

Recommendation System

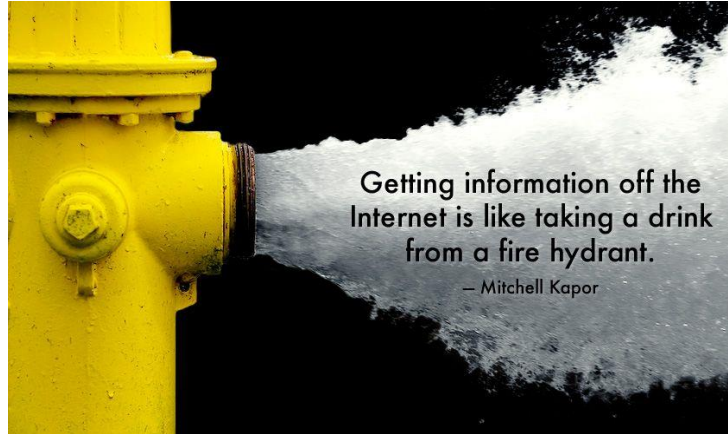
What is it?

- Recommendation System/Engine
 - Data filtering tools that make use of algorithms and data to recommend the most relevant items (product/movies/services/information etc.) to a particular user.



Why?

- We live in a world of information overload due to internet.



“Information overload occurs when the amount of input to a system exceeds its processing capacity. Decision makers have fairly limited cognitive processing capacity. Consequently, when information overload occurs, it is likely that a reduction in decision quality will occur.” – Gross (1964)

Why?

- Users expose to the whole digital world, their *experiences, behaviours, preferences* and *interests*.
- A recommendation engine provides an efficient way for companies to provide consumers with *personalised information and solutions*.

Netflix gets 16 million new sign-ups thanks to lockdown – BBC

Amazon and Netflix witnessed more than 60% growth in subscriber base during lockdown:
VelocityMR Study – Financial Express

