Users could like/dislike

- Millions of interactions, e.g.,
    - 9,600,000+ photo tags
    - 1,200,000+ wall posts
    - 4,800,000+ comments

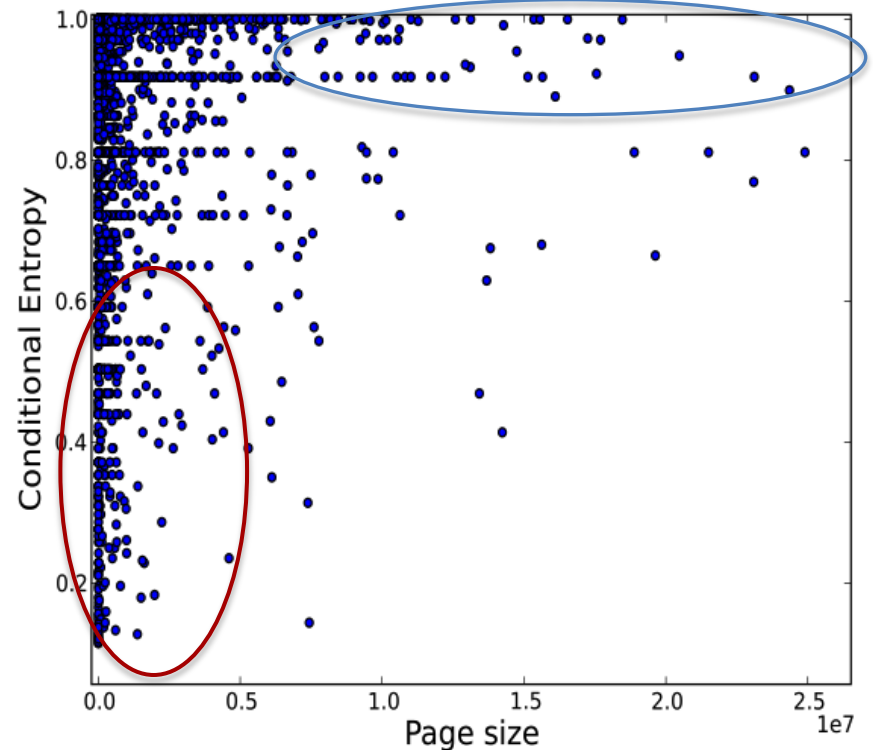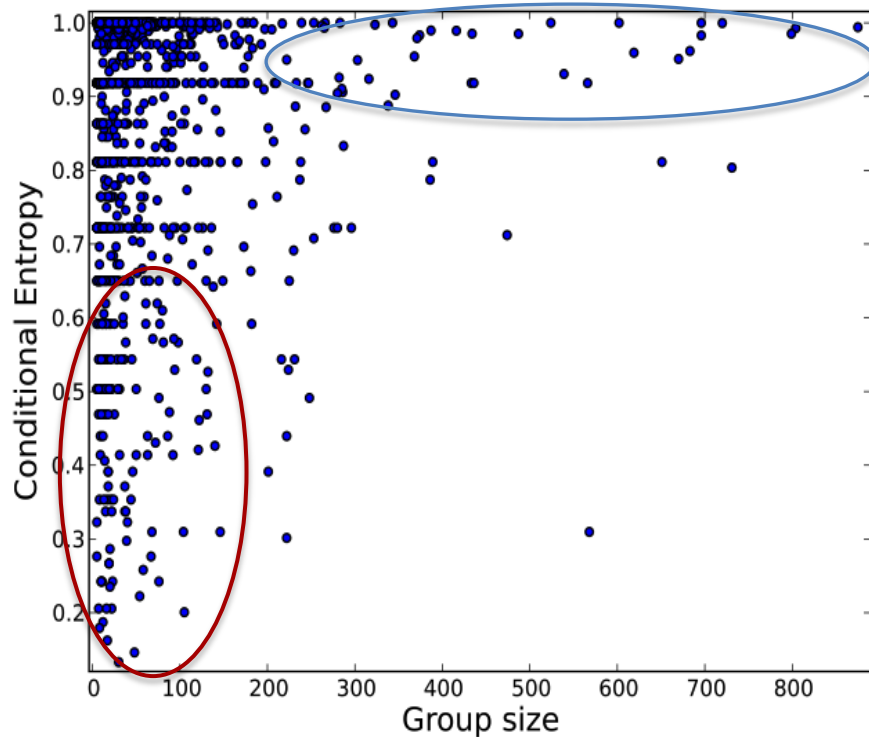- Thousands of activities for 119 users

Are all Interactions Equally Informative?

