

Fairness-Aware Recommendation of Information Curators

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Two stories in one:

1. Curator recommendation
 - A problem our lab is excited about
2. Fairness-aware recommendation in the context of multi-aspect datasets (modeled as a tensor)
 - Related paper in CIKM 2018 next month in Italy
 - “Fairness-Aware Tensor-Based Recommendation,” by Zhu et al.

Information Curators

Best Dessert Recipes

Collection by Nell | Rhythms of Play

This board is for all kinds of desserts and other sweet treats to eat. From cakes to cupcakes, cookies to bars, pies to pudding you can find it all here!

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Chocolate Cups with Nutel...

Cocoa (Chocolate)

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Best Skillet Recipes >



Chocolate Mousse Recipe

Chocolate

Chocolate desserts

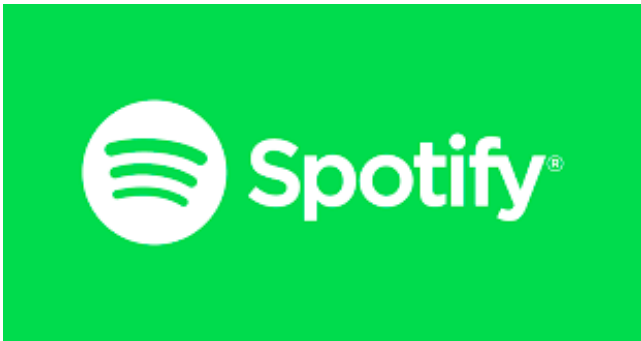
Best >



Fresh Blackberry Mini Pies

Mini Pie Recipes

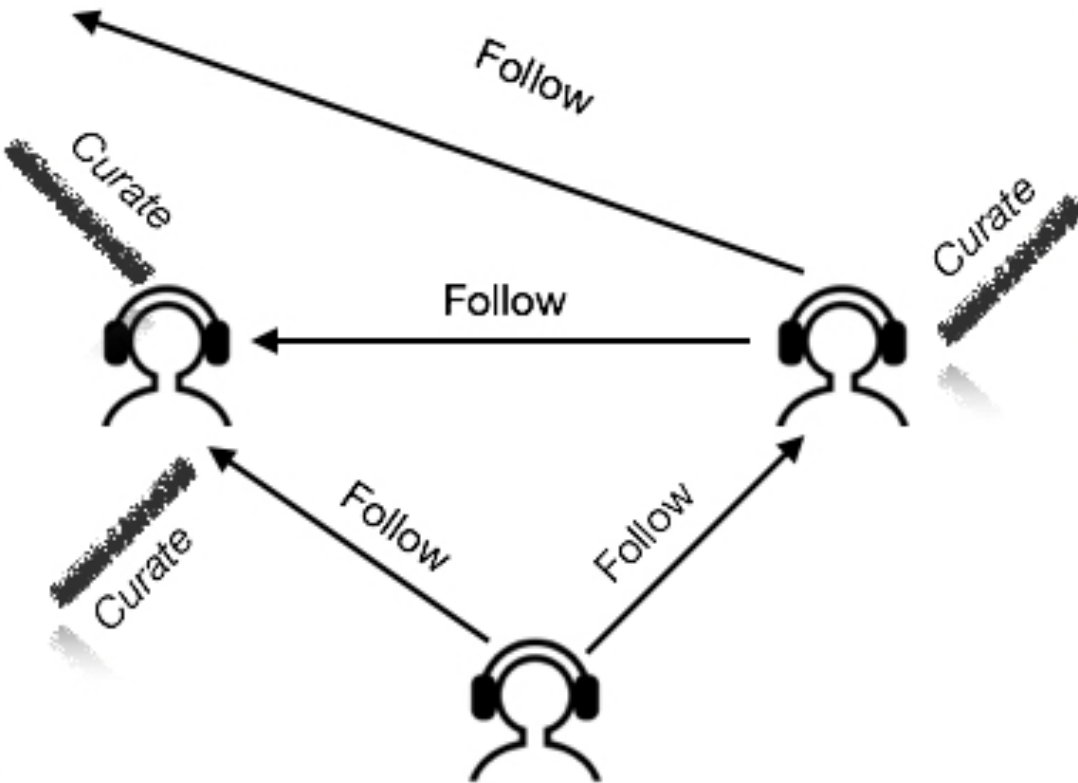
Best Dessert Recipes >



Coffee Time	
▶	1:21
▶	5:47
⋮	
▶	3:32
▶	4:28

HipHop	
▶	4:21
▶	2:51
⋮	
▶	3:45
▶	4:33

RunRunRun	
▶	3:11
▶	4:45
⋮	
▶	2:46
▶	3:11
▶	5:45



Information curators serve as conduits to high-quality curated content, providing unique specialized expertise, trustworthiness in decision-making, and access to novel content.

≠ friend recommendation

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Photo: Rozette Rago

Baby & Kid › Toys

The Best Kids Scooters

PUBLISHED SEPTEMBER 27, 2018

Our pick for toddlers: Micro Mini Deluxe

Also great: Razor A3



Photo: Rozette Rago

The competition

We decided not to test the [Micro Mini Original](#) because it costs almost as much as the Deluxe version, our pick for toddlers, but the non-adjustable handlebar makes it usable for a shorter period of time.

Smaller, 98 mm wheels and crappier bearings make the less expensive [Razor A](#) and [Razor A2](#) scooters a rougher ride and harder to learn on than our picks, the Razor A3 or Micro Maxi. Small wheels meant bumps in the sidewalk would send riders flying. The Razor A also lacks a wheelie bar.

The [Razor Jr. Lil' Kick](#) feels like a toy instead of a useful vehicle. While the deck is nice and as wide as the Micro Mini's, the Lil' Kick somehow felt less stable than the Micro scooters while also being slow and clunky. The scooter has three wheels but in a more traditional design, with one in the front and two in the back, and is the only scooter we tested that lacks an adjustable handlebar.

The [Den Haven's](#) materials feel cheap, and it's less steady and harder to turn than the Micro scooters. The plastic wheels and deck make more noise than those on the Maxi and Mini, especially when rolling over pavement, and the wheels are also narrower, resulting in a bumpier ride. Reviewers on Amazon note that the scooter frequently broke, especially the rear fender brakes. "I bought this for my youngest son thinking I found a great buy, it cracked only after 2 weeks," [writes](#) a reviewer.

The [Globber Primo](#) has some attractive features, like an adjustable handlebar and a steering lock mechanism that makes the scooter travel straight. It seems



Photo: Rozette Rago

Our pick



Also great



Noah Smith

Bloomberg Opinion Columnist

Noah Smith is a Bloomberg Opinion columnist. He was an assistant professor of finance at Stony Brook University, and he blogs at Noahpinion.

[@Noahpinion](#)

[RSS Feed](#)



Economics

Let Immigrants Save America's Struggling Cities

U.S. companies can sponsor foreign workers. Why not down-and-out cities and towns?

