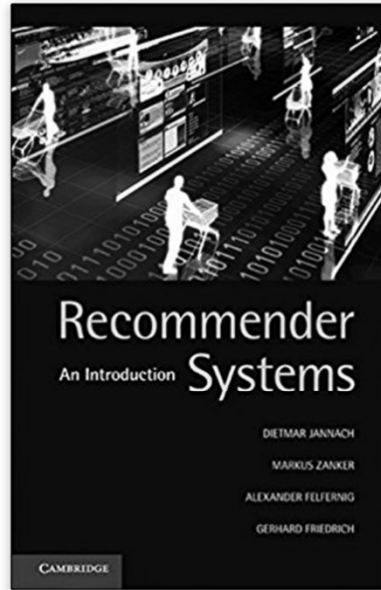


Priporočilni sistemi

- Pregled
- Klasifikacija priporočilnih sistemov
- Organizacija podatkov



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Recommender Systems: An Introduction Hardcover – 25 Nov 2010

by Dietmar Jannach (Author), Markus Zanker (Author), Alexander Felfernig (Author), & 1 more

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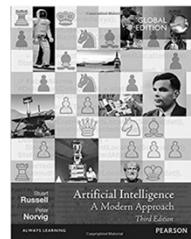
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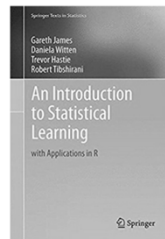
In this age of information overload, people use a variety of strategies to make choices about what to buy, how to spend their leisure time, and even whom to date. Recommender systems automate some of these strategies with the goal of providing affordable, personal, and high-quality recommendations. This book offers an overview of approaches to developing state-of-the-art recommender systems. The authors present current algorithmic approaches for generating personalized buying proposals, such as collaborative and content-based filtering, as well as more interactive and knowledge-based approaches.

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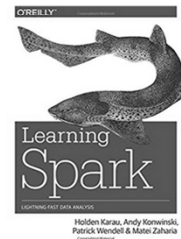
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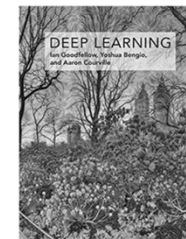
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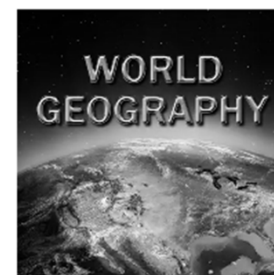
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2020-21 UEFA Champions League, Group Stage



Paris Saint-Germain



1

FT

0



RB Leipzig



- ✓ 15 Danilo Pereira
- ✓ 8 Leandro Paredes
- ✓ 21 Ander Herrera
- ✓ ↑↓ 6 Marco Verratti
- ✓ 10 Neymar
- ✓ ↑↓ 19 Pablo Sarabia
- ✓ 7 Kylian Mbappé
- ✓ ↑↓ 18 Moise Kean
- ✓ 11 Ángel Di María
- ✓ ↑↓ 12 Rafinha

SUBSTITUTES

- 30 Alexandre Letellier
- 20 Layvin Kurzawa
- 16 Sergio Rico
- 31 Colin Dagba
- 32 Timothee Pembele
- 36 Kays Ruiz-Atil
- 37 Badioungou Fadiga

Game Information

VENUE: Parc des Princes

9:00 PM CET, November 24, 2020

11h - Reuters



Paris Saint-Germain



RB Leipzig

Match Commentary

- Match ends, Paris Saint Germain 1, RB Leipzig 0.
- Match ends, Paris Saint Germain 1, RB Leipzig 0.
- 90'+6' ⚡ Second Half ends, Paris Saint Germain 1, RB Leipzig 0.