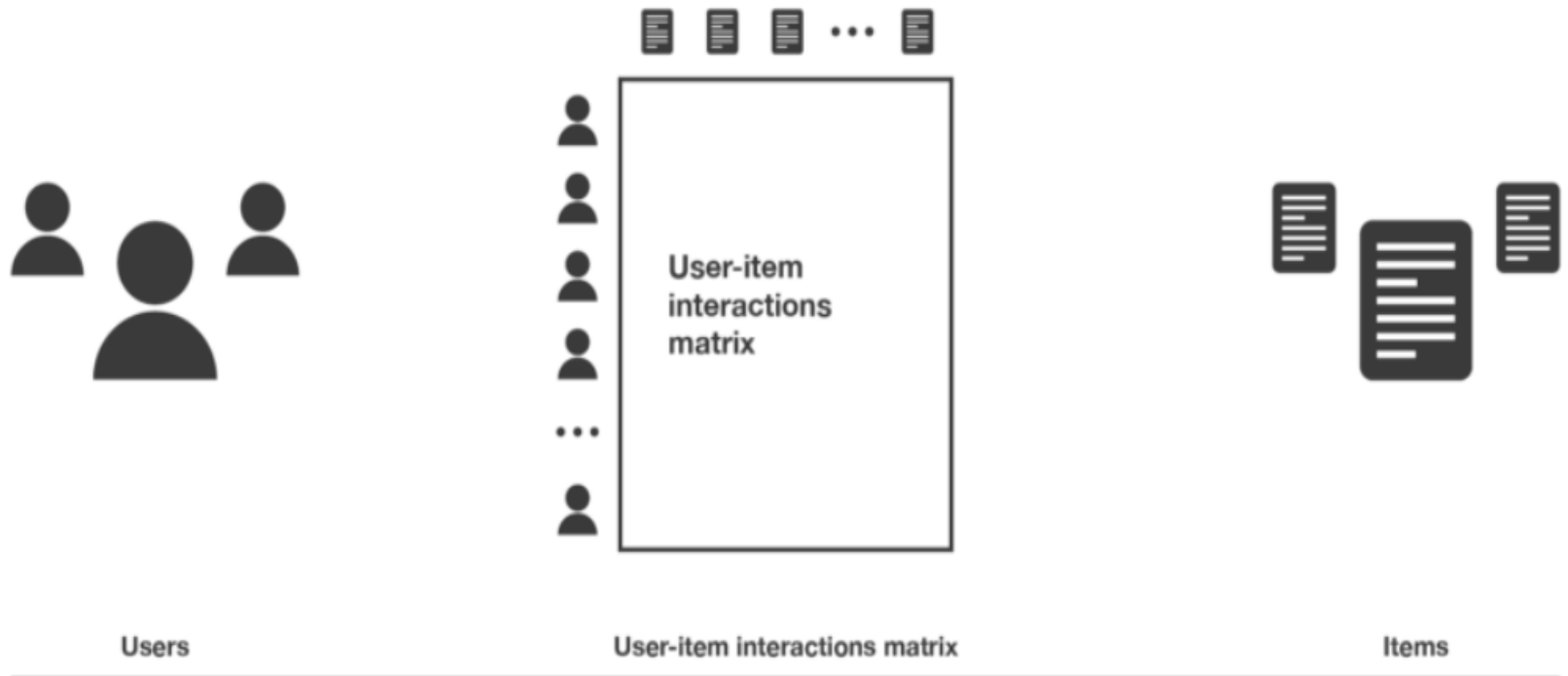


How?

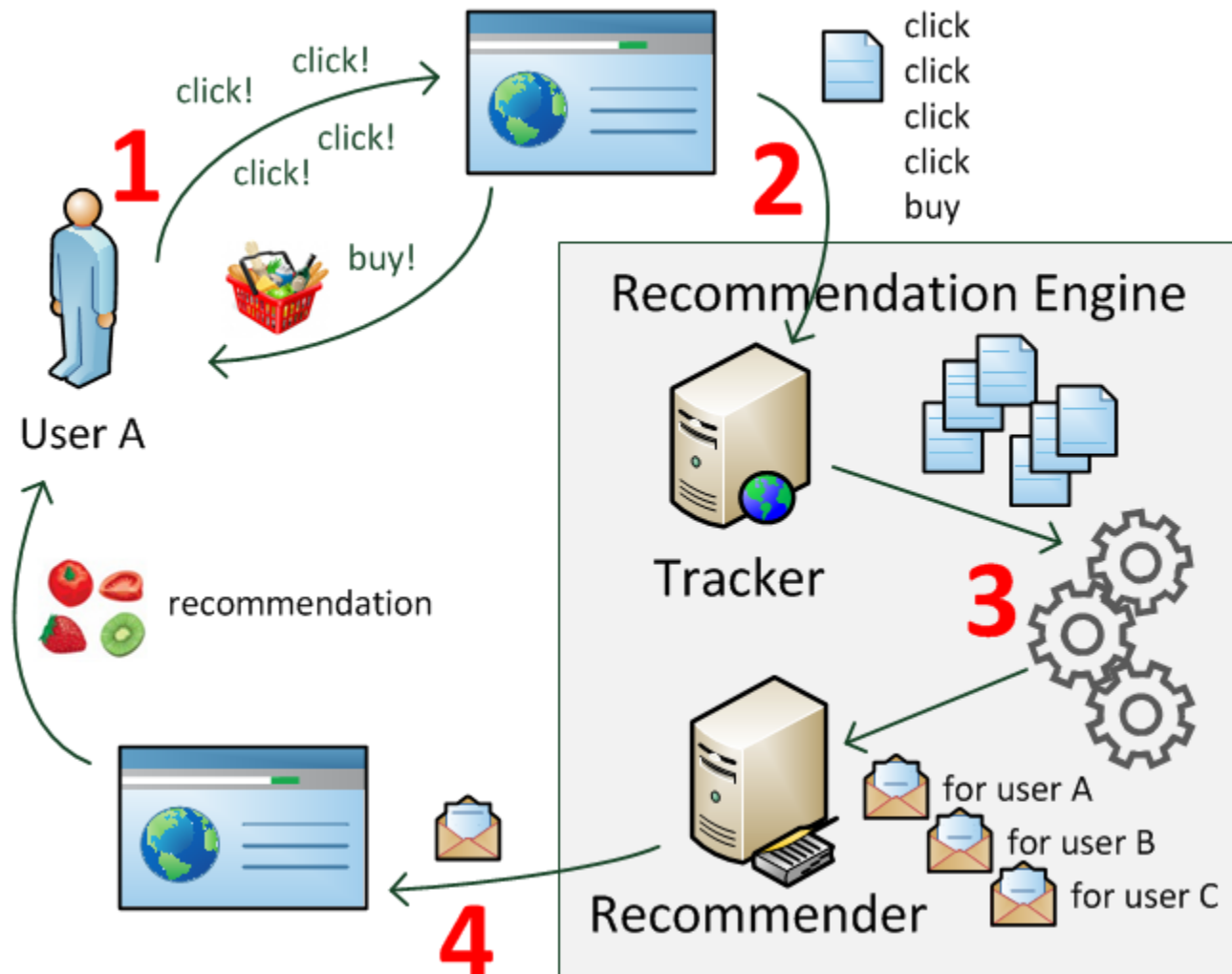
- Recommendation Engine needs to know you better in order to provide effective suggestions
- Information collection and integration - critical aspect of the process.
 - **Explicit interactions**
 - Information about your *past activity, your ratings, reviews and other information about your profile, such as gender, age, or investment objectives*
 - **Implicit interactions**
 - *device you use for access, clicks on a link, location, and dates.*

