



Data Science

Module-10

Recommendation Engine



Agenda

01

RECOMMENDATION
ENGINE

02

TYPES OF
RECOMMENDATION
ENGINES

03

COLLABORATIVE
FILTERING

04

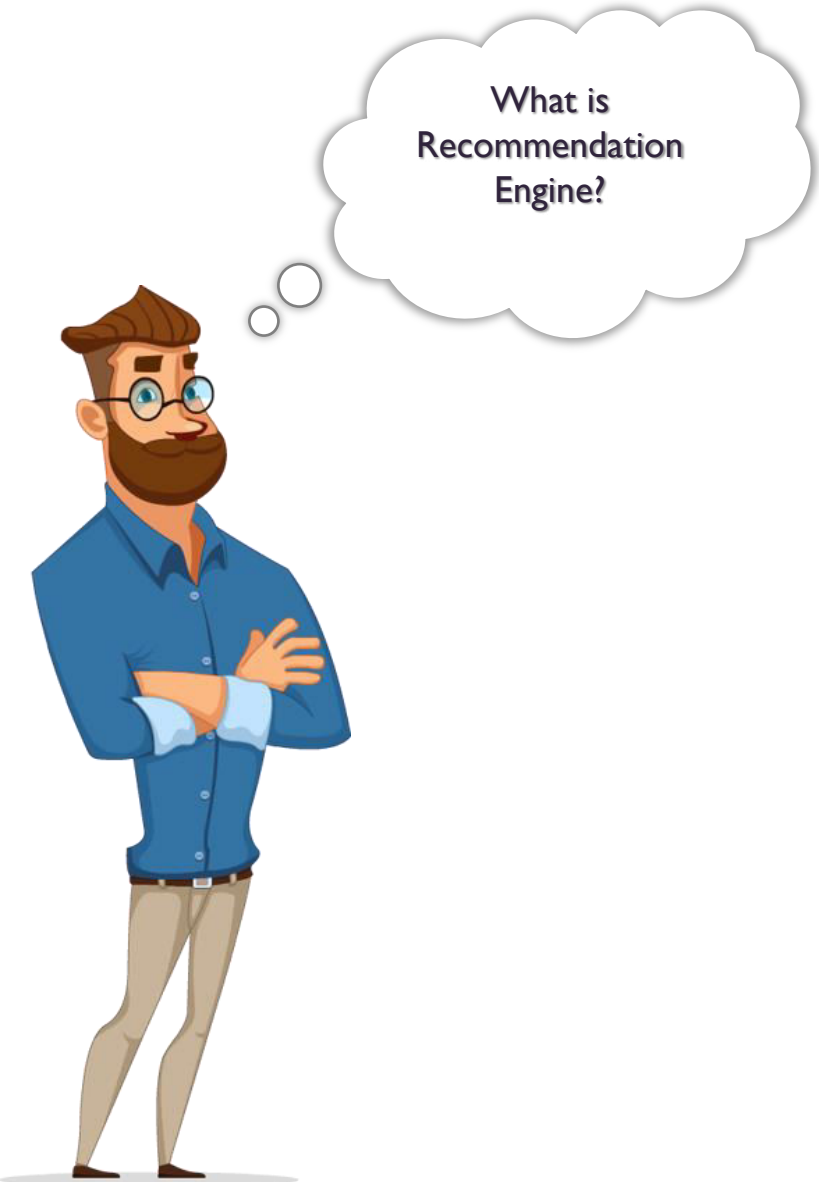
USER-BASED
COLLABORATIVE FILTERING

05

ITEM-BASED
COLLABORATIVE FILTERING

Recommendation Engine

Recommendation Engine

A cartoon illustration of a man with a beard and glasses, wearing a blue shirt and khaki pants, standing with his arms crossed and looking thoughtful. A thought bubble above him contains the text "What is Recommendation Engine?".

What is
Recommendation
Engine?

A filtering system that seeks to predict and show the items of user interest.

It may or may not be accurate

Utilized in a variety of areas

Mostly used in the digital domain

Can significantly boost revenues, CTRs, conversions, and other important metrics

Recommendation Engine

What is
Recommendation
Engine?