Conditional Entropy as a measure of informativeness

Modality (X)	$H(Y|X = true)$
video	0.850
link	0.915
post	0.918
photo	0.926

Are Larges Group More Informative?

Large groups tend not to be predictive

Most informative groups were small

Analysis of Favorites

Median Informative

| Median Informative Favourites by Category		
Movies	**Music**	**Television**
Forrest Gump	John Lennon	Futurama
Pretty Woman	U2	Star Trek
Napoleon Dynamite	AC/DC	The Trap Door
Harry Potter	The Smashing Pumpkins	Drawn Together
Toy Story 3	Gotye	Sherlock(Official)
The Godfather	The Rolling Stones	Hitchhiker's Guide to the Galaxy
Mulan	All Axess	Buffy The Vampire Slayer
How to Train Your Dragon	Steve Aoki	South Park

Most Informative

Most Informative Favourites by Category		
Movies	**Music**	**Television**
Billy Madison	Avascular Necrosis	Metalocalypse
Team America: World Police	Tortured	Beast Wars
Pan's Labyrinth	Elysian	Hey Arnold!
Pirates of the Caribbean	Anno Domini	Sherlock
Aladdin	Darker Half	Hey Hey It's Saturday
Starship Troopers	Hellbringer	Neil Buchanan and Art Attack!
Happy Gilmore	Johnny Roadkill	Breaking Bad
Timon and Pumbaa	Aeon of Horus	Red vs. Blue

- Median favorites were largely generic
- Most informative were largely specialized

Social Affinity Filtering

Sedhain, Sanner *et al* (COSN-13)

