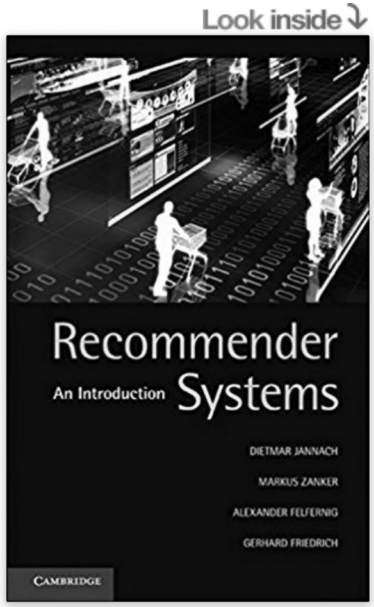
Priporočilni sistemi

- Pregled
- Klasifikacija priporočilnih sistemov
- Organizacija podatkov
- Preproste metode (idejno)


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Breaking Bad
SING
FREE FORM
THE FOSTERS
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are you here
FREE FORM
BABY DADDY
FREE FORM
Trending Now
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Schitt's Creek
ORANGE is the new BLACK
NETFLIX
OZARK
FOX
New Girl
NETFLIX
STRANGER THINGS
NEW EPISODES
Because you watched Narcos
NETFLIX
SURVIVING ESCOBAR
ALIAS JJ
GOMORRON
PABLO ESCOBAR
EL PATRÓN DEL MAL
NETFLIX
SUBURRA
BLOOD ON ROME
ALIAS JJ,
LA CELEBRIDAD DEL MAL
ANTHONY BOURDAIN
PARTS
CNN
New Releases
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Recommender Systems: An Introduction Hardcover – 25 Nov 2010

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

10 reviews from Amazon.com

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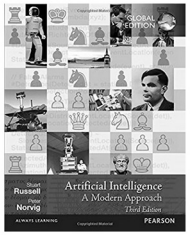
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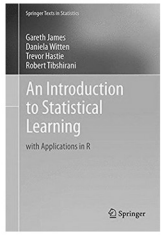
In this age of information overload, people use a variety of strategies to make choices about what to buy, how to spend their leisure time, and even whom to date. Recommender systems automate some of these strategies with the goal of providing affordable, personal, and high-quality recommendations. This 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.

Read more

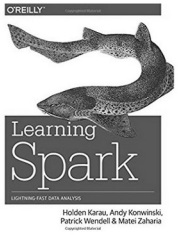
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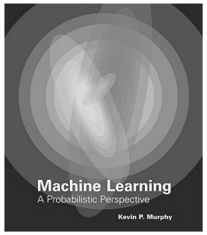
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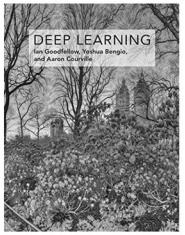
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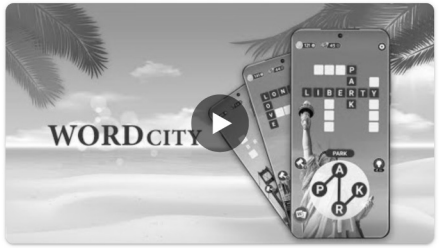
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4.7 ★



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Recommended for you



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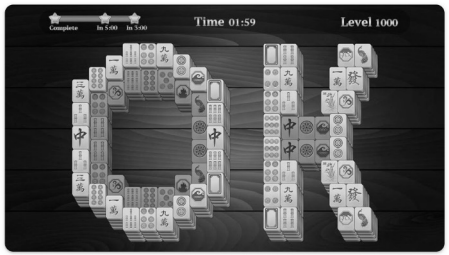
Based on your recent activity



Offline Games - No Wifi Games
Casual · Minigames
4.6 ★



Solitaire - Classic Card Games
Card · Solitaire
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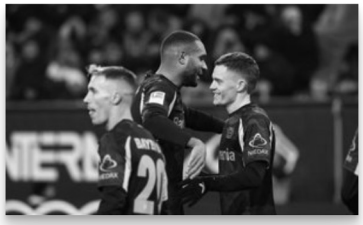
Mahjong
Puzzle · Mahjong solitaire
4.7 ★