Full Commentary

Match Stats



PSG

LEI

15	Fouls	19
5	Yellow Cards	1
0	Red Cards	0
0	Offsides	1
2	Corner Kicks	6
3	Saves	2



PSG

Possession

LEI

38%



62%

Shots (on Goal)

8 (3)



15 (3)



UEFA Champions League News

Ronaldo has last laugh after Ferencvaros player imitates celebration

Cristiano Ronaldo quickly responds with a goal after Ferencvaros striker Myrto Uzuni imitates his goal celebration.



Giroud, Morata deliver to send Chelsea & Juve to UCL last 16

Olivier Giroud and Alvaro Morata both score dramatic winners to send Chelsea and Juventus to the UCL round of 16.



Dest 'showing what he can do' with first Barca goal

Gab Marcotti says Sergino Dest could become Barcelona's permanent right back if he keeps up his current form.



Burley: Scary thing about Haaland is he can still improve

Gab Marcotti and Craig Burley react to Erling Haaland's latest star showing in Dortmund's 3-0 win over Club Brugge.



Bruno Fernandes demonstrates why Manchester United can't afford to do without him

At some point Bruno Fernandes will need to be given a rest, but as demonstrated vs. Istanbul Basaksehir, Man United can't afford to do without him.



Morata 'the only positive' in Juventus win vs. Ferencvaros

Steve Nicol is not impressed by Juventus' performance in a narrow Champions League win vs. Ferencvaros.



All soccer News

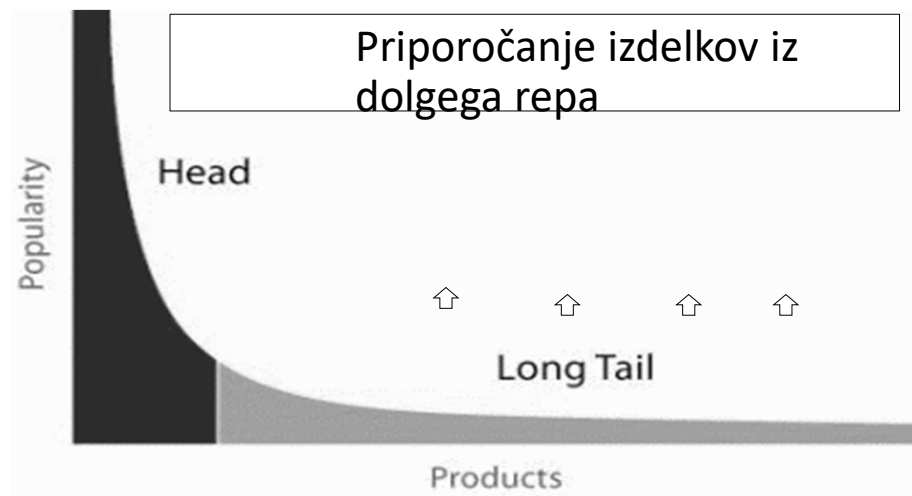
Problem priporočanja

- Priporočilni sistem „uporabnikom“ priporoča „izdelke“
 - Zmanjšuje informacijsko preobremenitev
 - Nudi pomoč pri nakupu (razlaga priporočila)

RS are software agents that elicit the interests and preferences of individual consumers [...] and make recommendations accordingly. They have the potential to support and improve the quality of the decisions consumers make while searching for and selecting products online.

- Različne paradigme
 - Odvisno od razpoložljivih podatkov
 - Odvisno od implicitnih ali eksplicitnih povratnih informacij
 - Odvisno od problema priporočanja

Kdaj priporočilni sistem dobro deluje?