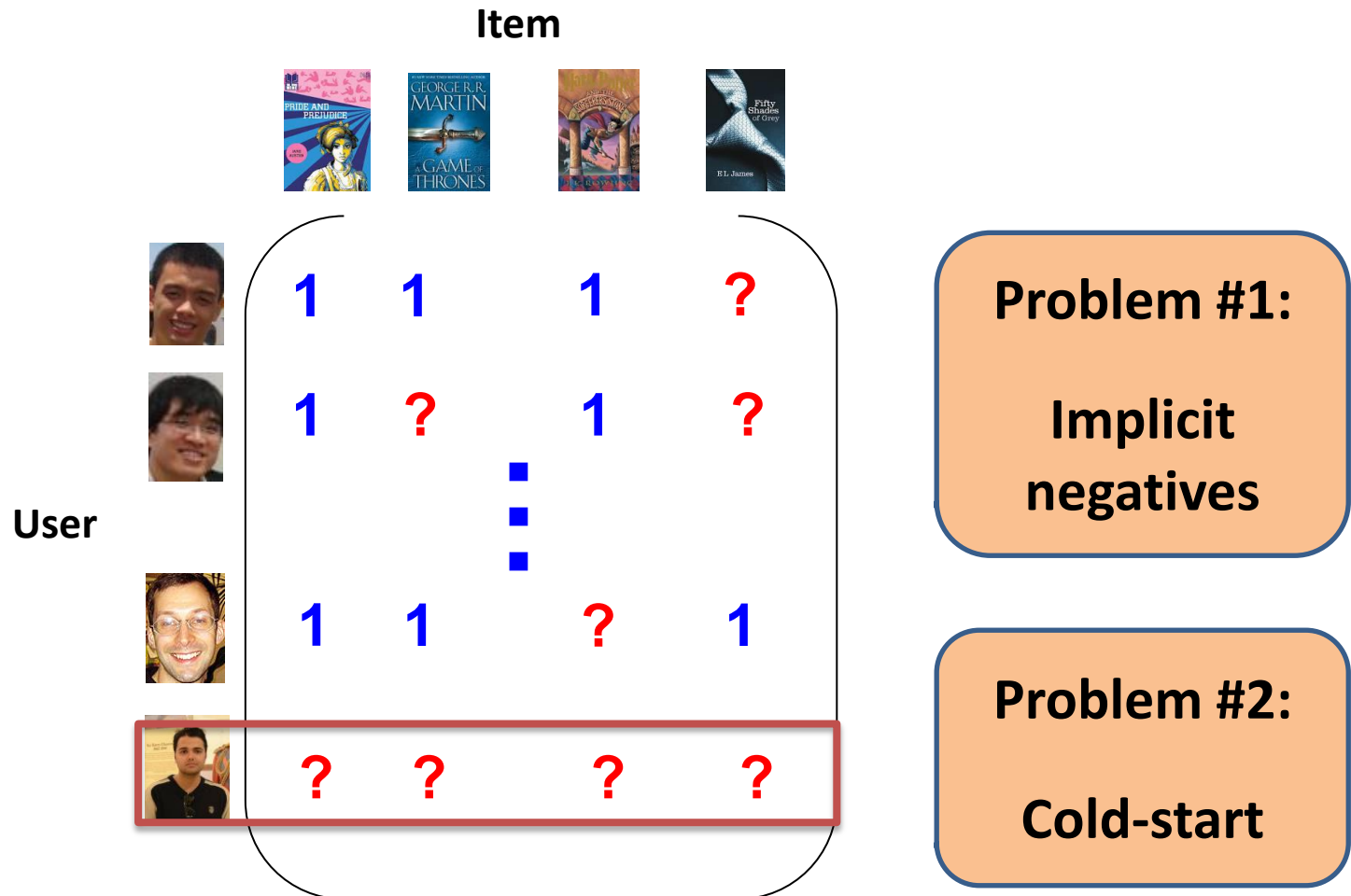Just need page likes! Low user privacy concern.
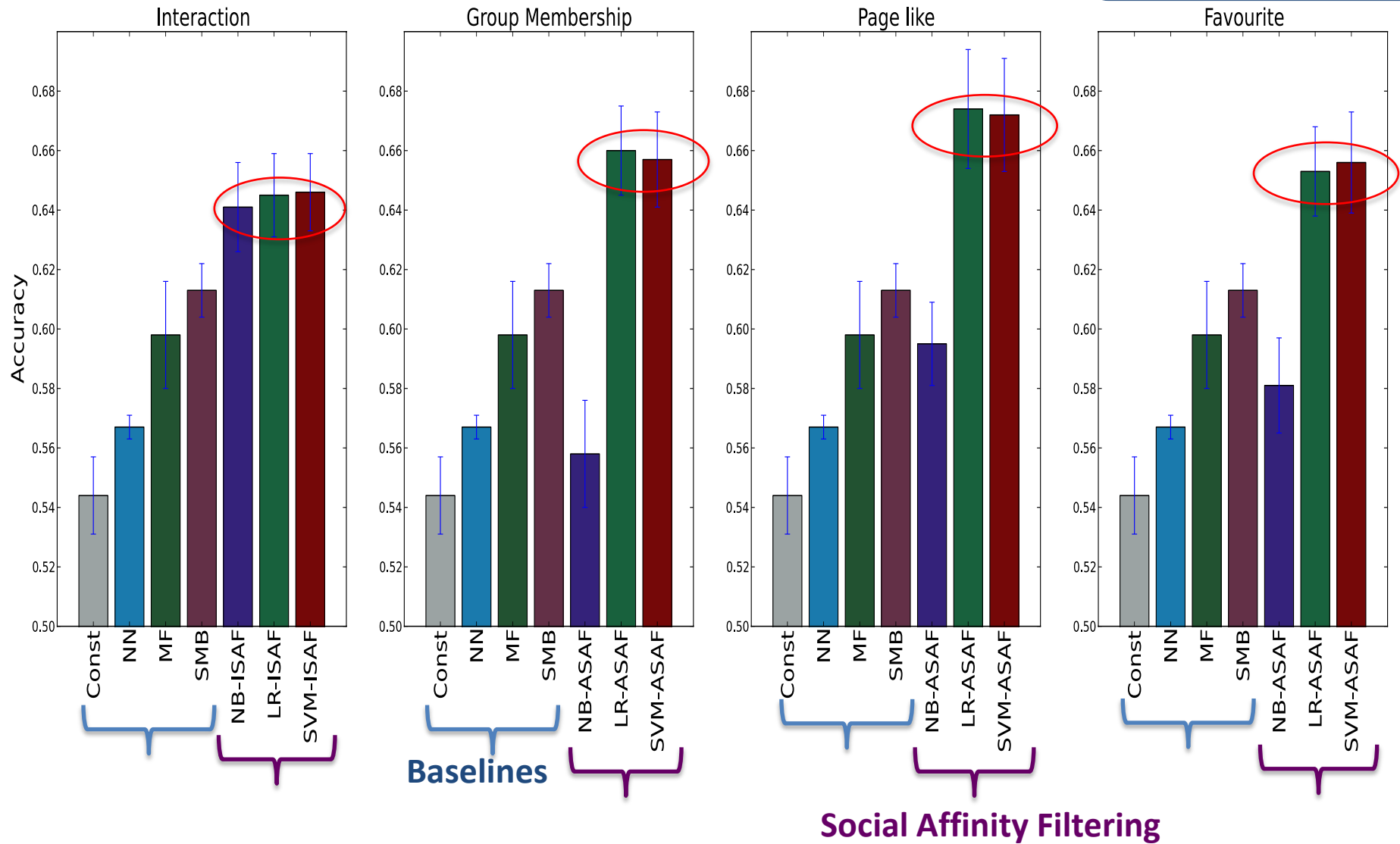
Predictive Power of FB Page Likes