24ur.com

Nogomet

Šeško zadel v polno ob pomembni zmagi Leipziga

SORODNI ČLANKI



Leverkusen izkoristil spodrsljaj Bayerna v Mainzu



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Boe konkurenco ugnal tudi na zasledovanju, Fak med najboljšo petnajsterico



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United poglobil krizo Cityja, Chelsea izkoristil spodrsljaje tekmecev



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Goggia prvič do zmage po poškodbi, Štuhec 10. mestu



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Napoli po preobratu odpravil Udinese, Atalanta ostaja na

Safari

Problem priporočanja

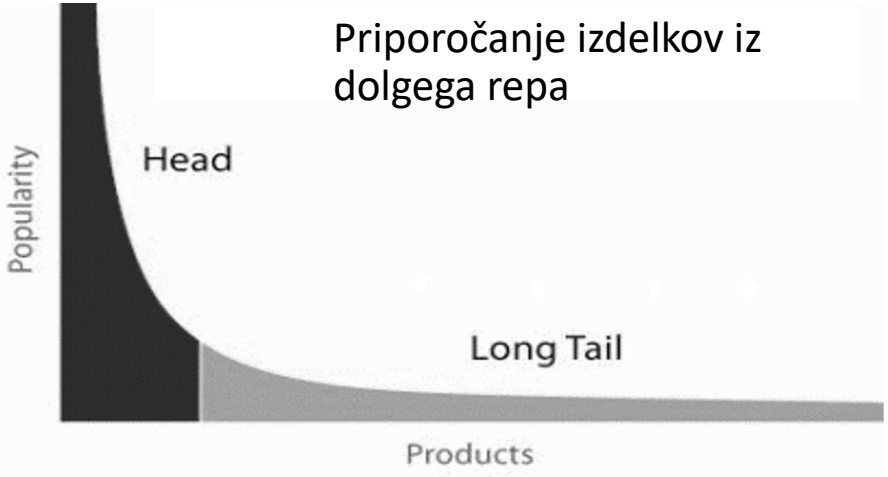
- Priporočilni sistem "uporabnikom" priporoča "izdelke"
  - Zmanjšuje informacijsko preobremenitev (iskanje med množico izdelkov)
  - Nudi pomoč pri nakupu (razlaga priporočila)

Recommender Systems 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!

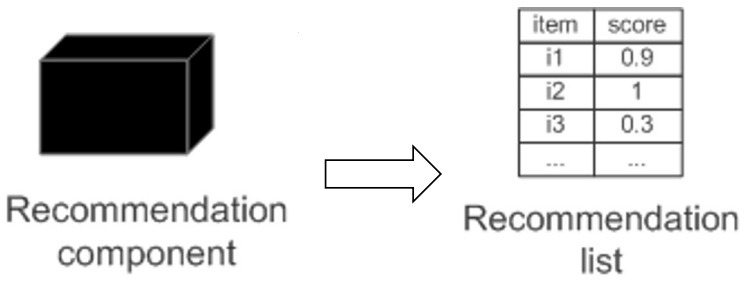
- MovieLens: 20% filmov ima 74% vseh pozitivnih ratingov (nad 3 na skali 1-5)

