the science behind Netflix recommendations

agenda

1. an introduction to recommendation engines (three types!)

2. how does Netflix make recommendations?

3. how can we code a recommendation engine?

part 1: an introduction to recommendation engines

types of recommendation engines, and **why**???

- why do we need recommendation engines + what are some examples?

- three main types of recommendation engines:
  a. non-personalized
  b. content-based
  c. collaborative filtering

non-personalized recommendation engines

content-based recommendation engines

- makes recommendations based on an item's **features**

movies	Genre	Actor	Director	Year	IMDB	Rotten Tomatoes	...
1							
2							
3							
4							
5							
...							

content-based recommendation engines

- what are some pros and some pitfalls of content-based recommendations?

Chinese Money Plant - Pass It On Plant - UFO Plant - Pilea peperomioides -4" Pot
★★★★☆ 184
$8.61

Dolphin Plant - Senecio Peregrinus - Extremely Rare - Live Plant Rooted in 2.5X 3.5 inch Pot - Dolphin Necklace
★★★★★ 1
$55.00

8 Hardy Succulent Variety Pack | 2" | Hens & Chicks | Chick Charms | Fairy Garden | Live Plants
1 offer from $15.99

Chinese Money Plant - Pass It On Plant -Pilea peperomioides-3" Clay Pot/Saucer
★★★★☆ 10
$9.99

Shop Succulents Crassula Ovata 'Jade' 2In Plant Kit
★★★★☆ 2
$14.99 ✓prime

Succulent 3-Pack/2.0" Pot/Live Home and Garden Plants/Free Care Guide
★★★★☆ 1
$9.99

collaborative filtering

- recommends items **based on ratings of other users**

- different ways to do collaborative filtering:
    - model-based: Singular Vector Decomposition (SVD)

collaborative filtering -- the **utility matrix**

- a utility matrix shows user ratings of different items

- the idea is to fill in the blanks

	Movie 1	Movie 2	Movie ...	Movie N
User 1	1	BLANK	BLANK	3
User 2	BLANK	5	BLANK	3
User 3	BLANK	BLANK	1	BLANK
User 4	2	3	BLANK	BLANK
User 5	BLANK	BLANK	1	BLANK
User 6	4	BLANK	5	BLANK
User 7	BLANK	4	BLANK	BLANK
User ...	BLANK	3	BLANK	BLANK
User m	BLANK	BLANK	BLANK	4

	Movie 1	Movie 2	Movie ...	Movie N
User 1	1	4	2	3
User 2	1	5	3	3
User 3	2.5	2.8	1	3.5
User 4	2	3	2	3.5
User 5	2.5	2.8	1	3.1
User 6	4	1.2	5	1.4
User 7	1	4	2.5	3
User ...	2	3	2	3
User m	1	4	2	4

modified SVD for filling in utility matrices

	U1	U2	U3	U4
I1	4	2	3	5
I2	3	2	4	2
I3	?	4	5	4
I4	3	2	4	4

≈

I1	×	×
I2	×	×
I3	×	×
I4	×	×

·

U1	U2	U3	U4
×	×	×	×
×	×	×	×

collaborative filtering -- pros and cons

- personalized for each user!

- computationally heavy
- popularity bias
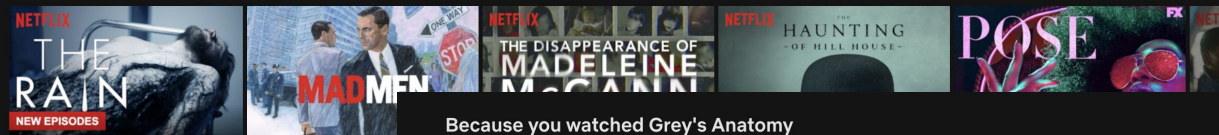- the **cold start** problem

part 2: how does Netflix make recommendations?
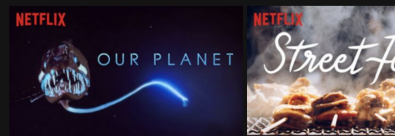
the Netflix algorithm

- Netflix uses a **hybrid** of content-based and collaborative filtering

- content based: tagging

- collaborative filtering: user patterns, user similarities

the Netflix algorithm

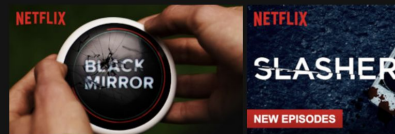# part 3: coding our own recommendation engine!

recommendation engines!!!

1. non-personalized
2. content-based
3. model-based collaborative filtering with SVD

code-along: https://github.com/yishuen/meetup-movie-recommender