October 3, 2018, 9:00 AM PDT

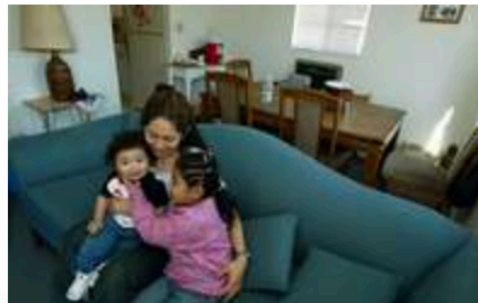


Economics

Monopolists Hit a Wall in Local Markets

As industries grow more concentrated nationwide, the opposite is happening in towns and cities.

October 2, 2018, 6:00 AM PDT



Economics

Earned Income Tax Credit Is a Cheap Way to Beat Poverty

The earned income tax credit is highly effective and should be expanded.

October 1, 2018, 6:00 AM PDT



Noah Smith ✓

@Noahpinion

Follow



The Dark Forest was a very good book, but the resolution had me thinking: "Guys, it's time for some game theory."

9:29 AM - 19 May 2017



Noah Smith ✓

@Noahpinion

Follow



I finally found good ramen in America! Mensho, in San Francisco, is great. Has both traditional and original/modern styles.

mensho.tokyo



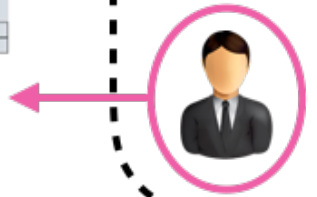
Online Web Content Consumers and Curators

Profile cards for user 'xxx xxx' showing various content types: text, image, and video. A metadata box lists: Age, Type, Interest, Location, Preference.

Recommendation cards: 'Nice Accessories' (watch, bag, shoes) and 'Must Go' (restaurant, cafe, bar).

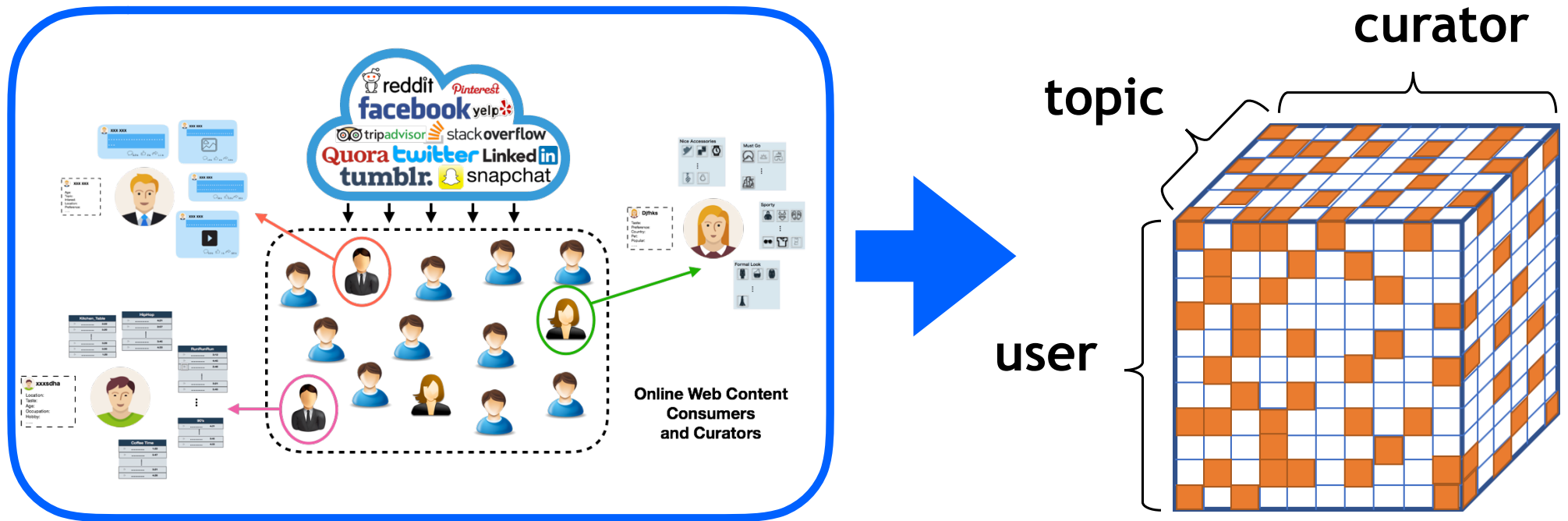
Profile card for user 'Djfhks' with metadata: Taste, Preference, Country, Pet, Popular. Recommendation cards: 'Sporty' (hat, shirt, shoes) and 'Formal Look' (hat, shirt, shoes).

Profile card for user 'xxsdha' with metadata: Location, Taste, Age, Occupation, Hobby. Recommendation cards: 'Kitchen Table', 'HipHop', 'RunRunRun', and 'Coffee Time'.