Abstrakcija priporočilnega sistema

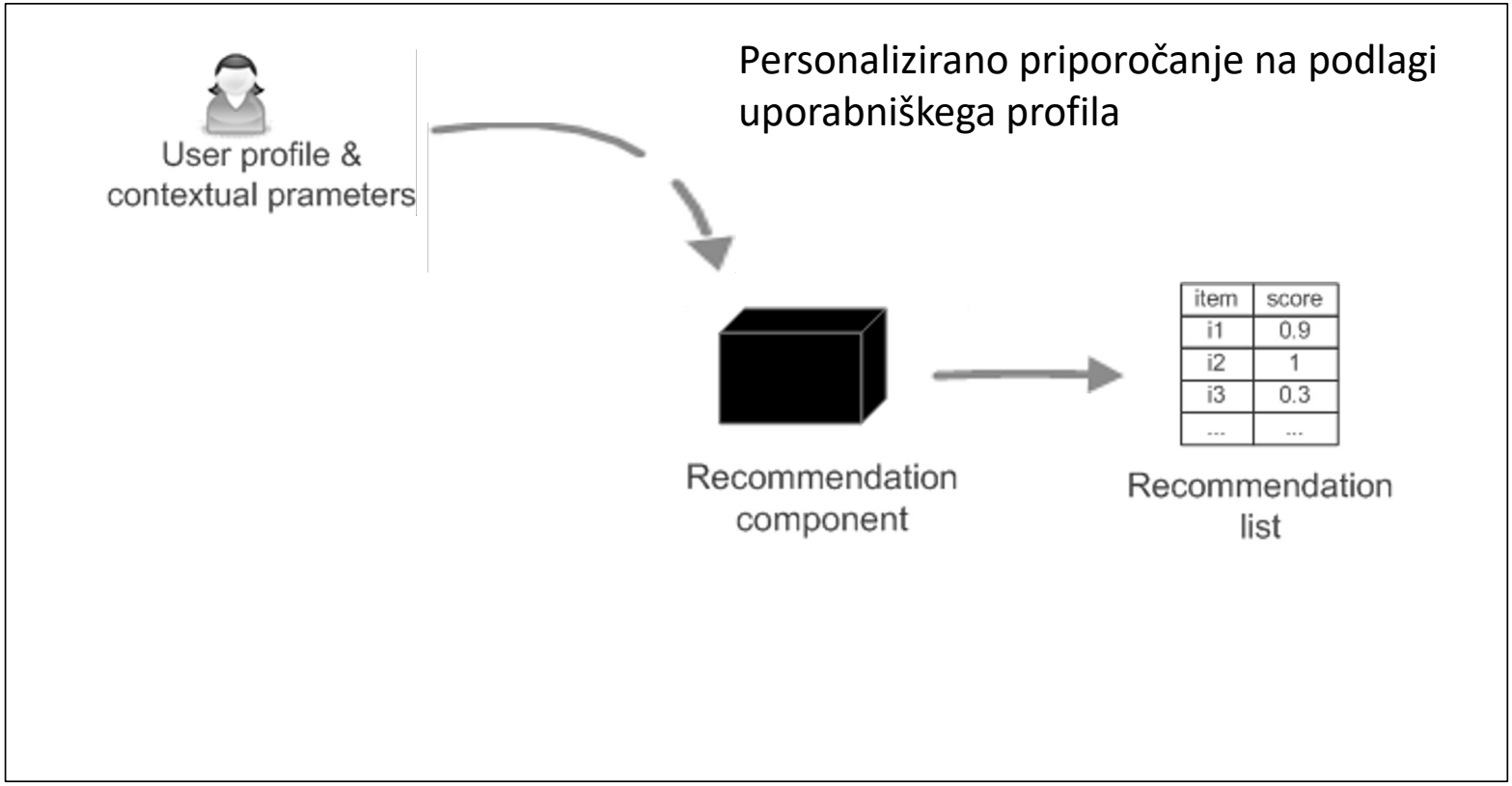
- Priporočilni sistem kot funkcija
- Predpostavka:
  - Nekako pridobimo uporabnikove preference (npr. ocene filmov, izdelkov od 1 do 5)
- Ob podanem:
  - Modelu uporabnika (preference, profil, demografski podatki, kontekst)
  - Izdelkih (z ali brez opisanih značilnosti)
- Poišči:
  - Relevantnost vsakega izdelka za vsakega uporabnika in jo uporabi za razvrščanje (rating)

