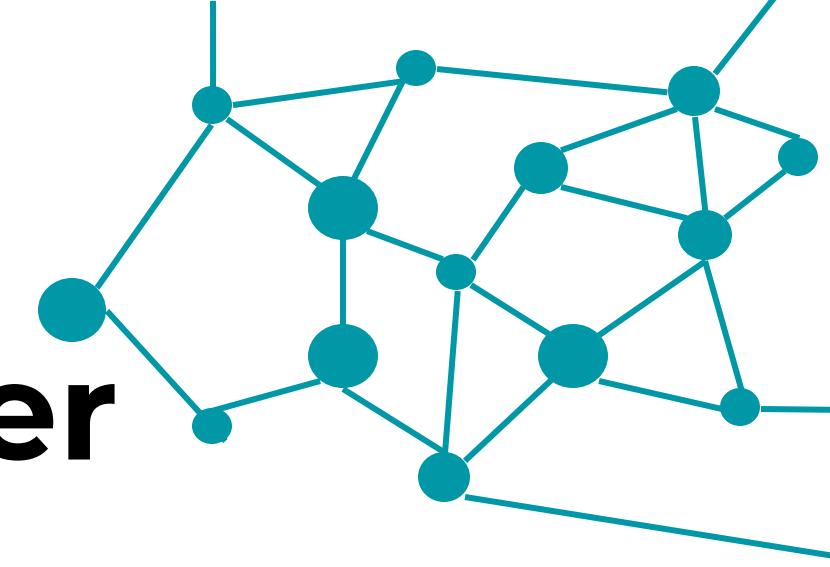
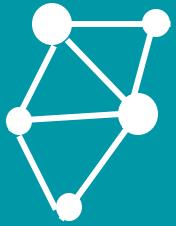


Intelligent User Interfaces

Recommender Systems

Jesse Grootjen, Thomas Weber, Xuedong Zhang





Recommender Systems



**Name a recommender system
you've interacted with last week**

Recommenders in the Wild

The Spotify interface displays several personalized playlists:

- Your Discover Weekly**: Your weekly mixtape of fresh music. Enjoy new discoveries and deep cu...
- Daily Mix 1**: Ty Segall, Jay Reatard, Elvis Costello & The Attractions and more
- Daily Mix 2**: David Garrett, Lindsey Stirling, Simply Three and more
- Daily Mix 3**: Zacari, Jay Rock, ScHoolboy Q and more

PLAYLIST • BY SPOTIFY

Customers Who Bought This Item Also Bought



The Netflix interface shows personalized recommendations:

- Recently Added**: An arrow points to the "ARQ" movie.
- Because you added To Kill a Mockingbird to your list**: An arrow points to the "GONE WITH THE WIND" movie.
- Because you watched Helmut Schmidt – Lebensfragen**: An arrow points to the "LA CONFIDENTIAL" movie.

How to make recommendations?

- Content-based
- Based on user preferences (collaborative filtering)
- Session-based
- Reinforcement learning

Collaborative Filtering

User Based

- Similarity between users
 - Based on how they've rated items
- Suggest items liked by similar users

Item Based

- Similarity between items
 - Similarity based on user ratings
- Suggest items similar to an item the user likes

Collaborative Filtering

Pros

- Does not need to know anything about the movie content (genre, etc.)
- Community contributes to recommendations

Cons

- Cold start for new users
- Cold start for new items

How to make a recommendation?

	Item A	Item B	Item C	Item D	Item E
User 1	1	3	3	5	5
User 2	5	5	3	4	3
User 3	3	3	4	4	?

How to make a recommendation?

	Item A	Item B	Item C	Item D	Item E
User 1	1	3	3	5	5
User 2	5	5	3	4	3
User 3	3	3	4	4	?