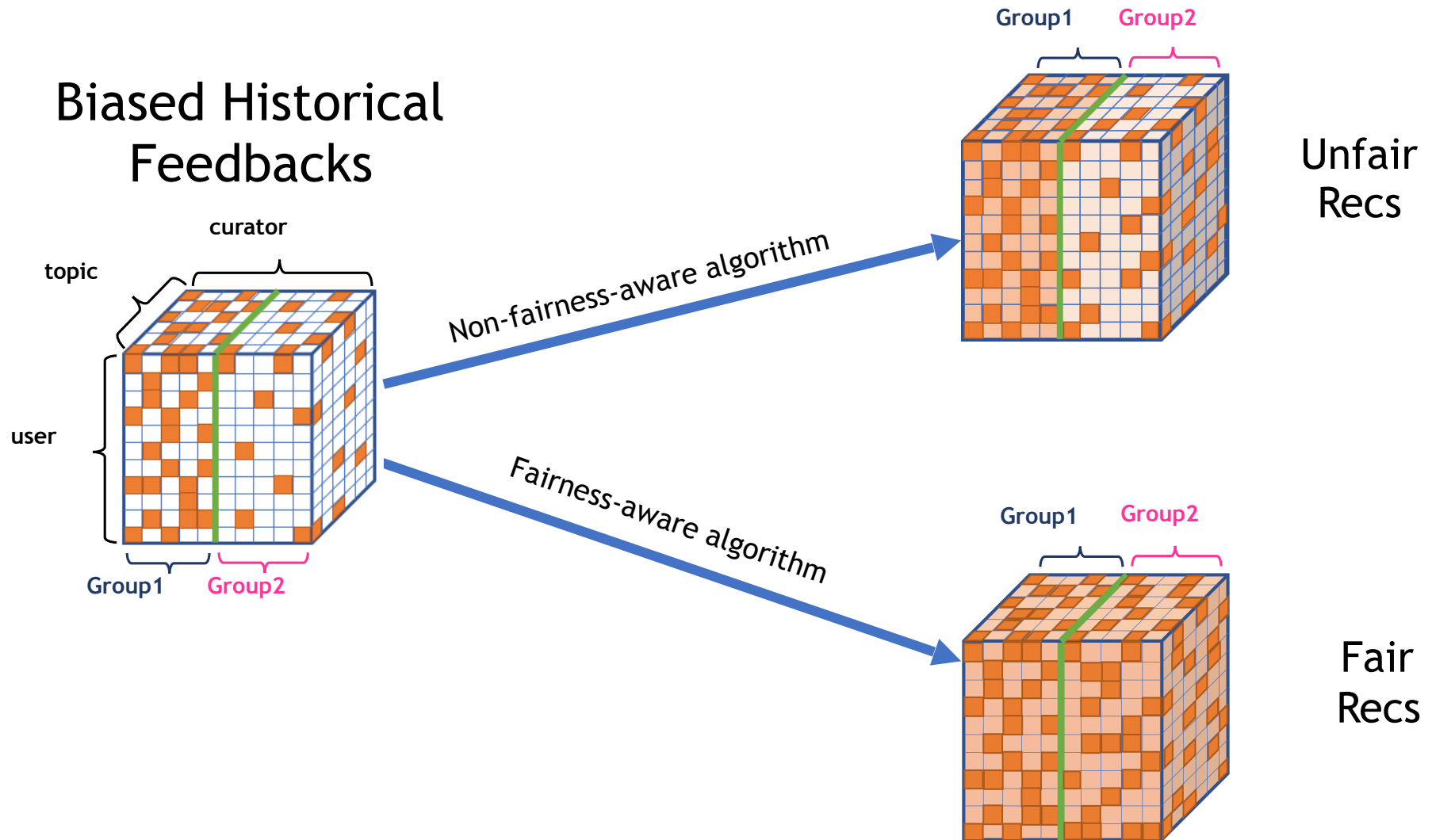


Recommendation?

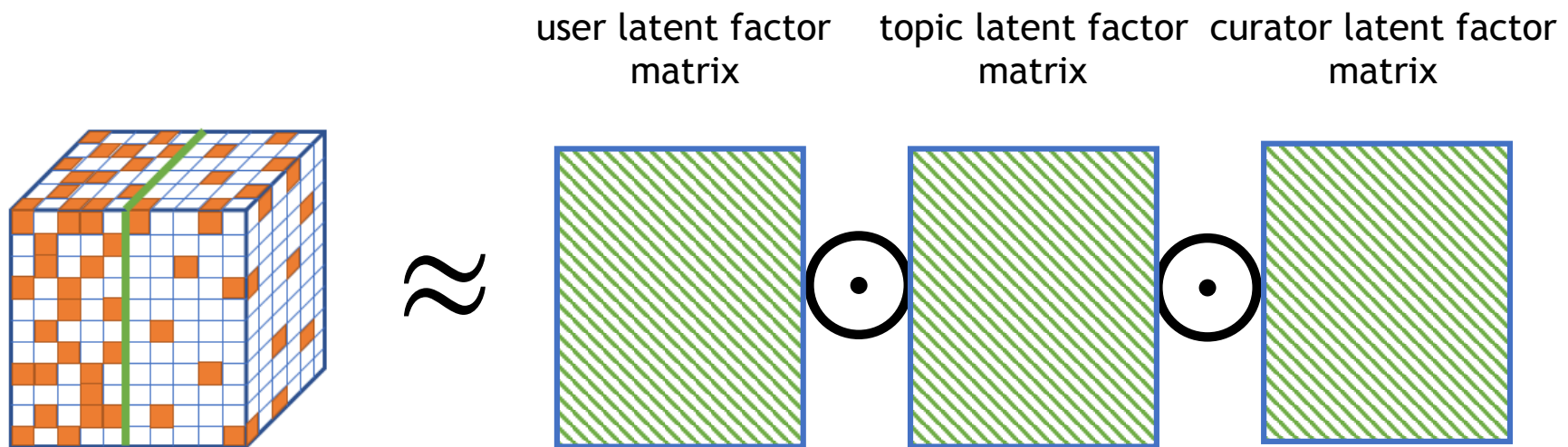
Model Curators in a Tensor



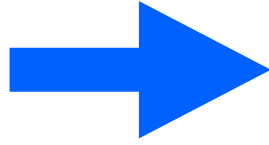
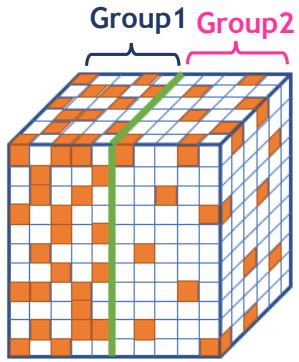
Fairness-aware vs. Non-fairness-aware Recommendation



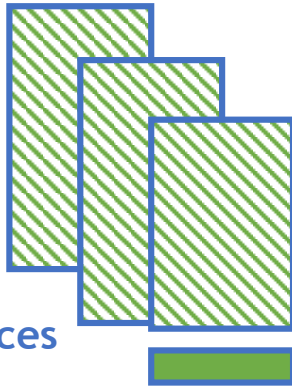
Conventional Tensor Factorization



Biased Historical Feedbacks

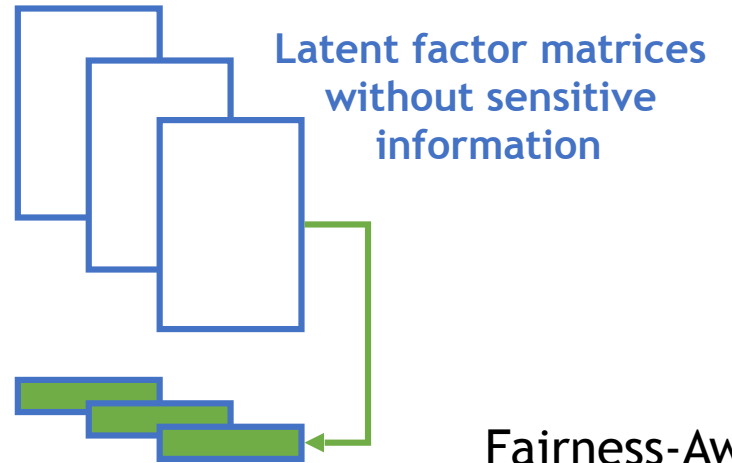


Isolate Sensitive features



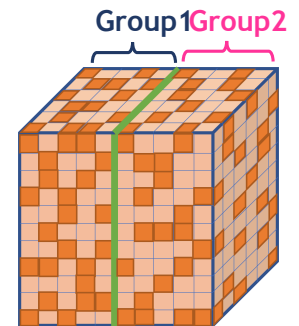
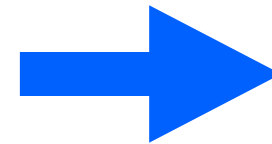
Latent factor matrices
with sensitive
information