- Relates to other work also published in 2013:

  - Page likes help to predict gender, relationship status, religion, etc.
    - Michal Kosinskia, David Stillwella, and Thore Graepel, Private traits and attributes are predictable from digital records of human behavior, PNAS 2013

  - Page likes help to predict user purchase behavior on eBay
    - Yongzheng Zhang and Marco Pennacchiotti, Predicting purchase behaviors from social media, WWW 13
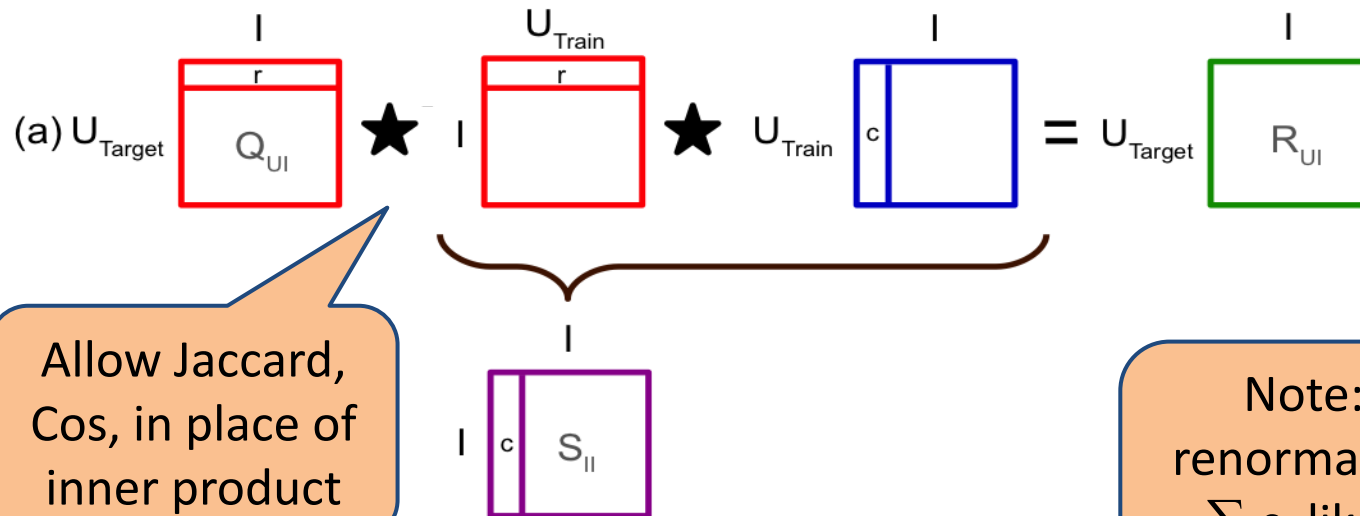
Great, can we use page likes for cold-start
e-book recommendation on *kobo.com*?