- Priporoča primerne izdelke, ki jih uporabnik še ne pozna
- O uporabniku mora sistem za dobra priporočila vedeti čimveč!
- MovieLens: 20% filmov ima 74% vseh pozitivnih ratingov (nad 3 na skali 1-5)

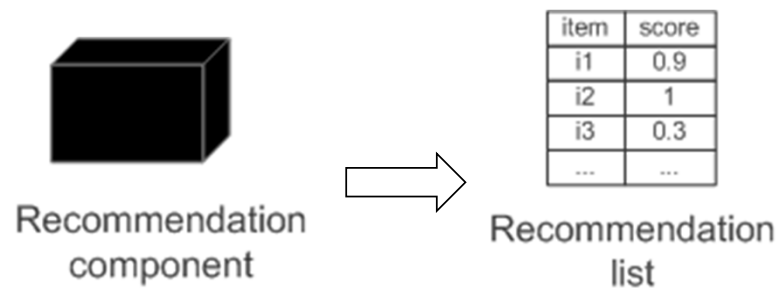
Abstrakcija priporočilnega sistema



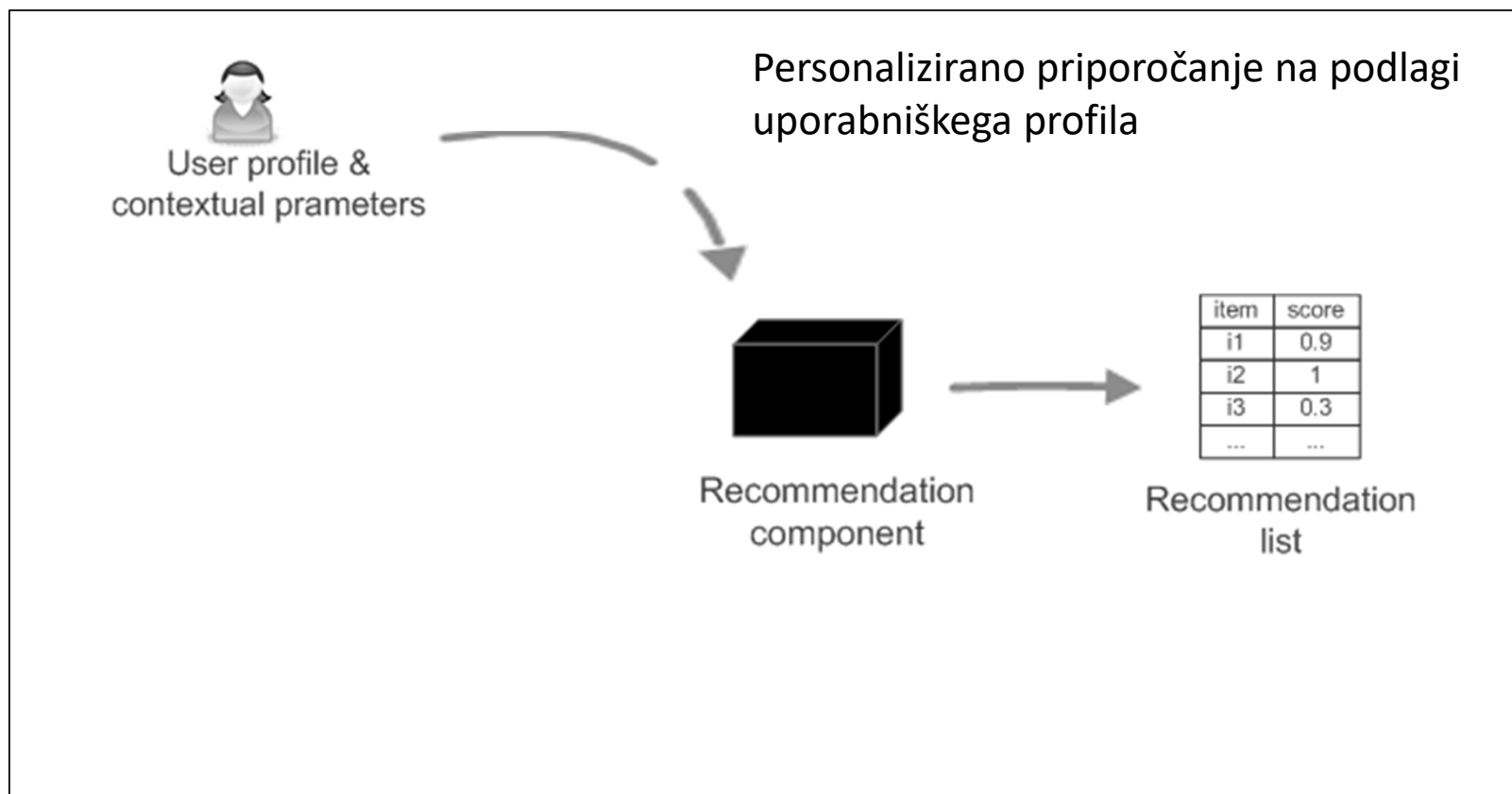
- Priporočilni sistem kot funkcija
- Ob podanem:
 - Modelu uporabnika (preference, profil, demografski podatki, kontekst)
 - Izdelkih (z ali brez opisanih značilnosti)
- Poišči:
 - Relevantnost vsakega izdelka za vsakega uporabnika in jo uporabi za razvrščanje (rating)