Extract Sensitive information

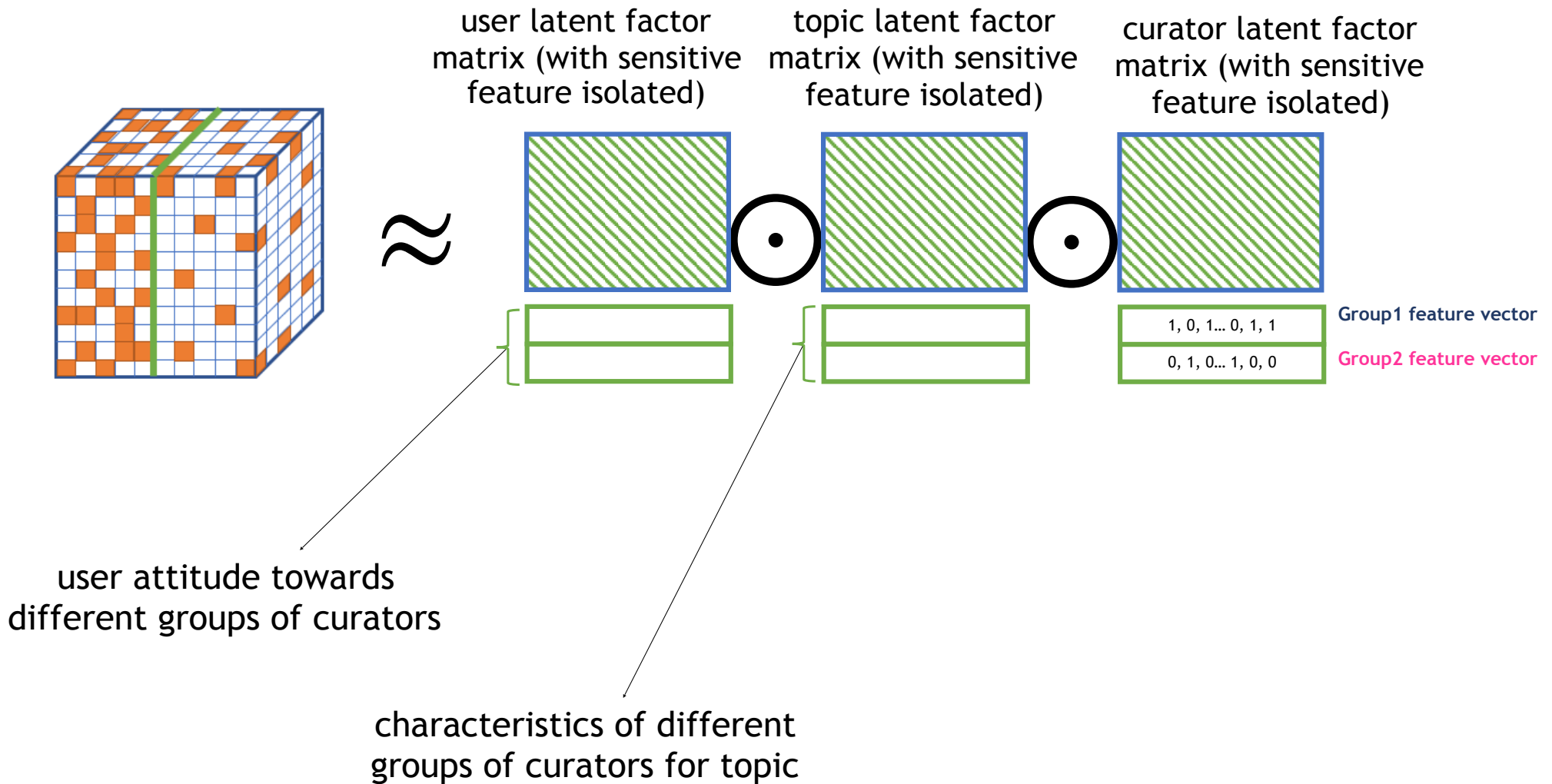


Latent factor matrices
without sensitive
information

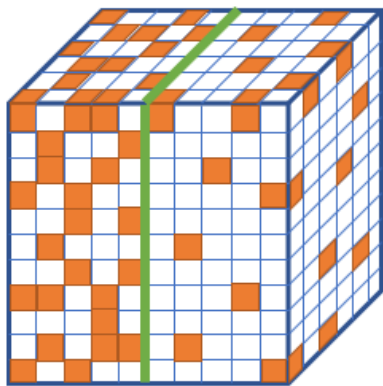
Fairness-Aware Recommendation



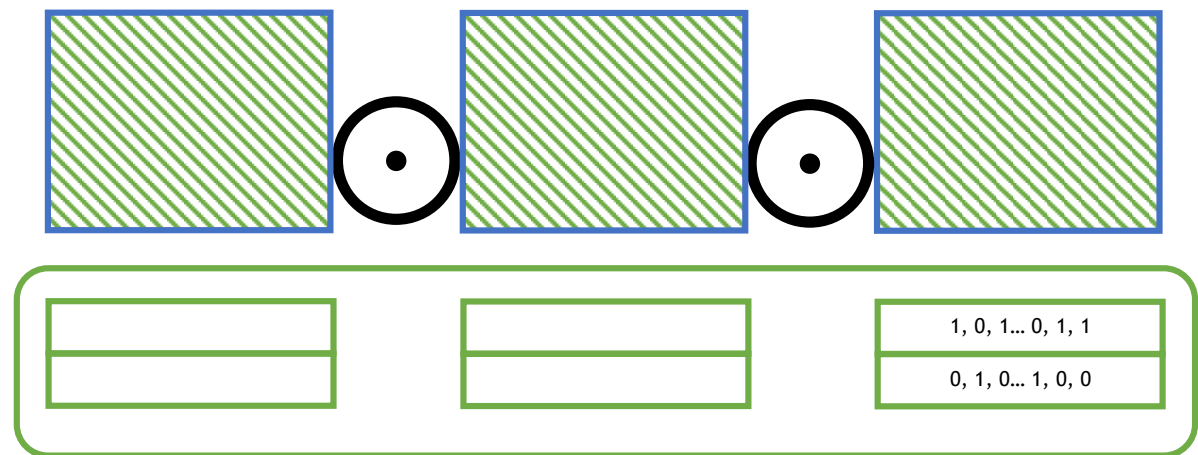
Sensitive Feature Isolation



Sensitive Feature Isolation



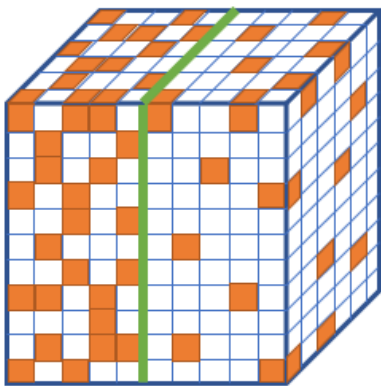
\approx



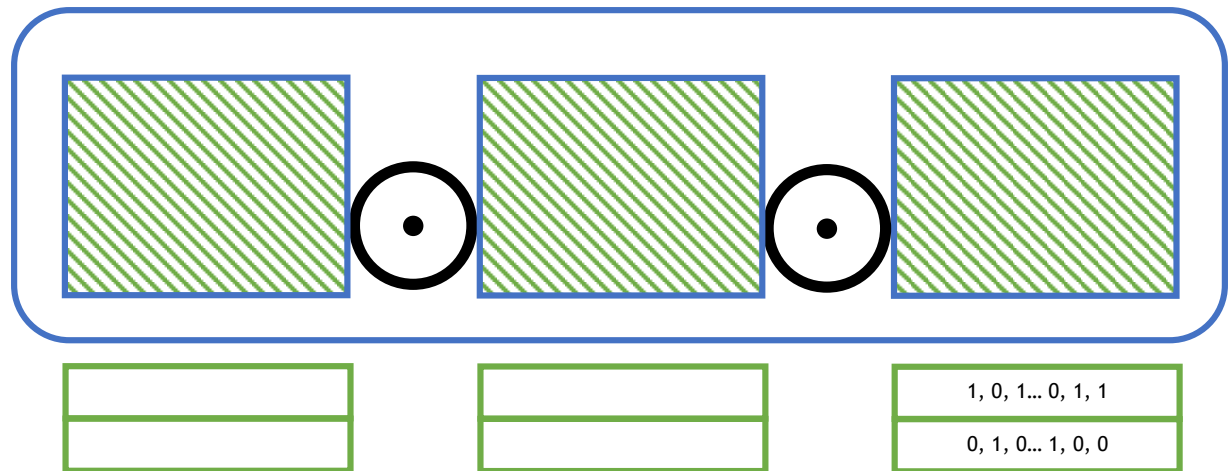
Sensitive Dimensions

Sensitive Feature Isolation

Non-sensitive Dimensions

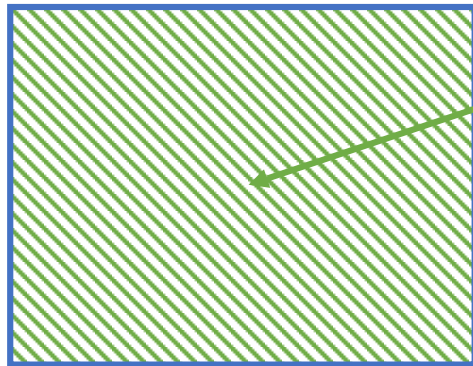


\approx