Data filtering tools that make use of algorithms and data to recommend the most relevant items to a particular use



An automated form of
"SHOP COUNTER GUY"

Recommendation Engine



Recommendation Engine Example

Increase Average Order Value

Frequently Bought Together



Price for all three: **\$74.20**

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[Show availability and shipping details](#)

- ✓ **This item:** Beginning Ruby: From Novice to Professional (Expert's Voice in Open Source) by Peter Cooper Paperback **\$27.78**
- ✓ Learn to Program, Second Edition (The Facets of Ruby Series) by Chris Pine Paperback **\$16.94**
- ✓ Ruby on Rails Tutorial: Learn Web Development with Rails (2nd Edition) (Addison-Wesley Professional Ruby ... by Michael Hartl Paperback **\$29.48**

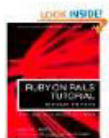
Customers Who Bought This Item Also Bought



Learn to Program, Second Edition (The Facets of...
Chris Pine
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Paperback
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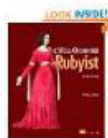
The Well-Grounded Rubyist
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Ruby on Rails Tutorial: Learn Web Development...
Michael Hartl
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Reference: Amazon

Recommendation Engine

Recommendation
Engine Example



Frequently bought together



Total price: **\$155.90**

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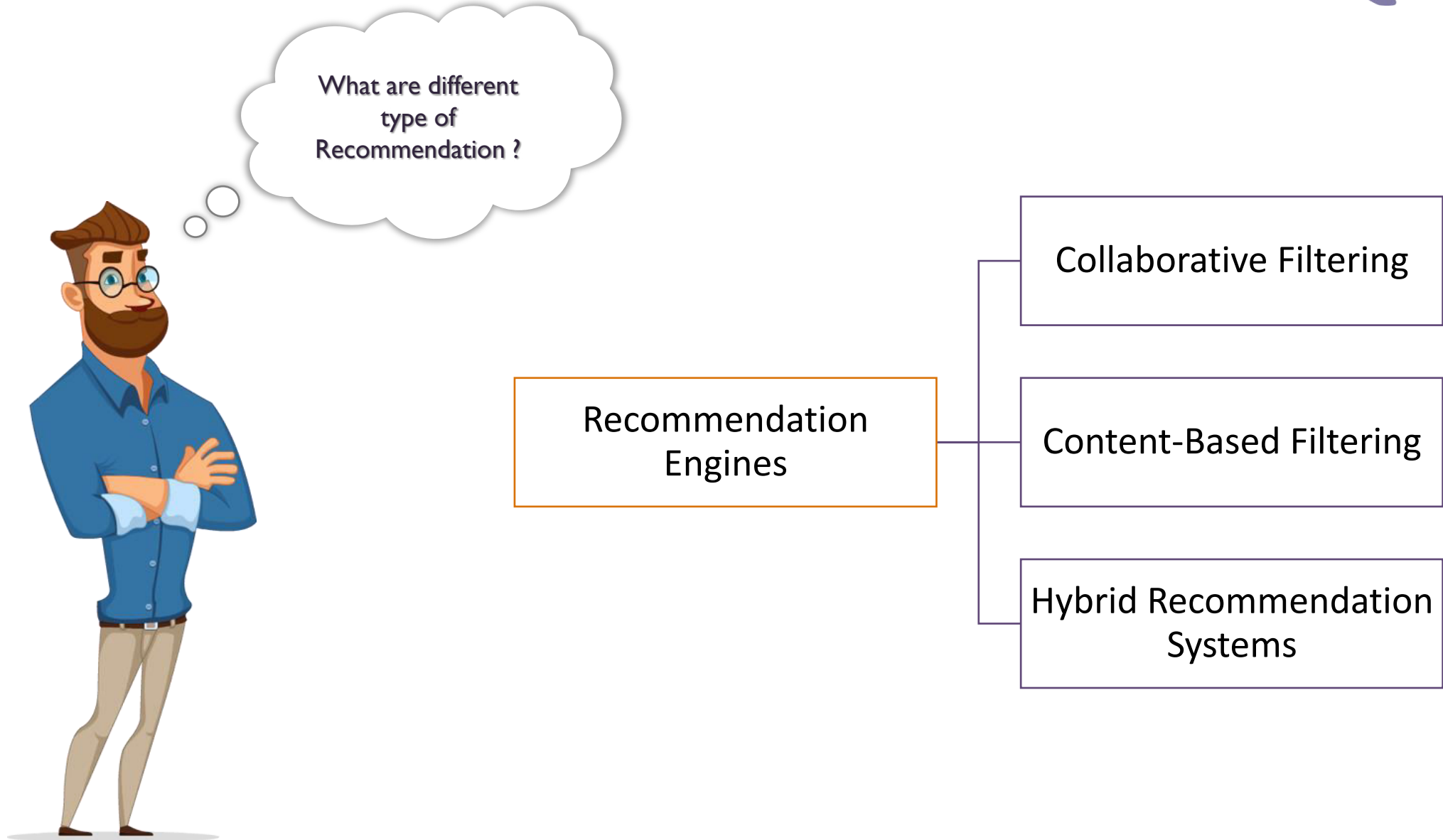
Some of these items ship sooner than the others. [Show details](#)