Cold-start is possible, but combining
with **implicit feedback** much harder…

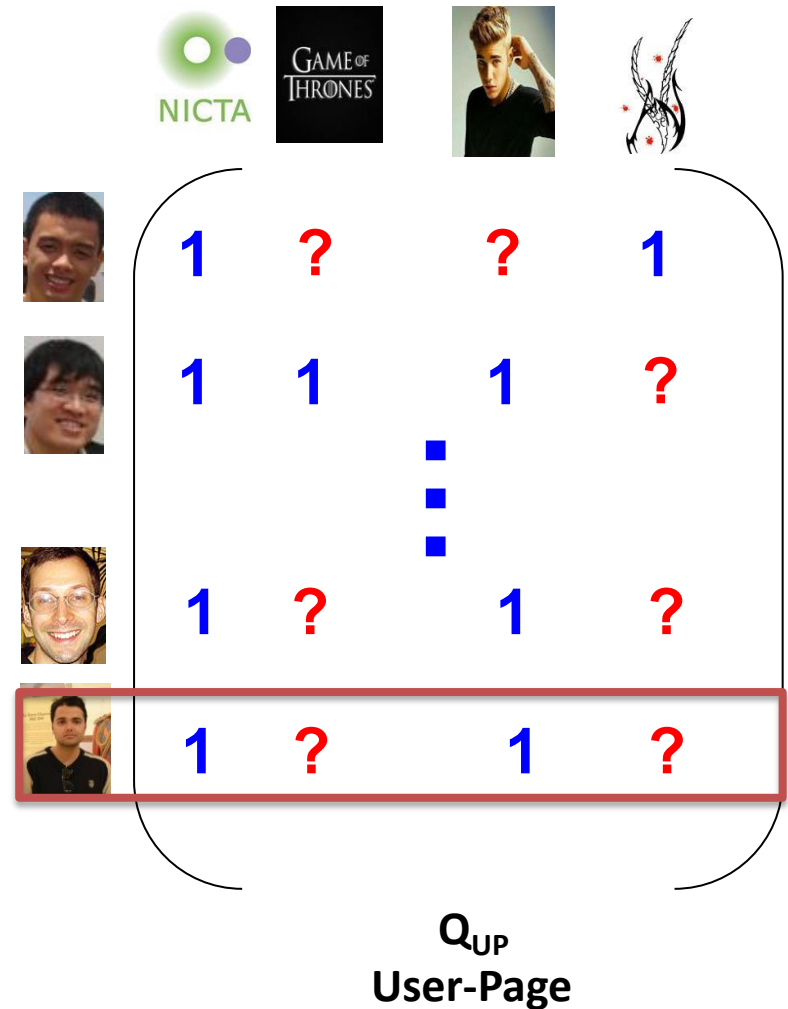# Cold-start Recommendation
with Implicit Feedback (RecSys-14)