Sensitive Information Extraction

curator latent factor matrix (with sensitive feature isolated)



Residual sensitive information residing in non-sensitive dimensions

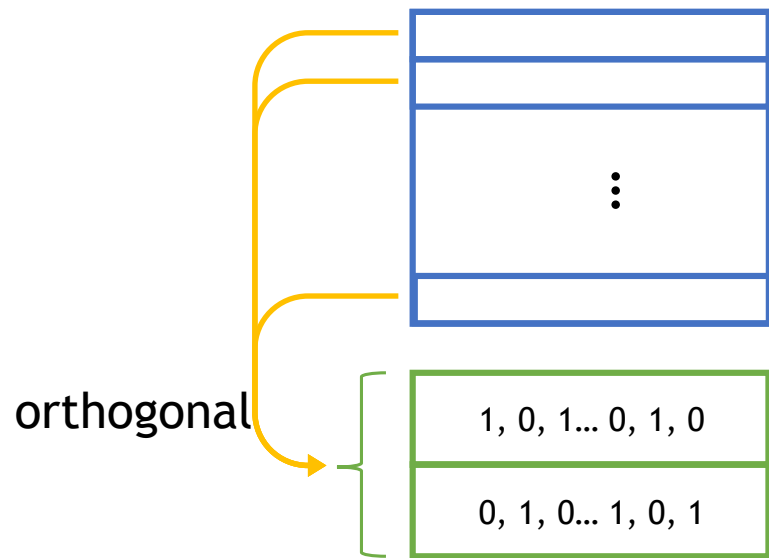
1, 0, 1... 0, 1, 1
0, 1, 0... 1, 0, 0

Group1 feature vector

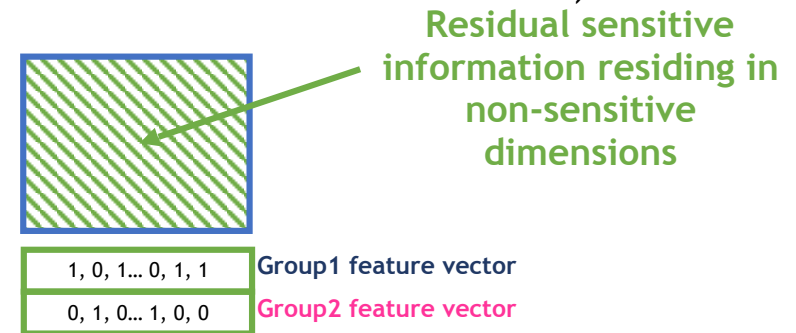
Group2 feature vector

Sensitive Information Extraction

curator latent factor matrix (with sensitive information extracted)

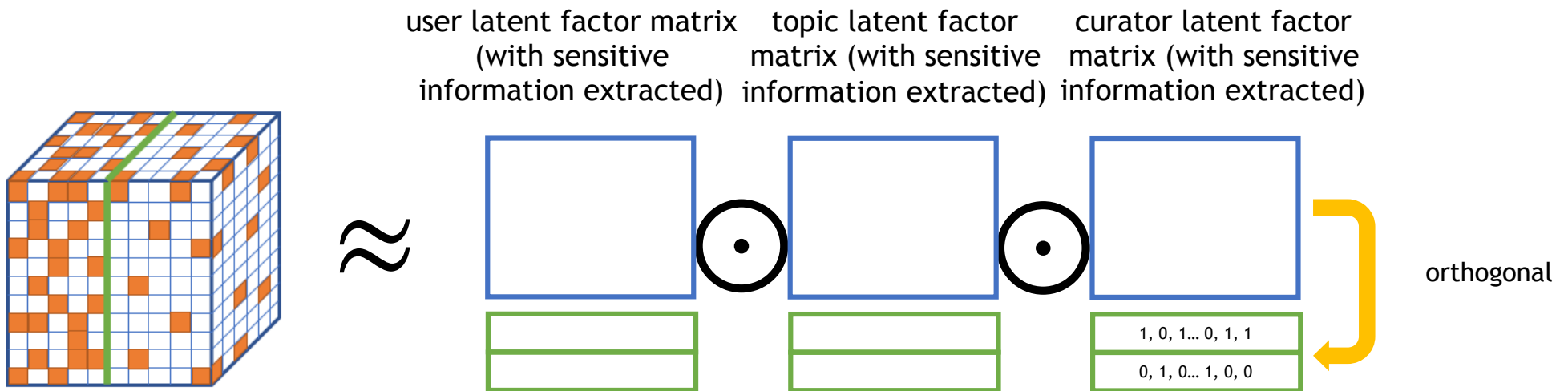


curator latent factor matrix (with sensitive feature isolated)