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User-Item Interaction Matrix

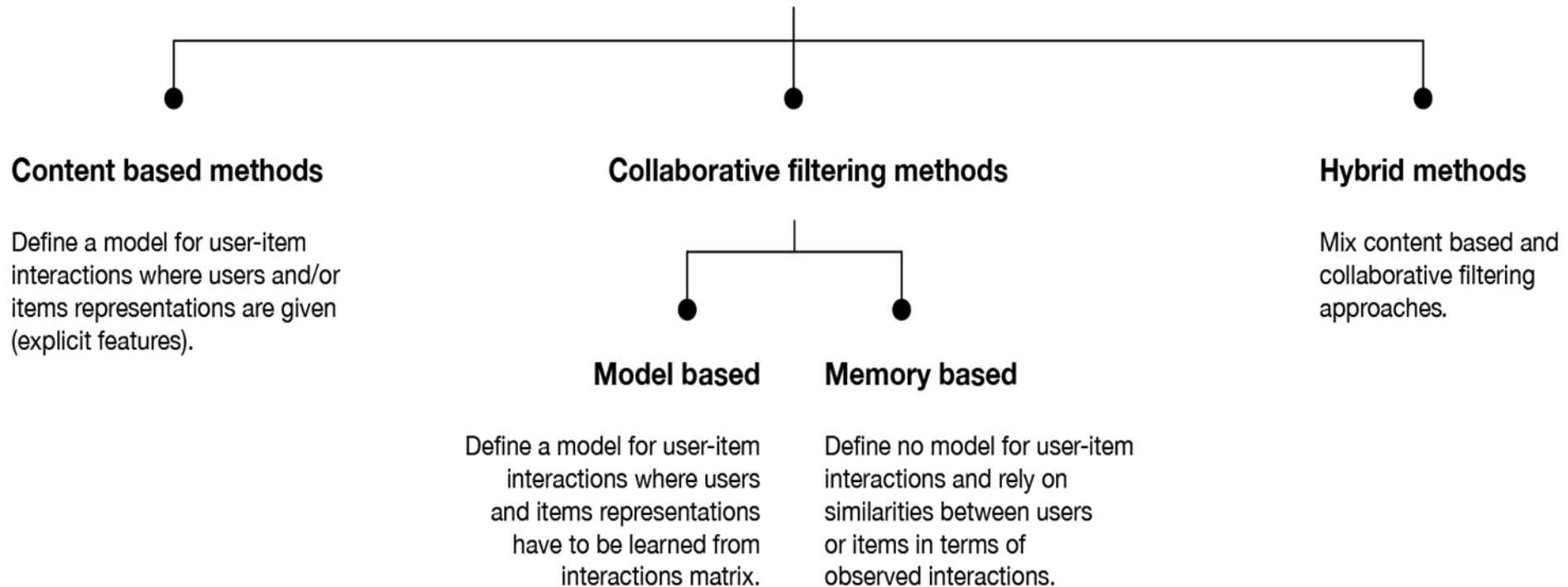


Process Involved



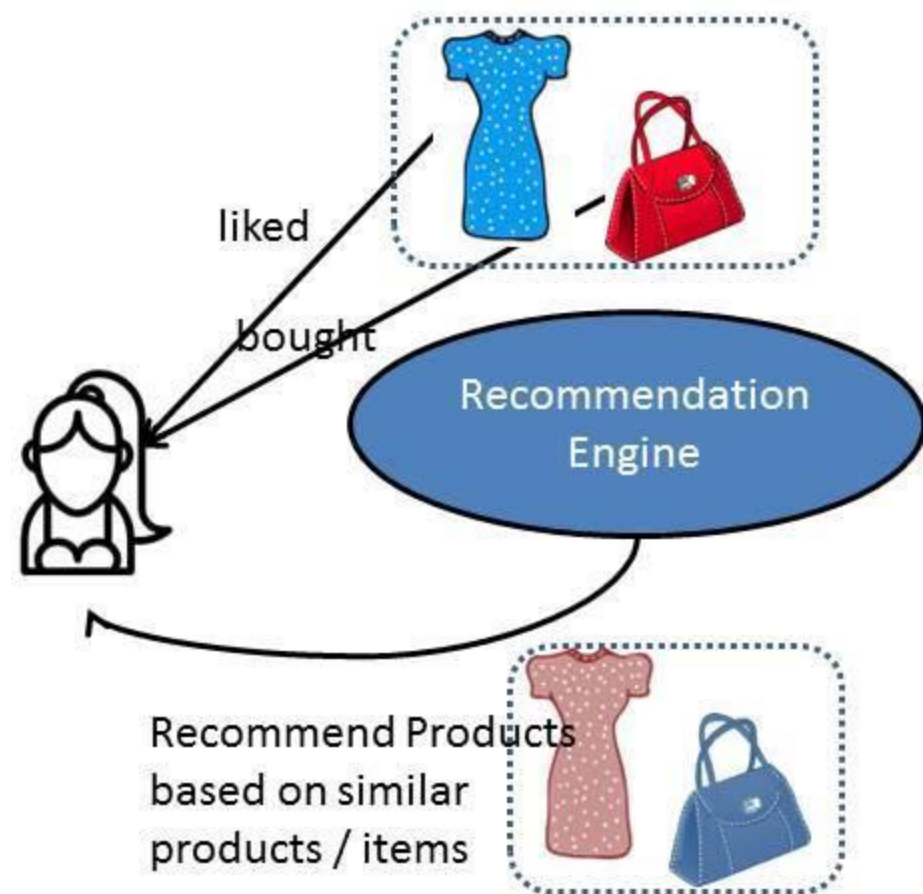
Types of Recommender Systems

Recommender systems





(a). Collaborative Filtering



(b). Content Filtering

Content based filtering

- *Based on a single user's interactions and preference.*
- Uses metadata collected from a user's history and interactions.
 - For example, recommendations will be based on looking at established patterns in a user's choice or behaviours.
 - Returning information such as products or services will relate to your likes or views.
- The more information that the user provides, the higher the accuracy.