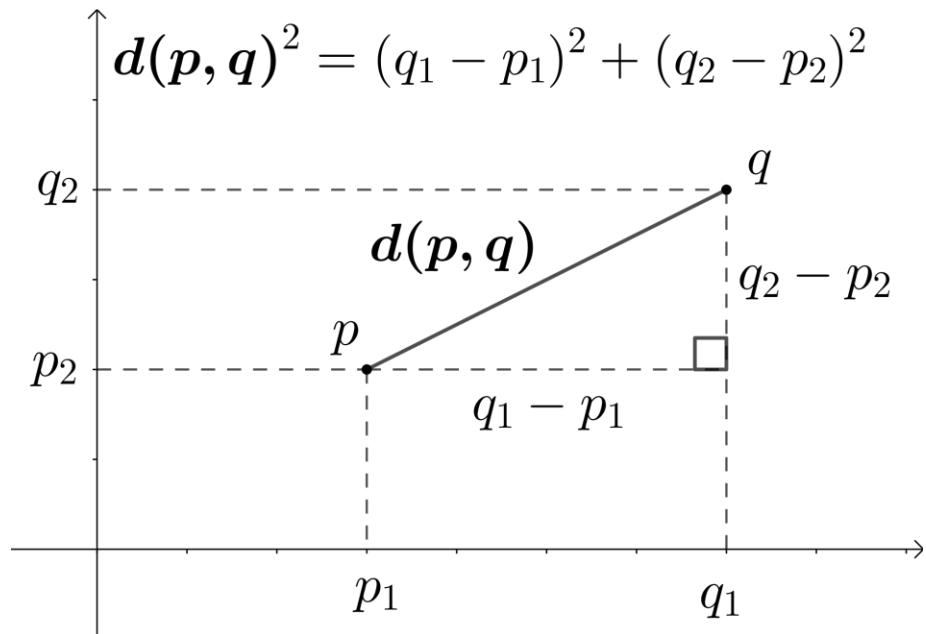
How to make a recommendation?

	Item A	Item B	Item C	Item D	Item E
User 1	1	3	3	5	5
User 2	5	5	3	4	3
User 3	3	3	4	4	?

How to calculate similarity?

Euclidean Distance

$$d(p, q) = |p - q|.$$

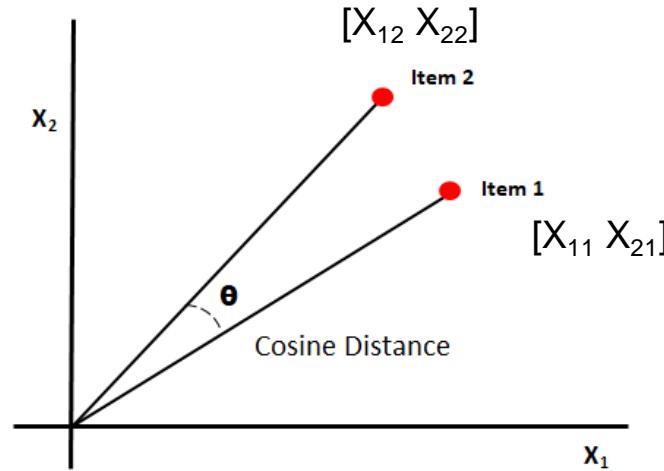


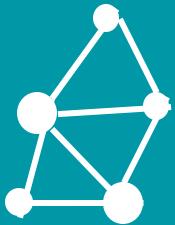
https://en.wikipedia.org/wiki/Euclidean_distance

How to calculate similarity?

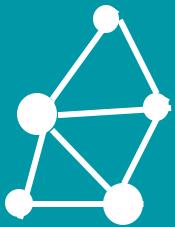
Cosine Similarity

$$\text{similarity}(A, B) = \frac{A \cdot B}{\|A\| \times \|B\|} = \frac{\sum_{i=1}^n A_i \times B_i}{\sqrt{\sum_{i=1}^n A_i^2} \times \sqrt{\sum_{i=1}^n B_i^2}}$$





Questions?



Live Coding