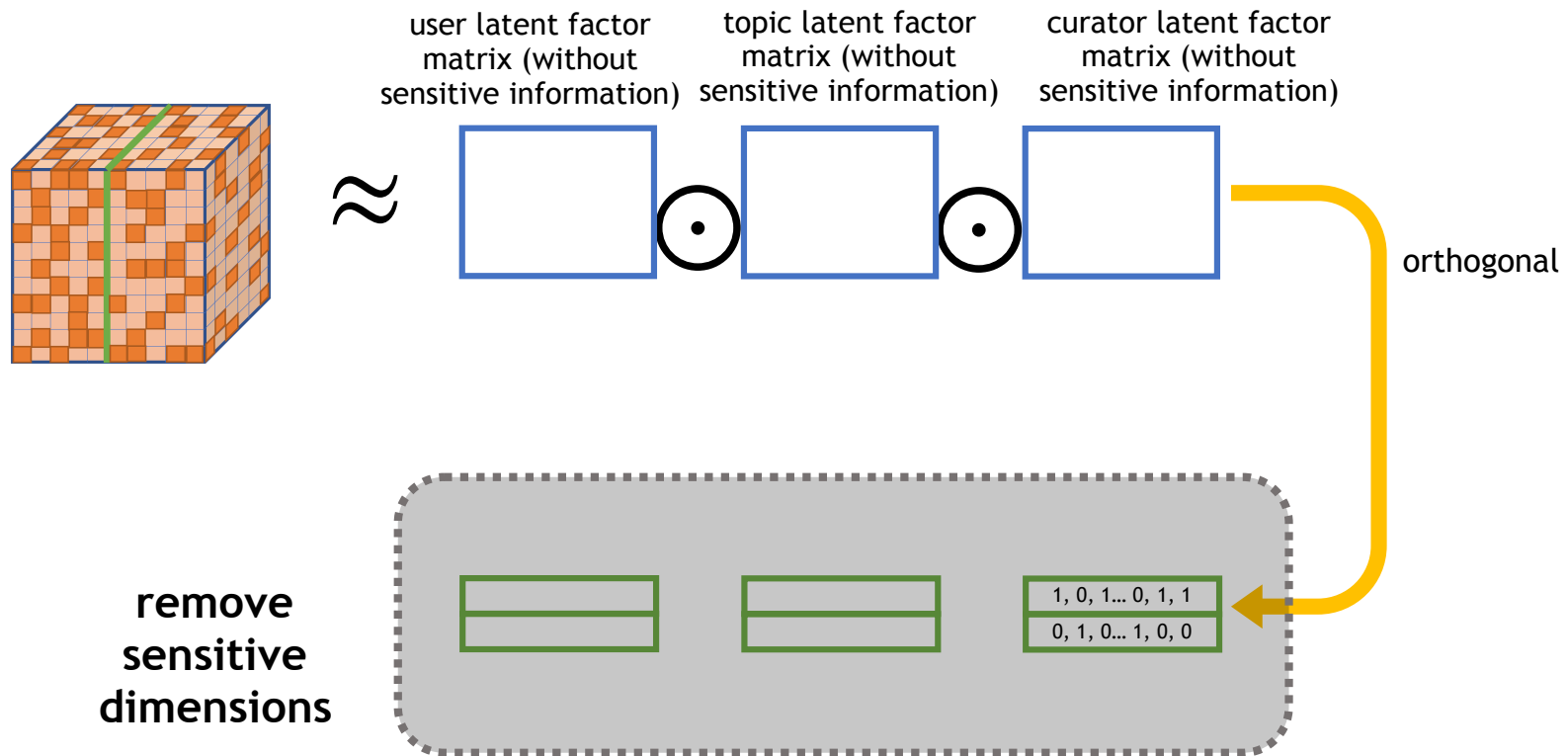


Sensitive Information Extraction

Goal: All sensitive information is extracted in sensitive dimensions.

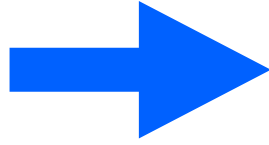
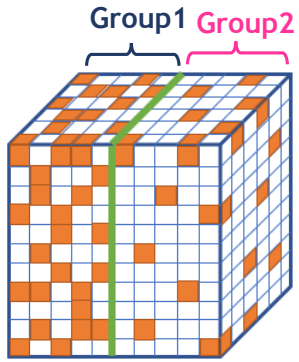


Finally: Remove the sensitive dimensions!

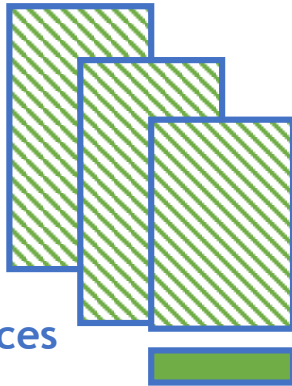


As a result: Fairness-aware recommendation based only on non-sensitive dimensions.

Biased Historical Feedbacks

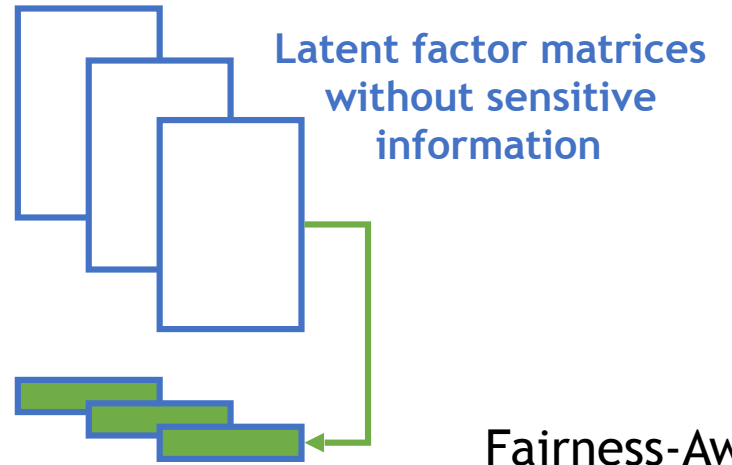


Isolate Sensitive features



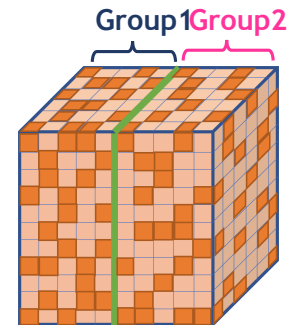
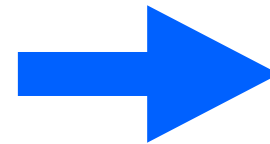
Latent factor matrices
with sensitive
information