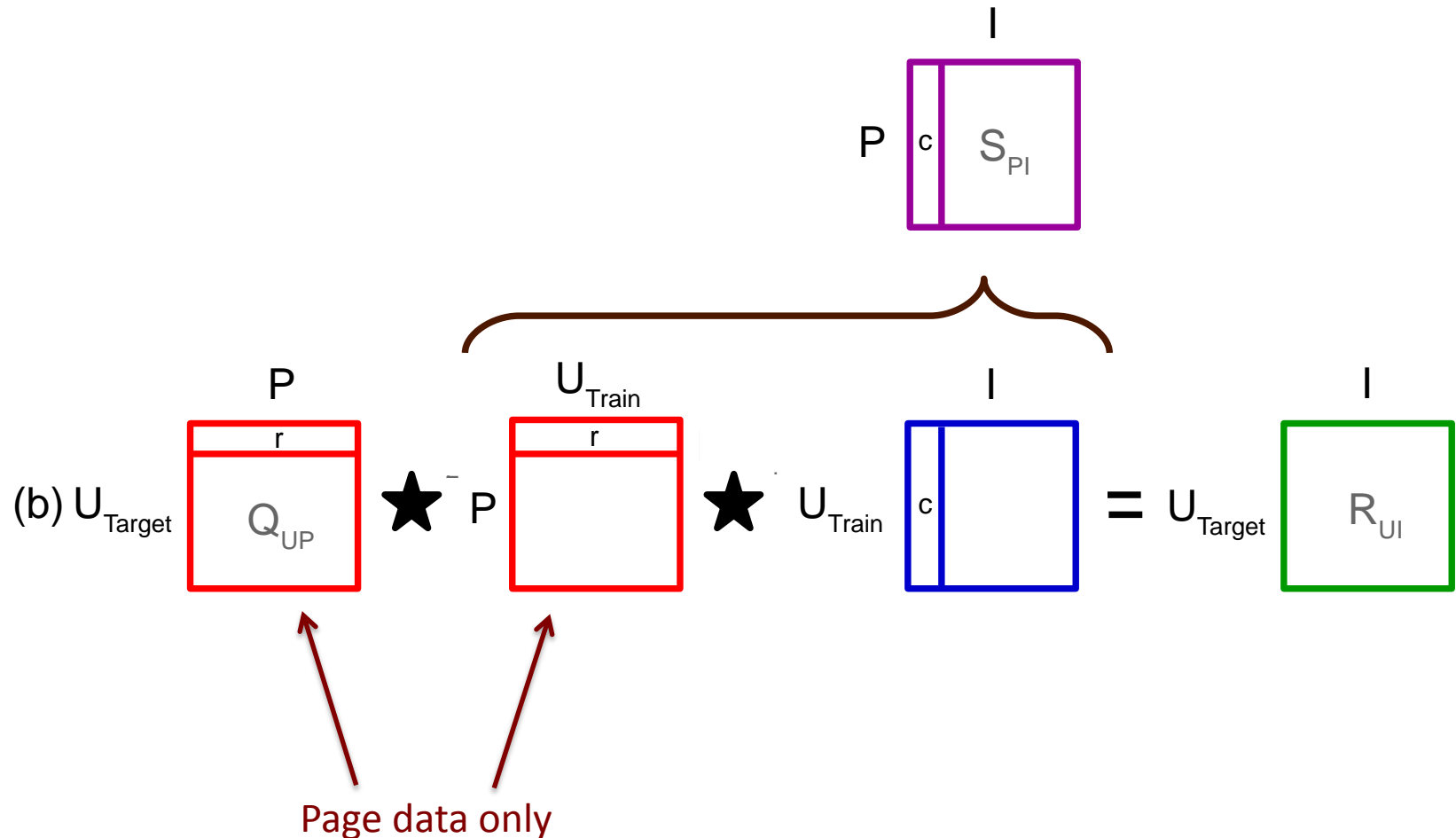# Solution to Implicit Feedback: Weighted Nearest Neighbor

Allow Jaccard, Cos, in place of inner product

Note: **not** renormalized by $\sum_j s_{ij}$ like Bell-Koren, why?