- ☒ **This item:** Samsung Galaxy J7 Neo (16GB) J701M/DS - 5.5", Android 7.0, Dual SIM Unlocked Smartphone... **\$140.96**
- ☒ Galaxy J7 Neo J701M/J7 Nxt J701F/J7 Core J701 Case, With Screen Protector & Stylus, Telegaming Dual... **\$7.99**
- ☒ [3-PACK]-Mr Shield For Samsung "Galaxy J7 Neo" [Tempered Glass] Screen Protector [0.3mm Ultra Thin... **\$6.95**

Reference: Amazon

Types of Recommendations

Types of Recommendation Engine

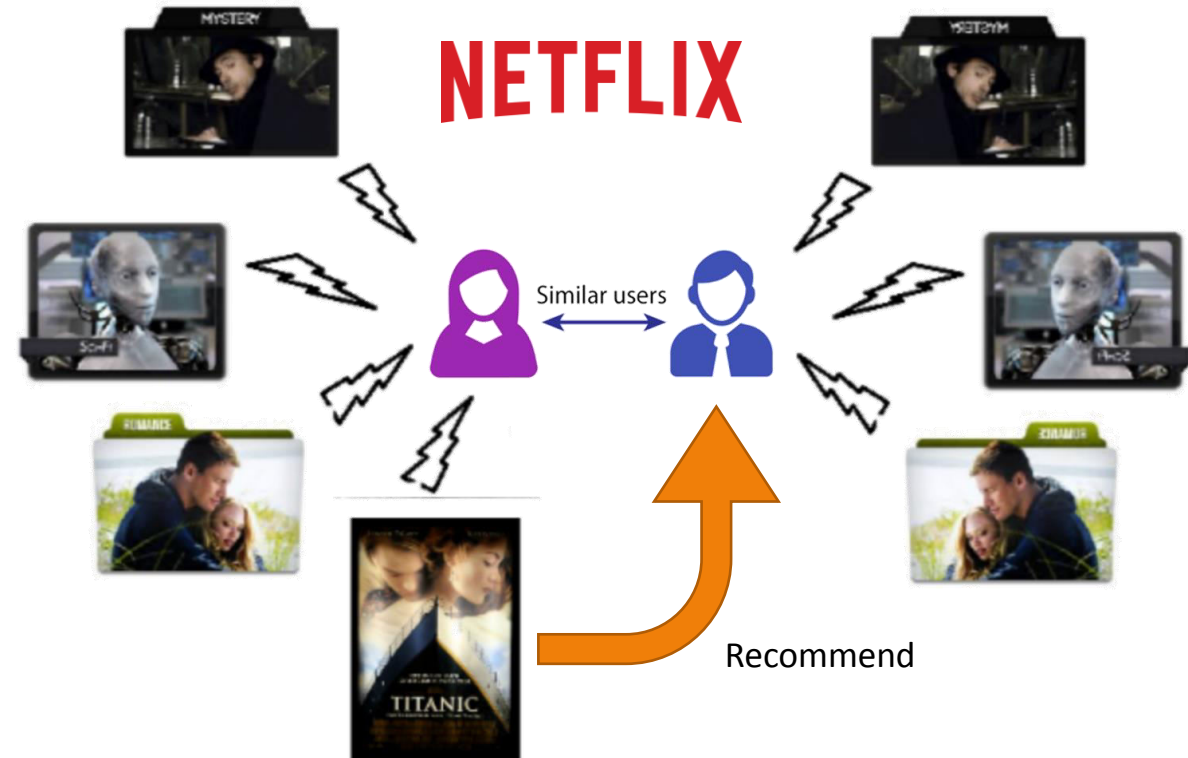


Collaborative filtering recommender systems

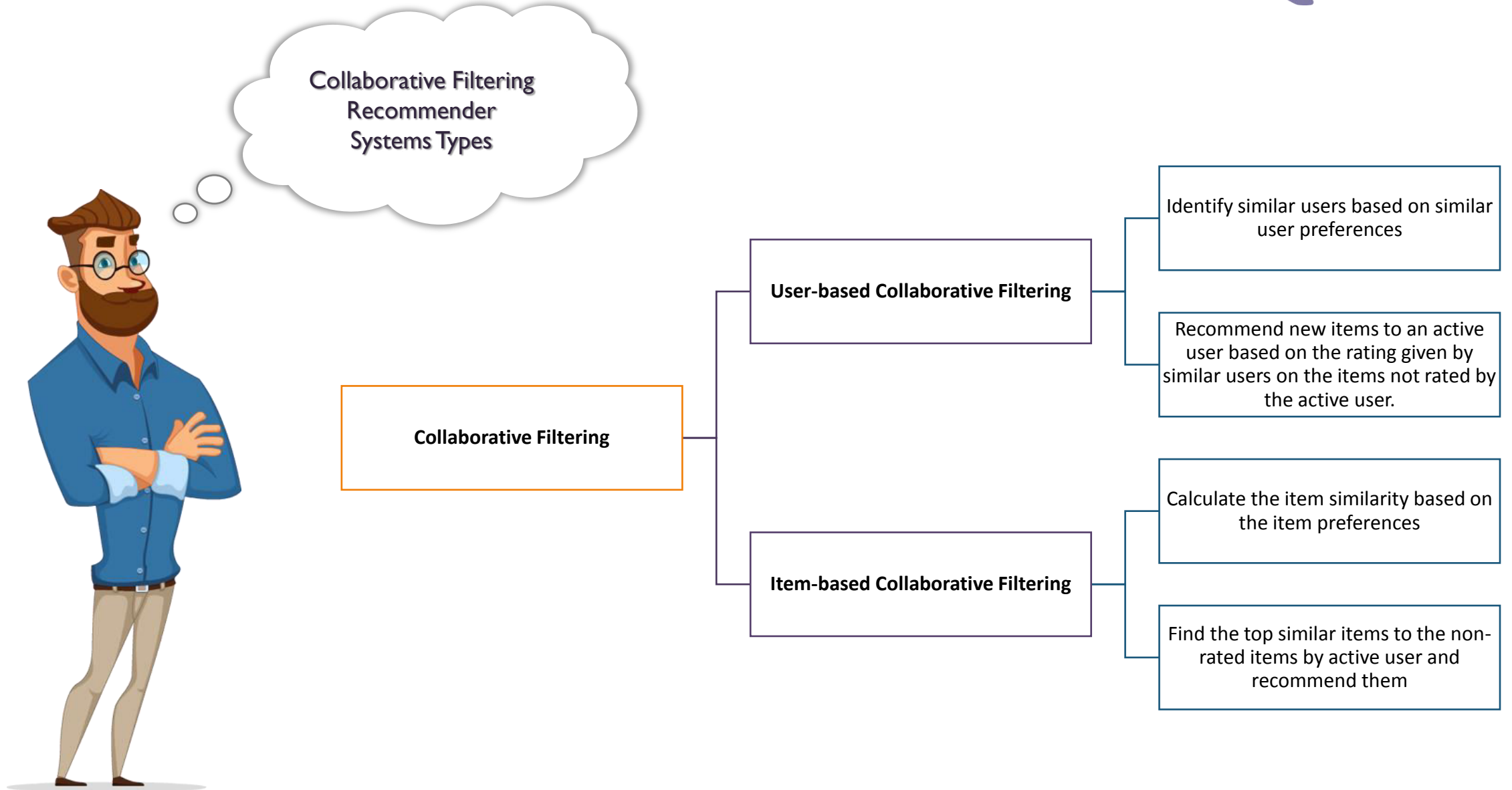
Collaborative filtering recommender systems

What is Collaborative Filtering Recommender Systems ?