Extract Sensitive information



Latent factor matrices
without sensitive
information

Fairness-Aware Recommendation



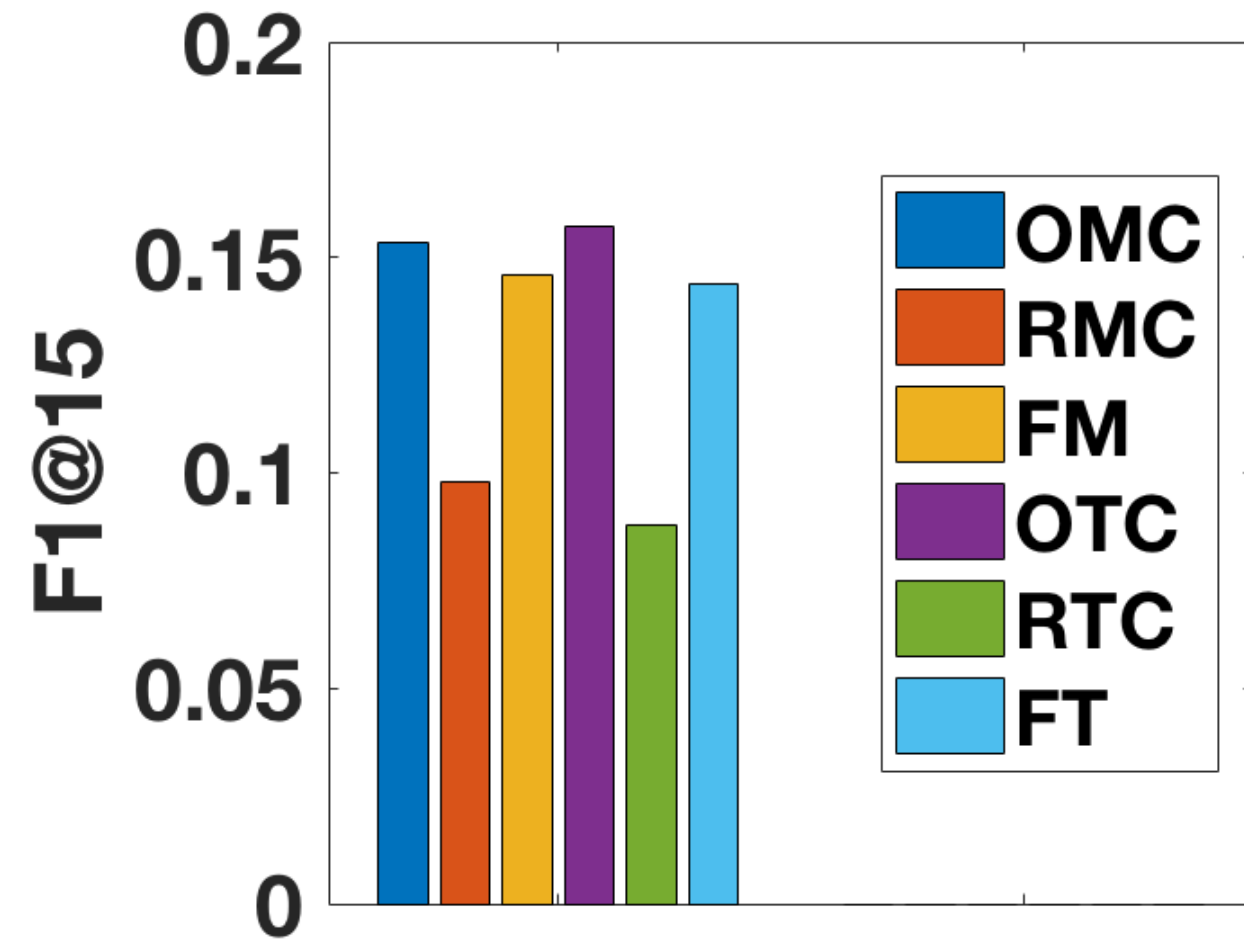
Experiments: Setup

- Approaches:
 - Ordinary Tensor Completion (OTC)
 - Regularization-Based Tensor Completion (RTC)
 - (variation of Kamishima et al.'s matrix-based approach)
 - Fairness-Aware Tensor Completion (FT, our method)
 - as well as matrix-versions of each (OMC, RMC, FM)
- Metrics:
 - Quality: Precision@k, Recall@k, and F1@k
 - Fairness:
 - Kolmogorov-Smirnov statistic to test for the equality of two distributions
 - Absolute difference between the mean ratings of different groups (MAD)

Experiments: Data

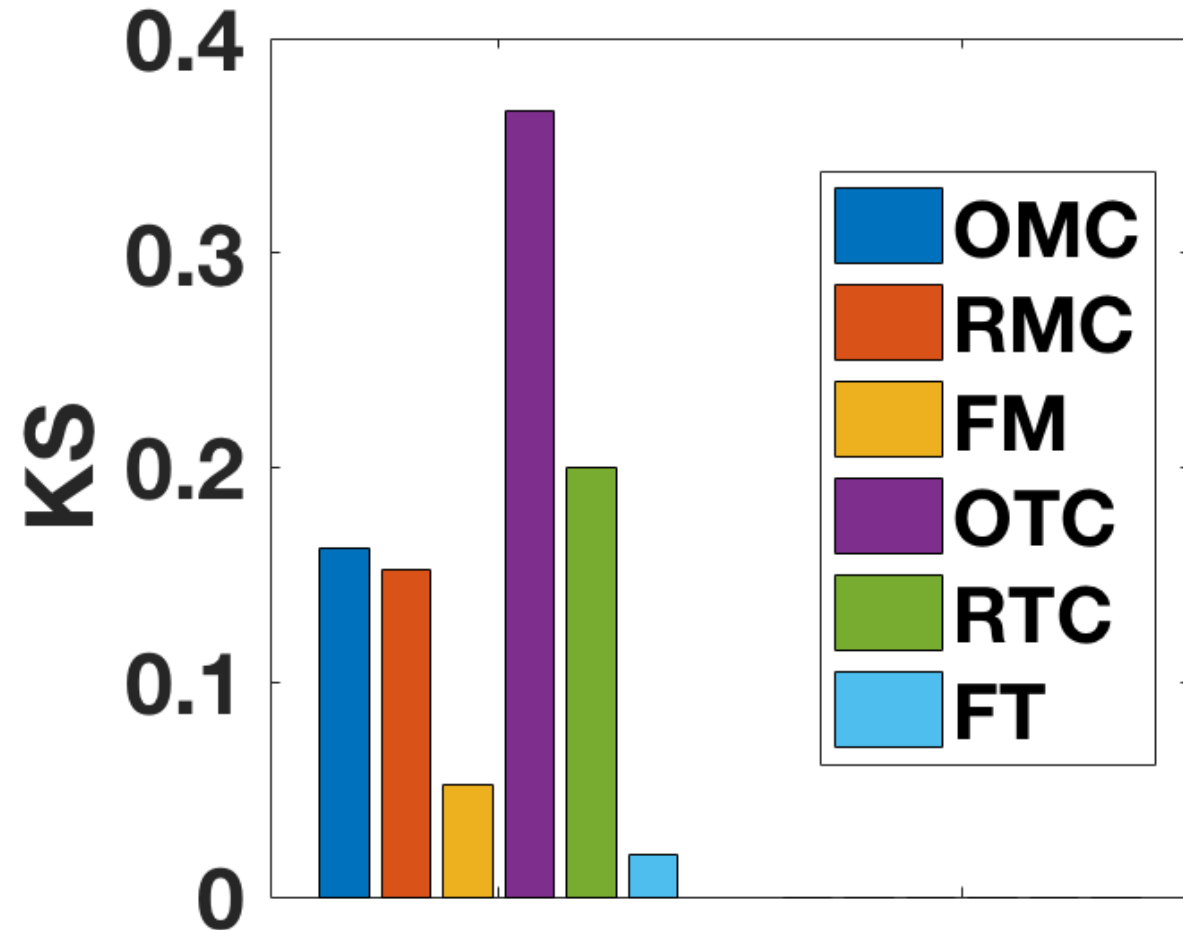
- Data: Twitter “expert” dataset
 - 589 users
 - 252 experts (curators)
 - 10 topics
- Sensitive attribute:
 - Race (using the Face++ API on user images)