Paradigme priporočilnih sistemov

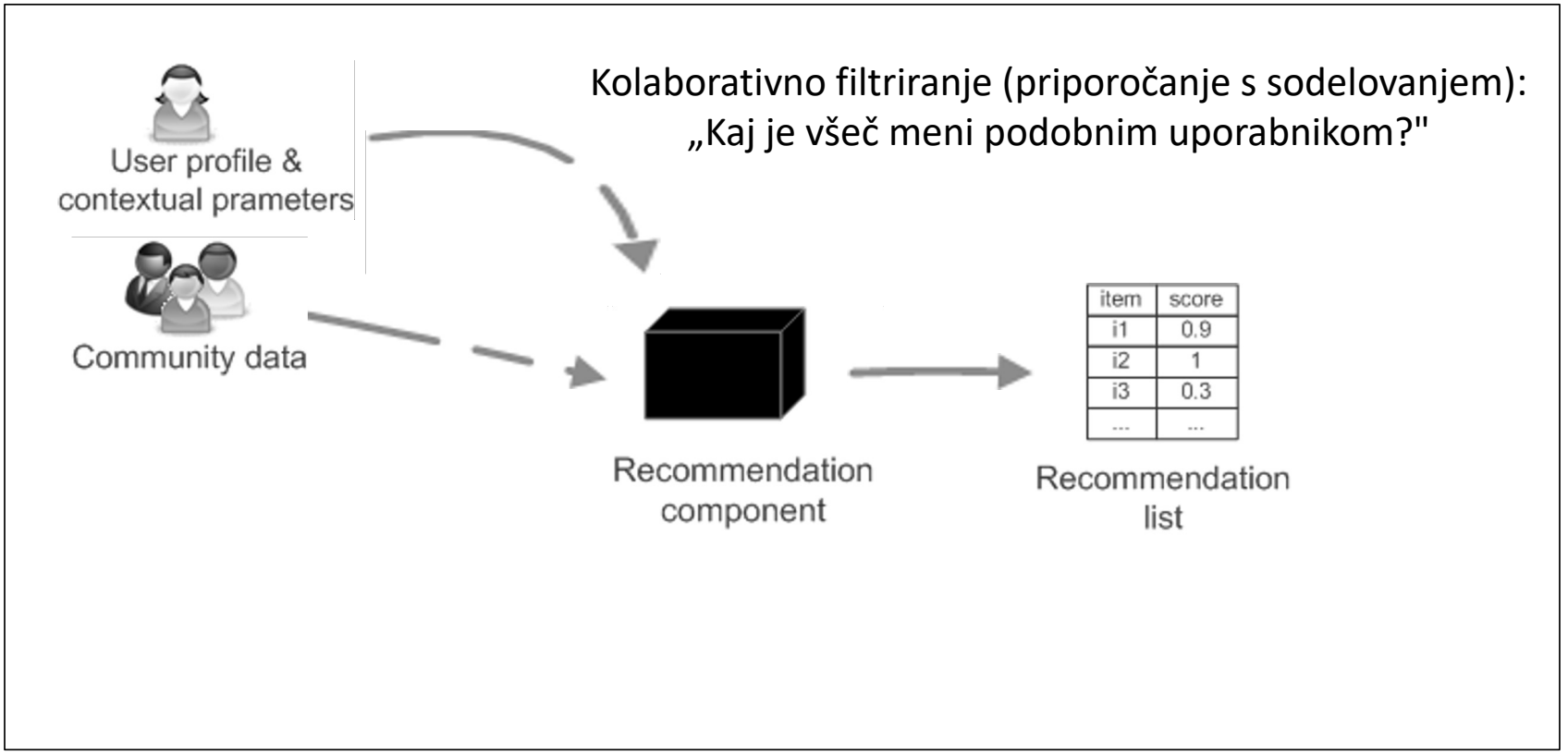
Zmanjševanje informacijske preobremenitve s priporočanjem relevantnih izdelkov. Kako?