Filtering items from a large set of alternatives is done collaboratively by users' preferences

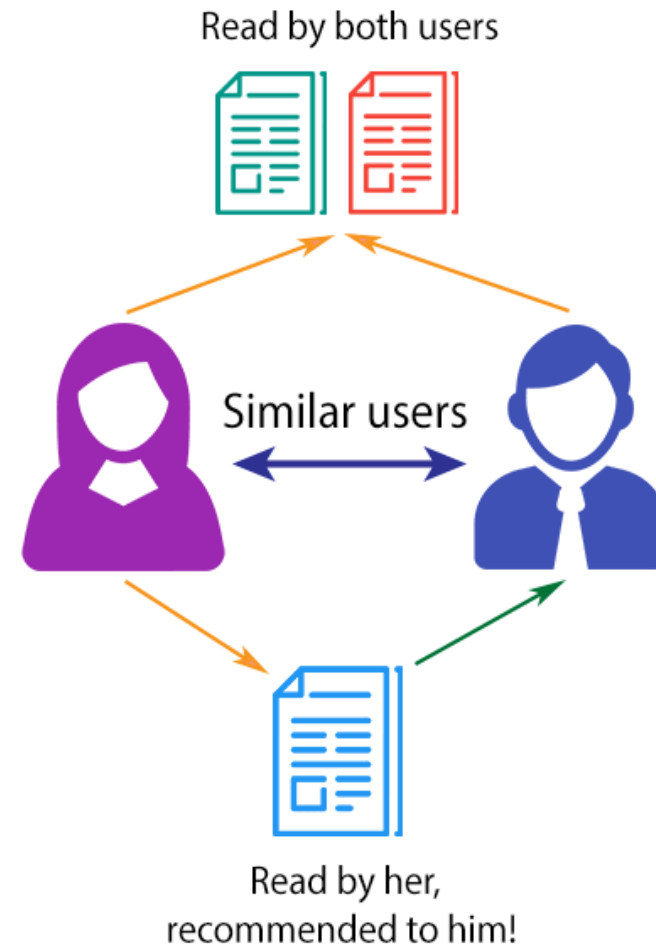
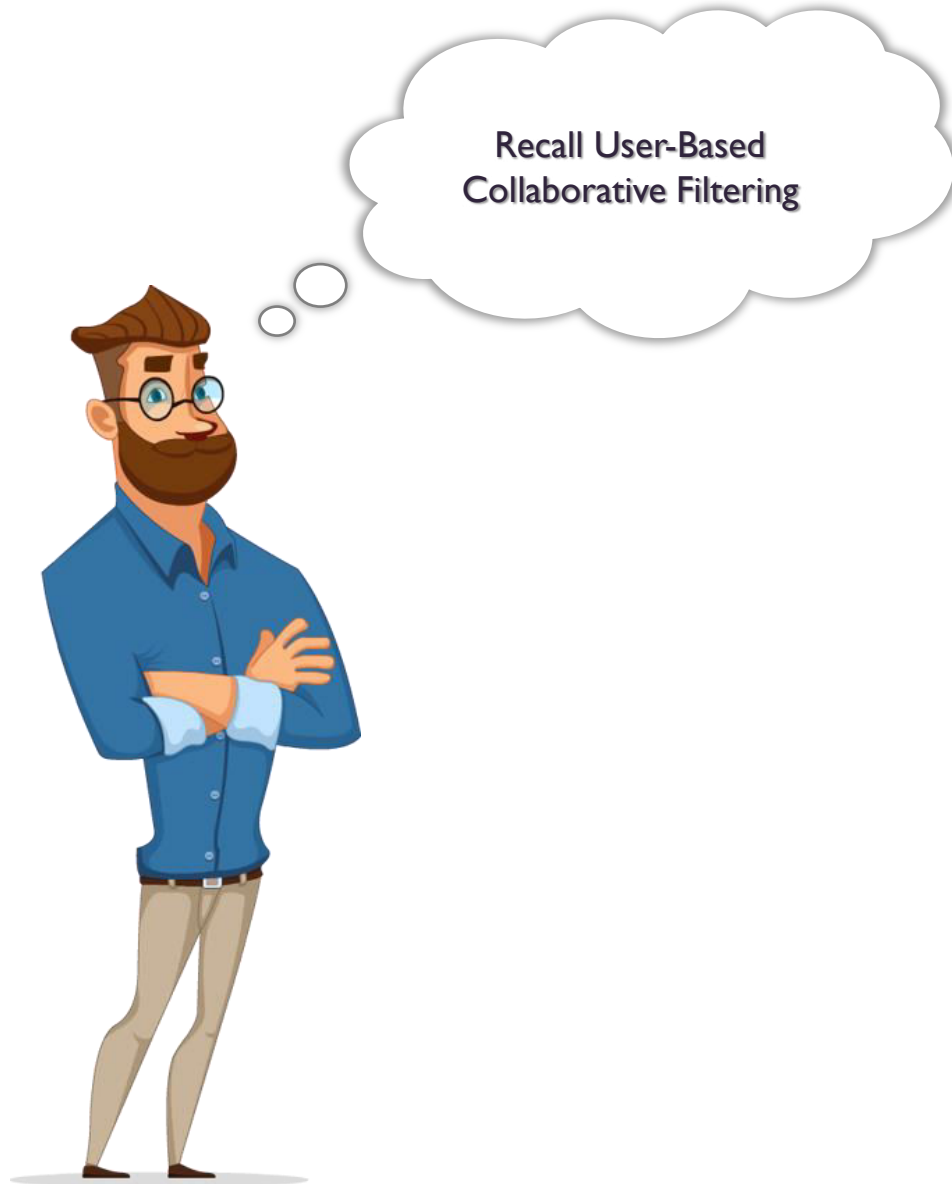