Results: Recommendation Quality



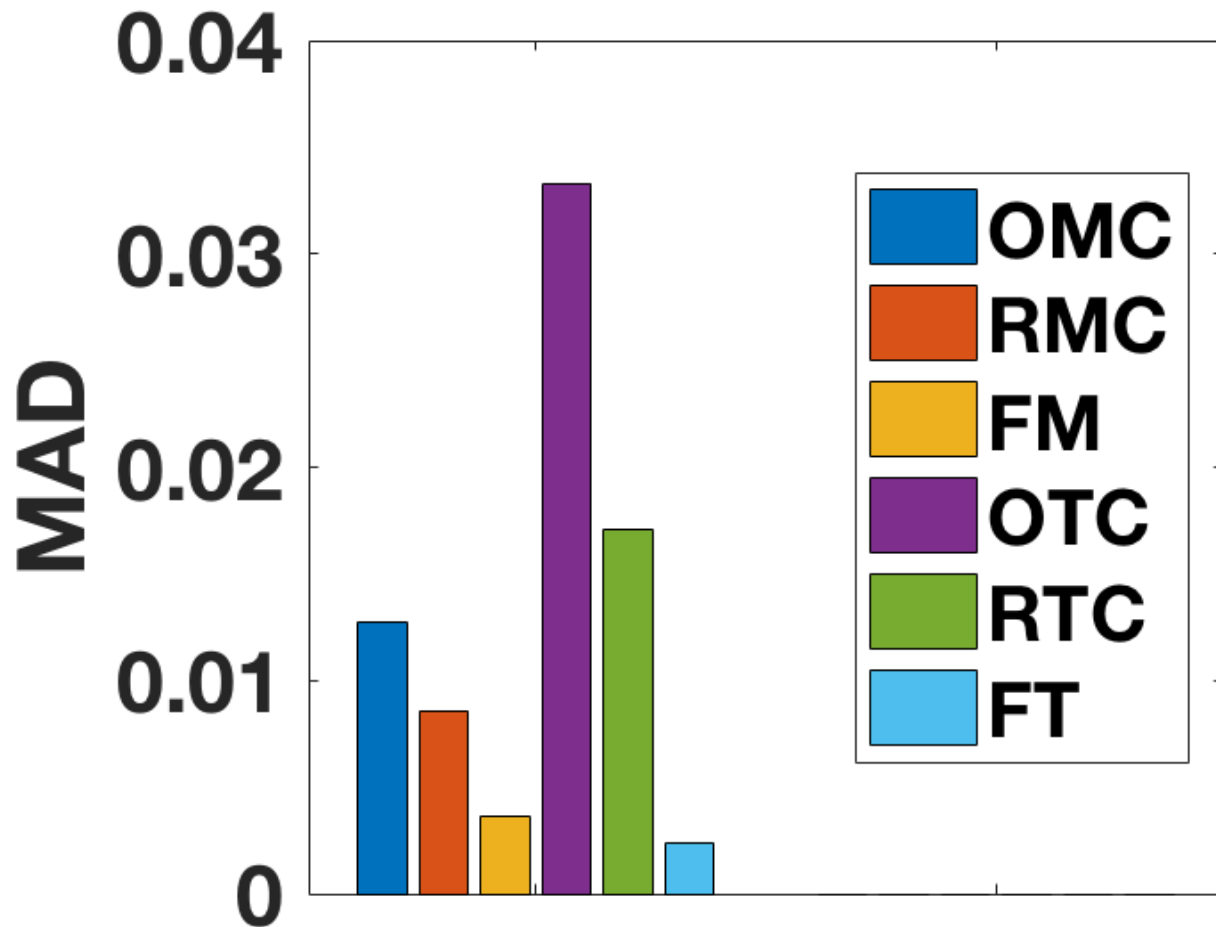
- Regularization-based approaches (RMC, RTC) add fairness but lose recommendation quality
- Our approach (FT, FM) performs about the same as non-fair OTC
- (good news: on other datasets, similar results!)

Results: Fairness (KS)



- Our approach (FT, FM) yields the most similar distributions (lowest KS = most “fair”)
- Non-fair methods (OMC, OTC) suffer here
- Regularization-based approach (RTC) performs pretty well (but at cost of sacrificing quality)

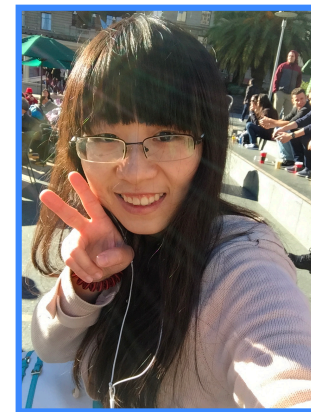
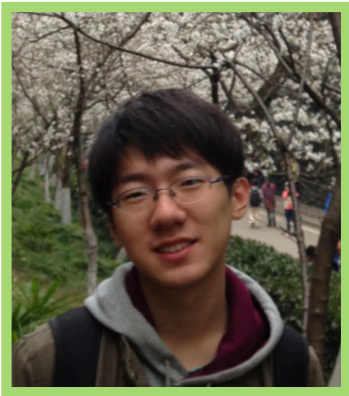
Results: Fairness (MAD)



- Similar results as we saw with KS!

Next steps

- **Domain:** Curators —> other domains (ongoing work), richer models of curators, ...
- **Method:** Fairness-Aware Tensor Recommendation
 - Statistical parity: overly strict and not necessarily aligned with what we would expect of a fair recommender —> Exploring how we define recommendation fairness (lots of related work in the classification literature + a growing rec literature)
 - “Quality” vs “Fairness” is not quite the right way to think about it
 - Tensors offer lots of advantages, but could be limiting in how we view the problem
 - Exploring neural architectures (of course), adversarial models, ...



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