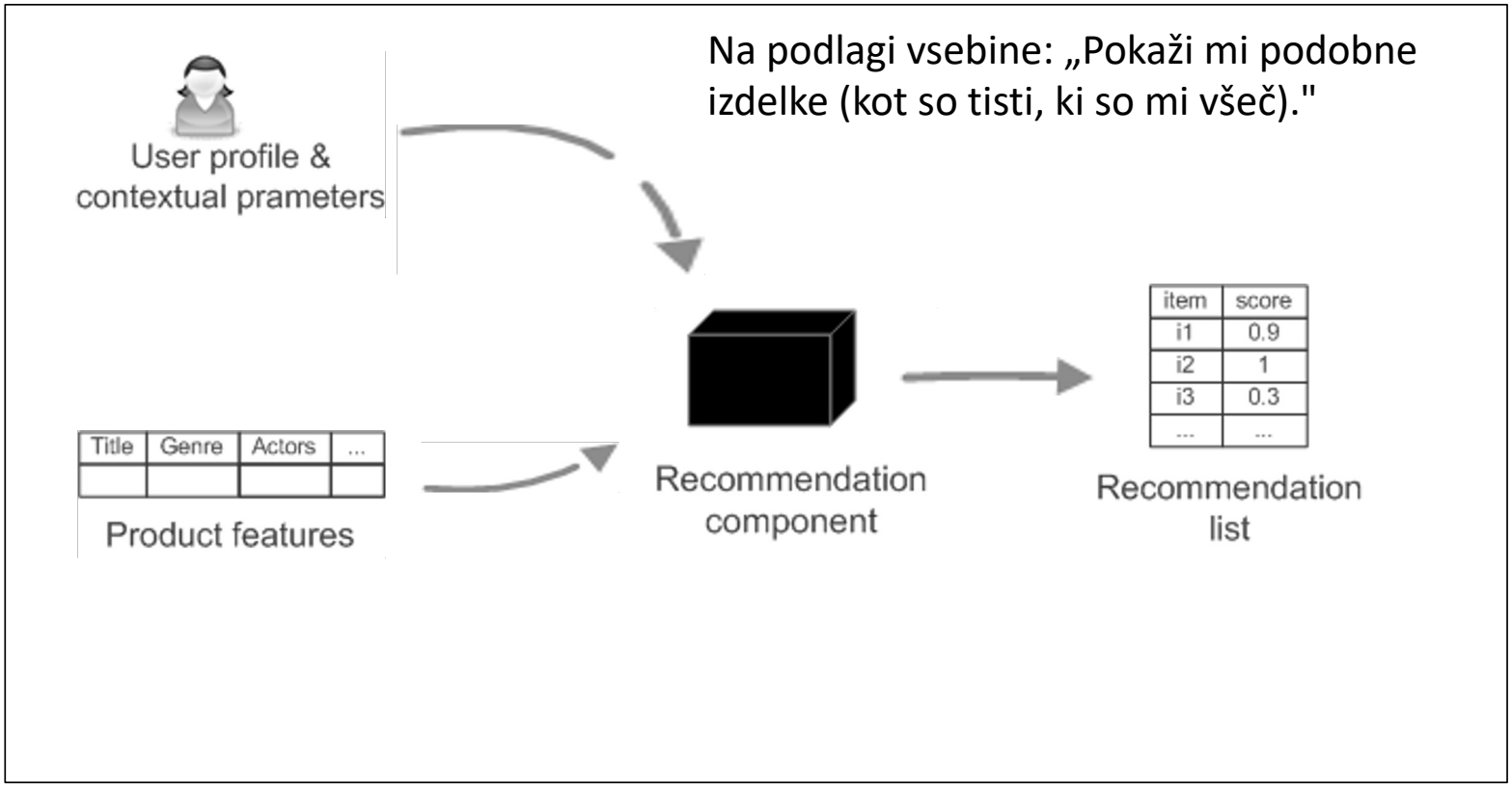
Paradigme priporočilnih sistemov



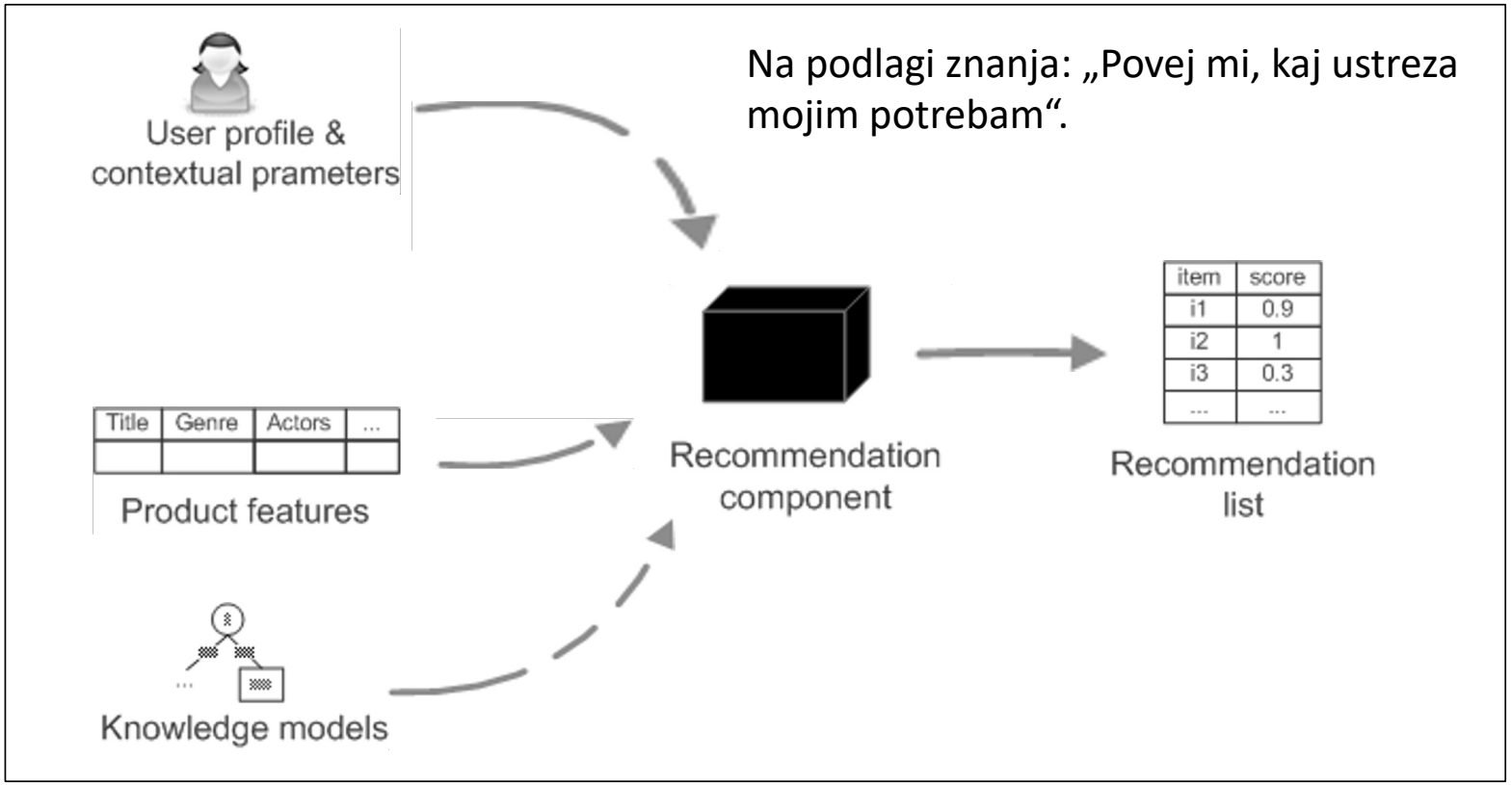
Paradigme priporočilnih sistemov



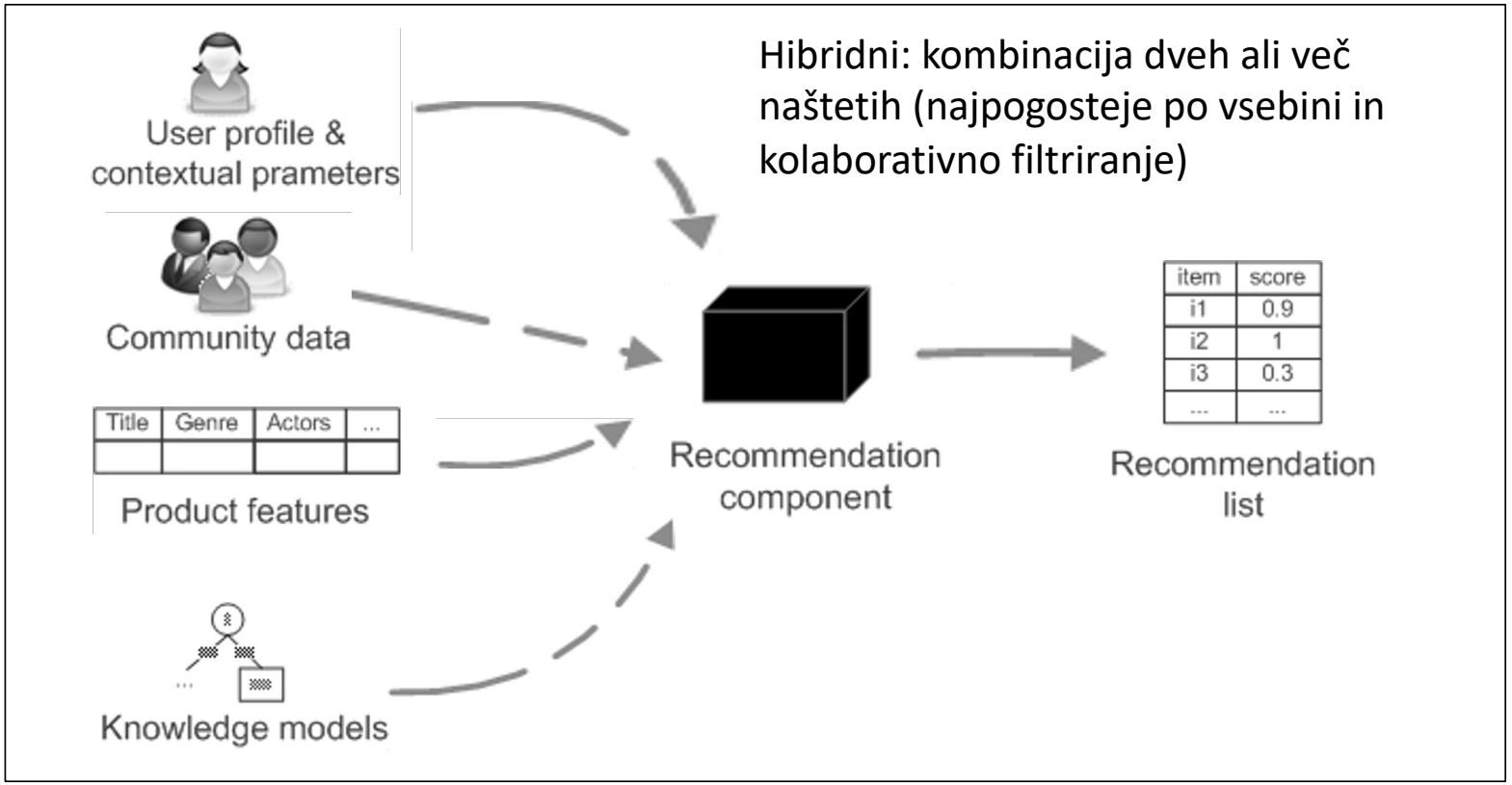
Paradigme priporočilnih sistemov



Paradigme priporočilnih sistemov

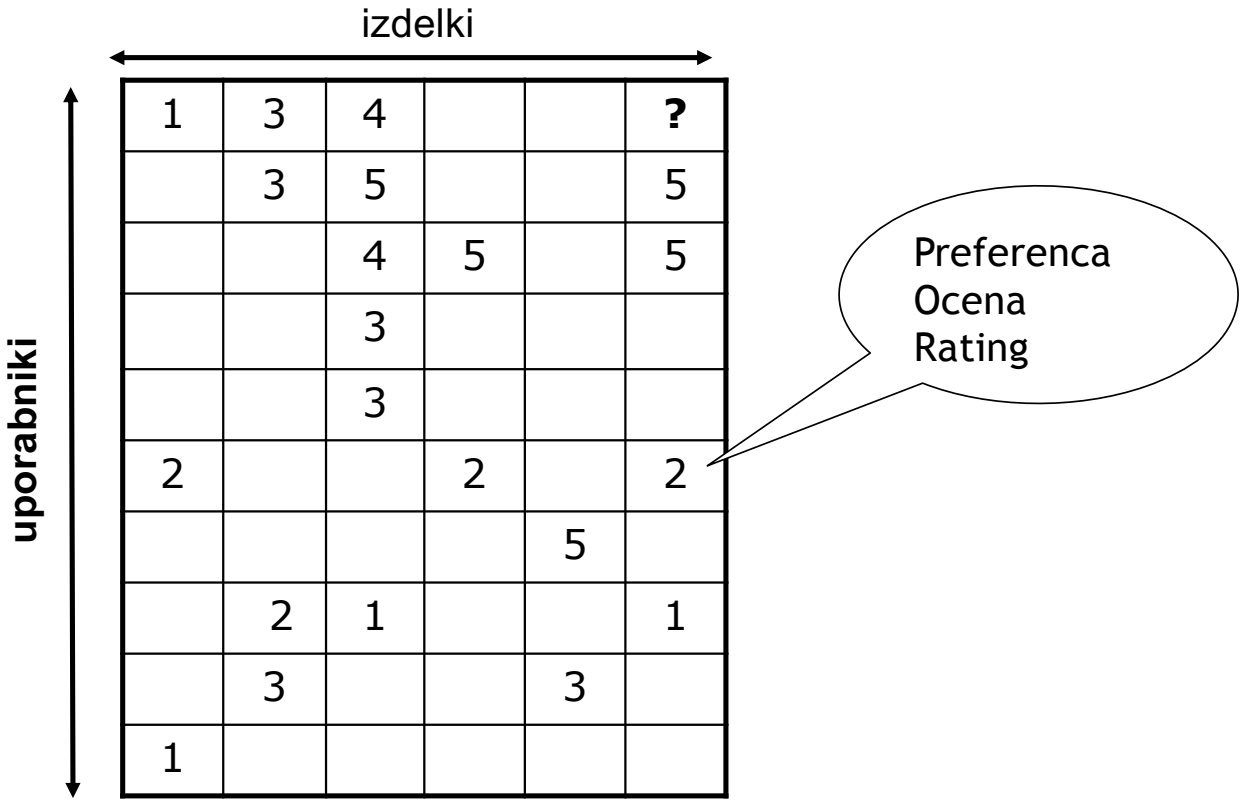


Paradigme priporočilnih sistemov



Hibridni: kombinacija dveh ali več naštetih (najpogosteje po vsebini in kolaborativno filtriranje)

Preferenčna matrika (utility matrix)



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

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

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

- Izračun preference:

a, *b*: uporabnika
p: izdelek