Content based filtering

- *Case-based Recommender*
 - Evaluate items' similarities
 - Extensively deployed in e-commerce
 - Typical Example
 - A recommendation like 'products similar to this'
- Suffer from 'cold start' problems
 - when a recommender system cannot draw inferences for a query due to lack of sufficient information

Collaborative filtering

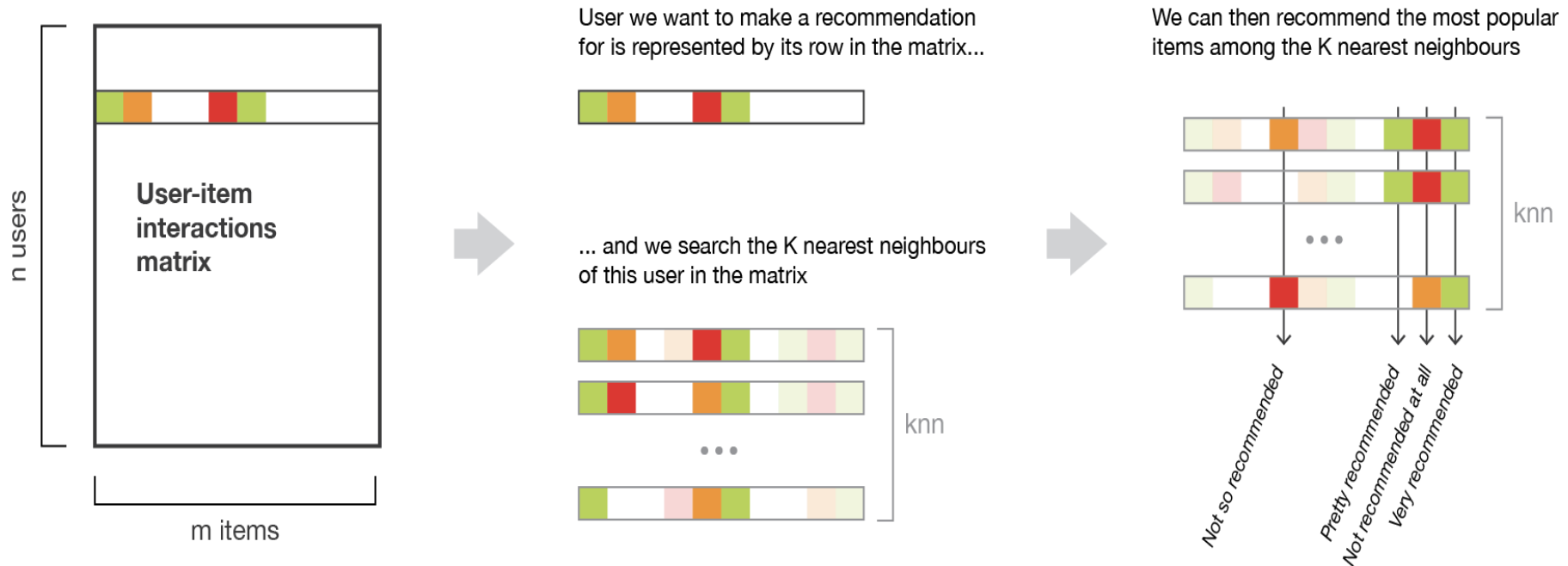
- *Based on multiple users interactions and preferences*
- Recommendations are based on other users with similar tastes or situations.
 - ‘Next buy’ recommendations is a typical usage
- Has higher accuracy than content-based filtering. But, can also introduce some increased variability and sometimes less interpretable results.