$$Score(u,i) = \sum_j s_{ij} \times purchased(u,j)$$

Resolves implicit feedback, but not cold-start

Solution to Cold-start: Leverage Social Info

$$Q_{UI}$$
User-Item

$$Q_{UP}$$
User-Page

Social Cold-start Recommendation

Experiment

| k	Most Popular		Demographics		Friend Network		Page Likes	
	Precision	Recall	Precision	Recall	Precision	Recall	Precision	Recall
@1	0.006+/-0.003	0.006+/-0.003	0.014+/-0.004	0.014+/-0.004	0.014+/-0.006	0.014+/-0.006	**0.038+/-0.015**	**0.038+/-0.015**
@3	0.008+/-0.003	0.023+/-0.010	0.010+/-0.003	0.031+/-0.008	0.011+/-0.004	0.032+/-0.012	**0.025+/-0.010**	**0.076+/-0.029**
@5	0.008+/-0.004	0.039+/-0.019	0.010+/-0.004	0.050+/-0.018	0.009+/-0.003	0.044+/-0.016	**0.023+/-0.009**	**0.117+/-0.044**
@10	0.007+/-0.003	0.074+/-0.034	0.008+/-0.003	0.083+/-0.029	0.006+/-0.002	0.062+/-0.022	**0.017+/-0.006**	**0.173+/-0.059**
@20	0.006+/-0.003	0.120+/-0.067	0.006+/-0.003	0.125+/-0.051	0.004+/-0.001	0.078+/-0.025	**0.010+/-0.003**	**0.205+/-0.063**
mAP	0.026+/-0.011		0.035+/-0.010		0.029+/-0.010		**0.075+/-0.025**	

Table 1: Comparison of Most Popular baseline with various cold-start recommender systems.
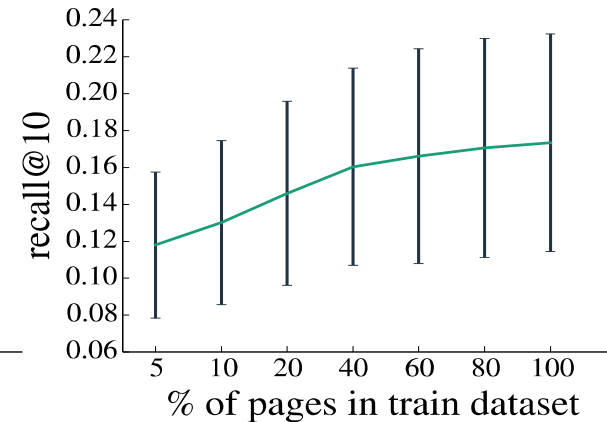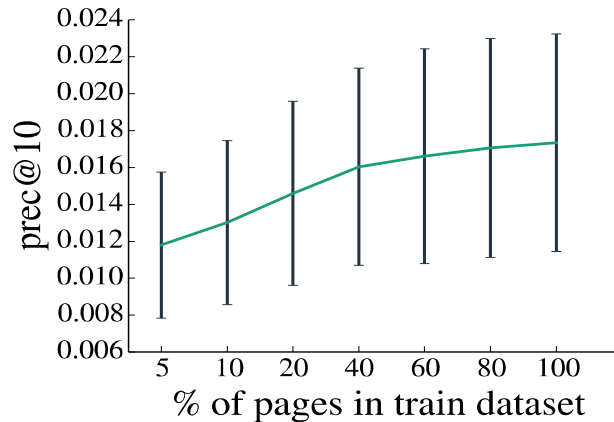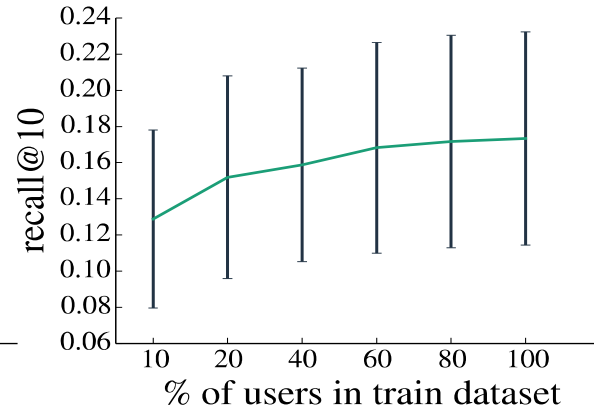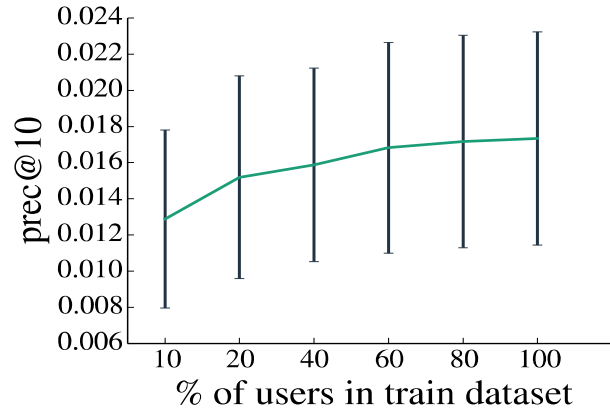Demographics: age group , gender, location

~300% improvement vs. best of alternatives!