Paradigme priporočilnih sistemov

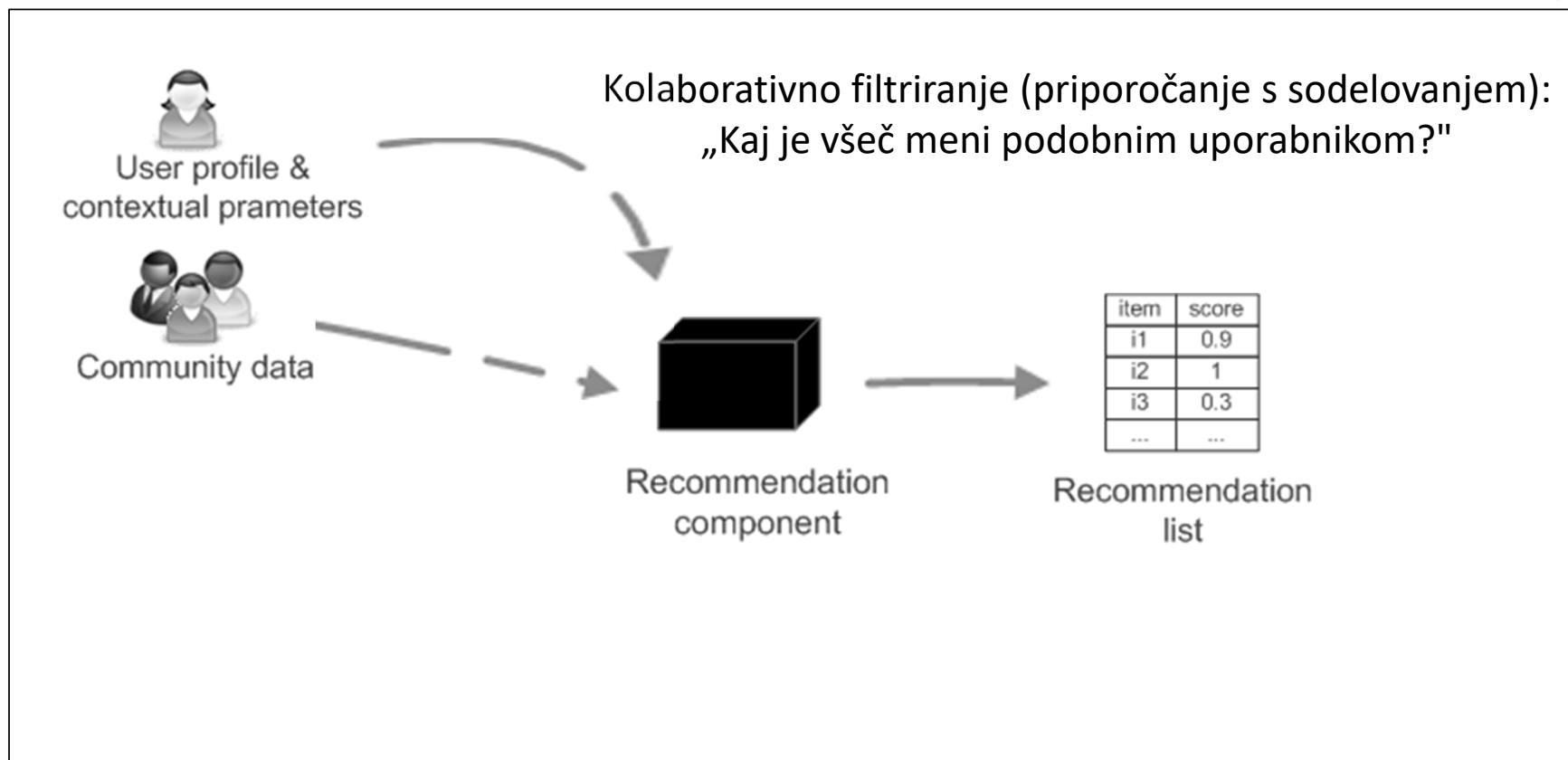
Zmanjševanje informacijske preobremenitve s priporočanjem relevantnih izdelkov. Kako?