Collaborative Filtering – Memory based

positive interactions

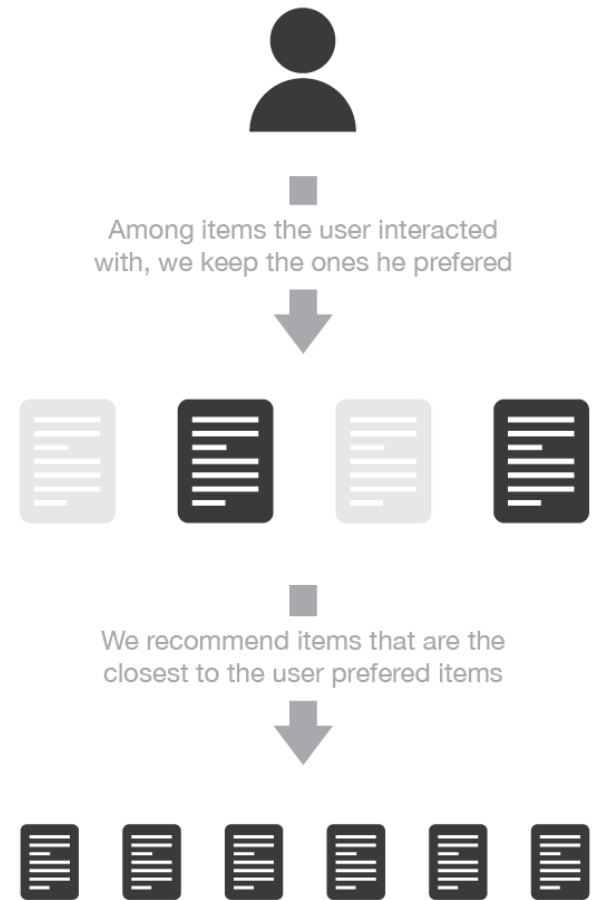
neutral interactions

negative interactions



Collaborative Filtering – Memory based – User-User Vs. Item-Item

user-user



Collaborative Filtering – Model based

- Rely on user-item interactions information and assume a latent model supposed to explain these interactions.
 - For example, matrix factorisation algorithms consists in decomposing the huge and sparse user-item interaction matrix into a product of two smaller and dense matrices:
 - a user-factor matrix (containing users representations) that multiplies a factor-item matrix (containing items representations).
 - close users in terms of preferences as well as close items in terms of characteristics ends up having close representations in the latent space.

Hybrid Methods

- A system that combines content-based filtering and collaborative filtering could take advantage of both methods

Metrics

- ***Accuracy***
 - *fraction of correct recommendations out of the total possible recommendations*
- ***Coverage measures***
 - *the number of items or users that the system is actually able to provide recommendation for*
- ***Mean Square Error***

Common Challenges

- Sparsity of data
- Latent association
- Scalability

References

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