Critical detail: omit free books!

Analysis(1): # Page likes and performance
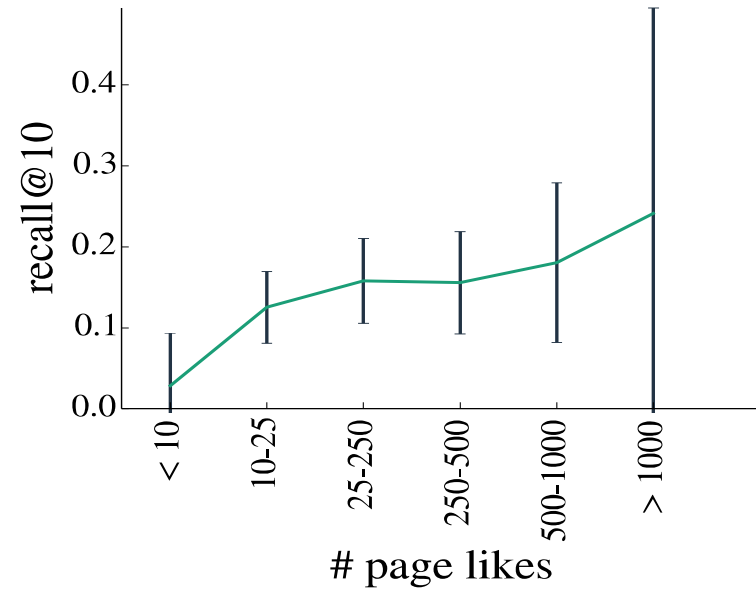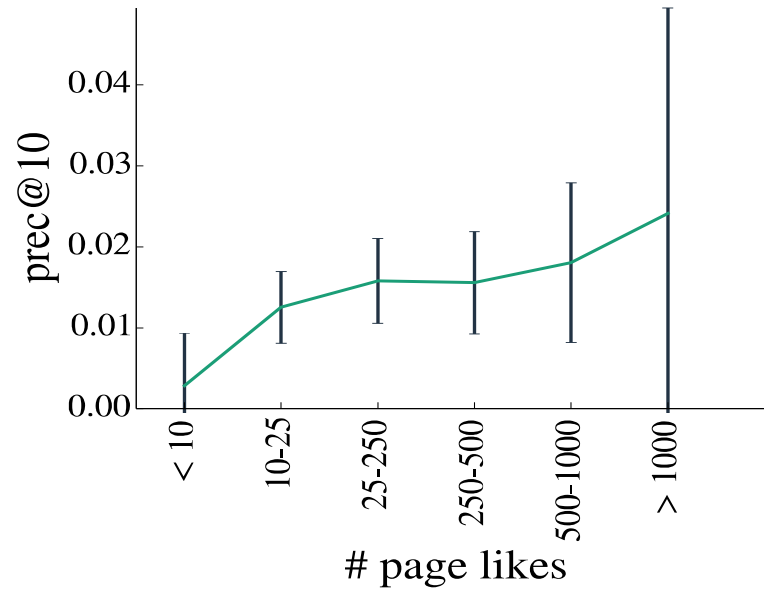
Analysis(2): How many users/pages are sufficient?

Summary and Future Directions

- **All Interactions and activities not equally predictive** (COSN 2013)
  - Page likes are quite powerful (fine-grained, not limited to friends)
  - Considered less invasive by users than personal interactions

- **Can extend to implicit, cold-start recommendation** (RecSys 2014)
  - 300% improvement in cold-start recommendation for Kobo

- **Work still in progress on *learning* to weight pages**
  - Subsampling unobserved entries as negative feedback does not work

- **Temporal relevance also an important extension**
  - For e-books, use only recent purchases
  - What about page likes?