Collaborative filtering recommender systems




User-based Collaborative Filtering

User-based Collaborative Filtering



User-based Collaborative Filtering



How do we measure
the similarity?

Pearson Correlation

$$u_{ik} = \frac{\sum_j (v_{ij} - v_i)(v_{kj} - v_k)}{\sqrt{\sum_j (v_{ij} - v_i)^2 \sum_j (v_{kj} - v_k)^2}}$$

Cosine Similarity

$$\cos(u_i, u_j) = \frac{\sum_{k=1}^m v_{ik} v_{jk}}{\sqrt{\sum_{k=1}^m v_{ik}^2 \sum_{k=1}^m v_{jk}^2}}$$

$$v_{ij}^* = K \sum_{v_{kj} \neq ?} u_{jk} v_{kj}$$

User-based Collaborative Filtering

	The Avengers	Sherlock	Transformers	Matrix	Titanic	Me Before You	Similarity(i, E)
A	2		2	4	5		NA
B	5		4			1	0.87
C			5		2		1
D		1		5		4	-1
E	3.51*	3.81*	4	2.42*	2.48*	2	1
F	4	5		1			NA

Users' preference can change over time

Item-based Collaborative Filtering

Item-based Collaborative Filtering


	The Avengers	Sherlock	Transformers	Matrix	Titanic	Me Before You
A	2		2	4	5	2.94*
B	5		4			1
C			5		2	2.48*
D		1		5		4
E			4			2
F	4	5		1		1.12*
Similarity	-1	-1	0.86	1	1	

Scalability

The worst-case complexity is $O(mn)$

Sparsity

Collaborative Filtering

A cartoon illustration of a man with a beard and glasses, wearing a blue shirt and khaki pants, standing with his arms crossed and looking thoughtful. A thought bubble is above his head.

Building collaborative
filtering recommender
systems

- How to calculate the similarity between users?
- How to calculate the similarity between items?
- How recommendations are generated?
- How to deal with new items and new users whose data is not known?

Cold Start problem

Thank You