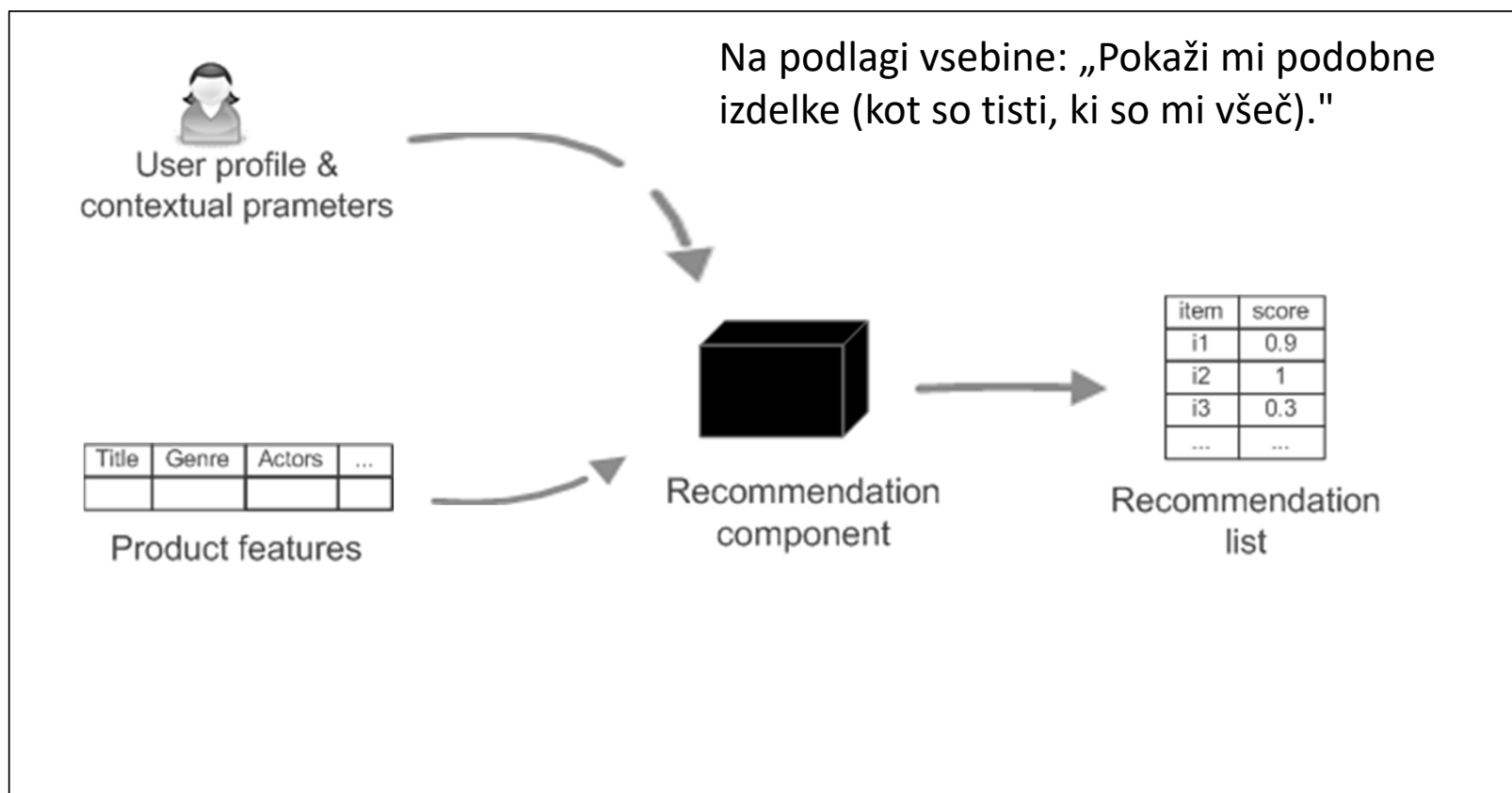
Paradigme priporočilnih sistemov



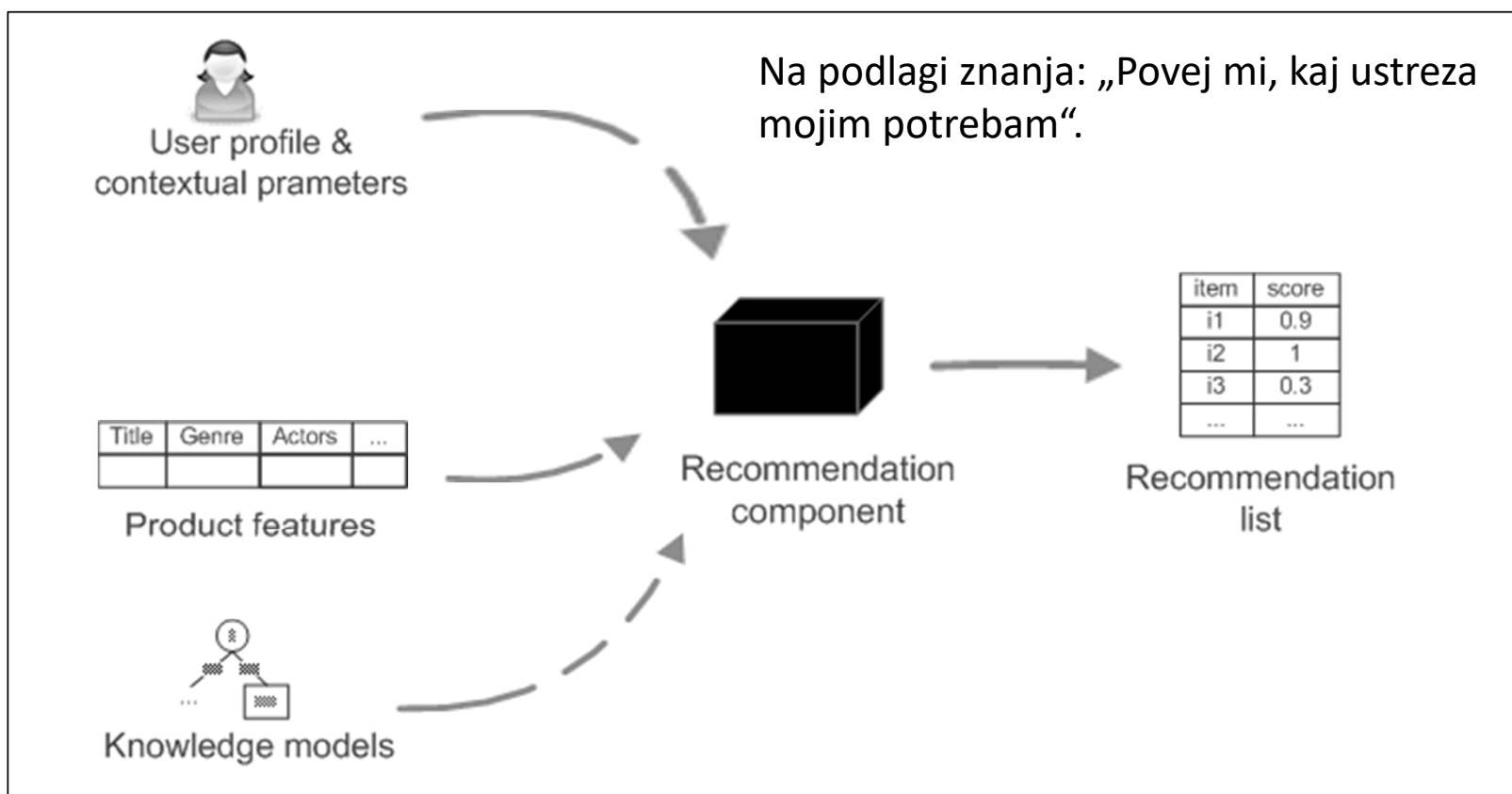
Paradigme priporočilnih sistemov



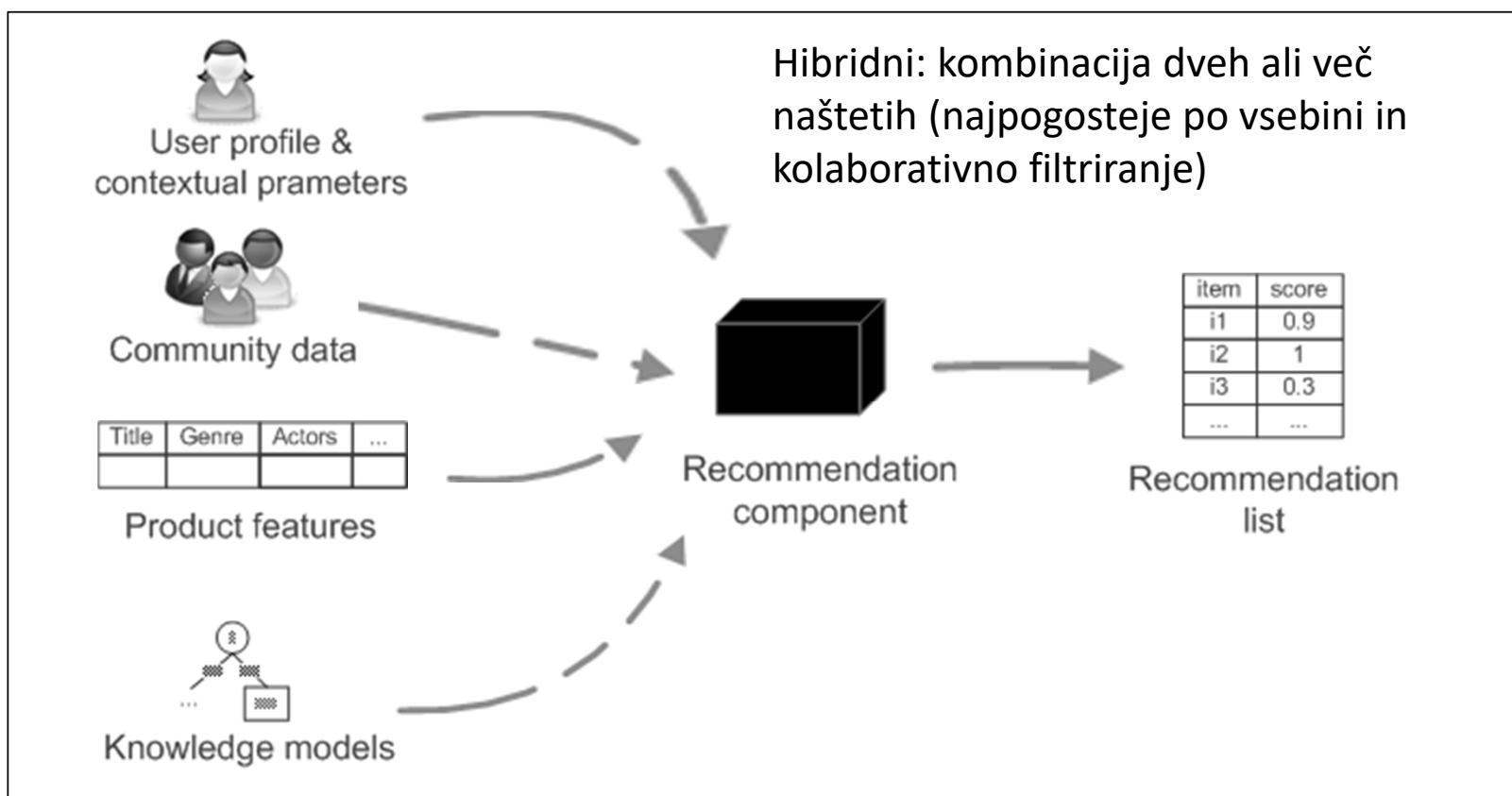
Paradigme priporočilnih sistemov



Paradigme priporočilnih sistemov



Paradigme priporočilnih sistemov



Preferenčna matrika (utility matrix)

Diagram illustrating a Preference Matrix (Utility Matrix) with dimensions labeled:

- Horizontal axis: izdelki (Products)
- Vertical axis: uporabniki (Users)