$$pref(a,p) = \overline{r_a} + \frac{\sum_{b \in N} sim(a,b) * (r_{b,p} - \overline{r_b})}{\sum_{b \in N} sim(a,b)}$$

(na podlagi najbližjih sosedov b∈N)

Priporočanje na podlagi modela (model based)

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

Preprost model – Slope One (premica $y = 1 \cdot x + n$)

- Oceno izdelka izračunamo na podlagi tega, kako se ocene uporabnika za druge izdelke razlikujejo od ocen drugih uporabnikov za isti izdelek.
- Za vsak par izdelkov (i, j) izračuna povprečno razliko v ocenah uporabnikov, ki so ocenili oba izdelka: $dev(i, j)$.
- Napovedovanje ocen: za napoved uporabnikove ocene izdelka *j*, upoštevaj vse izdelke $i \in I$, ki jih je uporabnik že ocenil. Za vsak tak izdelek i je $delna\ ocena(j; i) = ocena(i) + dev(i, j)$
- Združevanje delnih ocen: povprečenje po vseh izdelkih *i*, ki jih je uporabnik že ocenil.
- Končno: $ocena(j) = \frac{1}{|I|} \sum_{i \in I} (ocena(i) + dev(i, j))$

Organizacija podatkov za priporočanje

- Predstavitev preferenc/ratingov
  - Redka (skoraj prazna) preferenčna matrika
  - Tipično manj kot 0,01% definiranih vrednosti
  - Amazon: 300 milijonov uporabnikov, 350 milijonov izdelkov (vključno z Marketplace)
  - Manj potratno: koordinatna (COO) preferenčna matrika
  - Princip ključ-vrednost oz. slovar: *preferenca(user, item, rating)*
  - Kateri način je primernejši za hrambo v PB?
- Tipične operacije:
  - Izračun podobnosti
  - Iskanje najbližjih sosedov
  - Izračun, uporaba napovednega modela
  - Matrična faktorizacija

	I_1	I_2	I_3	…	…	I_N
U_1	1	3	4			**?**
U_2		3	5			5
U_3			4	5		5
…			3			
U_M	1					

Uporabnik (user)	Izdelek (item)	Ocena (rating)
U_1	I_1	1
U_1	I_2	3
U_1	I_3	4
U_2	I_2	3
U_2	I_3	5
U_2	I_N	5
…	…	…
U_M	I_1	1

Priporočanje v podatkovni bazi

- Preprosta integracija v poljuben informacijski sistem
  - Priporočilo kot rezultat operacije (poizvedbe, funkcije, procedure) v PB
- Izbor organizacije podatkov in primerne metode na nivoju PB
  - Predstavitev preferenčne matrike?
  - Preproste metode (npr. Slope One) – linearni model z enim faktorjem
  - https://stackoverflow.com/questions/2440826/collaborative-filtering-in-mysql
  - Nerelacijske PB (grafi)
  - Vektorski dodatki relacijskim SUPB (pgvector) ali vektorski SUPB – iskanje najbližjih sosedov
  - Napovedni model znotraj SUPB?