1	3	4			?
	3	5			5
		4	5		5
		3			
		3			
2			2		2
				5	
	2	1			1
	3			3	
1					

A callout bubble points to the value '2' in the 6th row, 6th column, containing the text:

- Preferenca
- Ocena
- Rating

Priporočanje na podlagi podobnosti med uporabniki ali izdelki (memory based)

- Podobnost med uporabniki: Pearsonov korelacijski koeficient (ali kosinusna podobnost, za izdelke)

$$\text{sim}(a, b) = \frac{\sum_{p \in P} (r_{a,p} - \bar{r}_a)(r_{b,p} - \bar{r}_b)}{\sqrt{\sum_{p \in P} (r_{a,p} - \bar{r}_a)^2} \sqrt{\sum_{p \in P} (r_{b,p} - \bar{r}_b)^2}}$$

- Izračun preference:

a, b : uporabnika
 p : izdelek

$$\text{pref}(a, p) = \bar{r}_a + \frac{\sum_{b \in N} \text{sim}(a, b) * (r_{b,p} - \bar{r}_b)}{\sum_{b \in N} \text{sim}(a, b)}$$

(na podlagi najbližjih sosedov $b \in N$)

Priporočanje na podlagi modela (model based)



- Napovedni modeli s področja podatkovnega rudarjenja
 - Regresija
 - SVM
 - Bayesovski modeli
 - Nevronske mreže
 - Latentni faktorji (matrična faktorizacija)

Organizacija podatkov za priporočanje



- Gosta ali redka preferenčna matrika?
- Tipične operacije:
 - Izračun podobnosti
 - Iskanje najbližjih sosedov
 - Izračun, uporaba napovednega modela
 - Matrična faktorizacija
- Izbor primerne metode in organizacije podatkov na nivoju PB
 - Redka predstavitev (user, item, rating)
 - Preproste metode (npr. Slope One)
 - <https://stackoverflow.com/questions/2440826/collaborative-filtering-in-mysql>
 - Nerelacijske PB (grafi)