Semantic Search in Cafebazaar

PageRank revisited in a different way

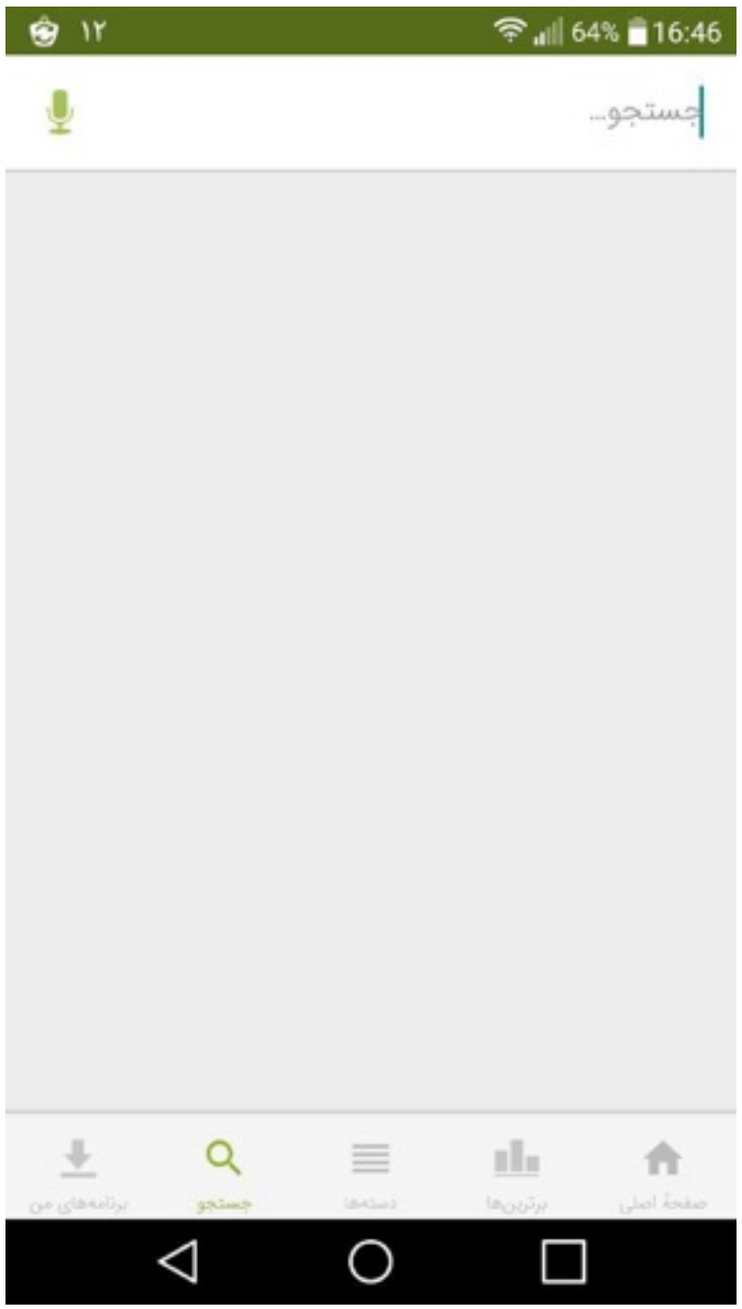
Yasmin Sarcheshmehpour

Cafe bazaar Search

Cafebazaar


۱۲
63% 16:49
بازار
KING FIGHT
چالش با دیگران در یک نبرد حماسی
فقط در کافه‌بازار
برنامه‌های تازهٔ برگزیده
همه
حسابیت (فاکتور آنلاین)
رایگان
طاقچه | کتاب‌های الکتر...
رایگان
وی‌تور (راهنمای ویدیویی سفر)
رایگان
ycards by Duolingo
رایگان
بازی‌های تازهٔ برگزیده
همه
صفحهٔ اصلی
برترین‌ها
دسته‌ها
جستجو
برنامه‌های من

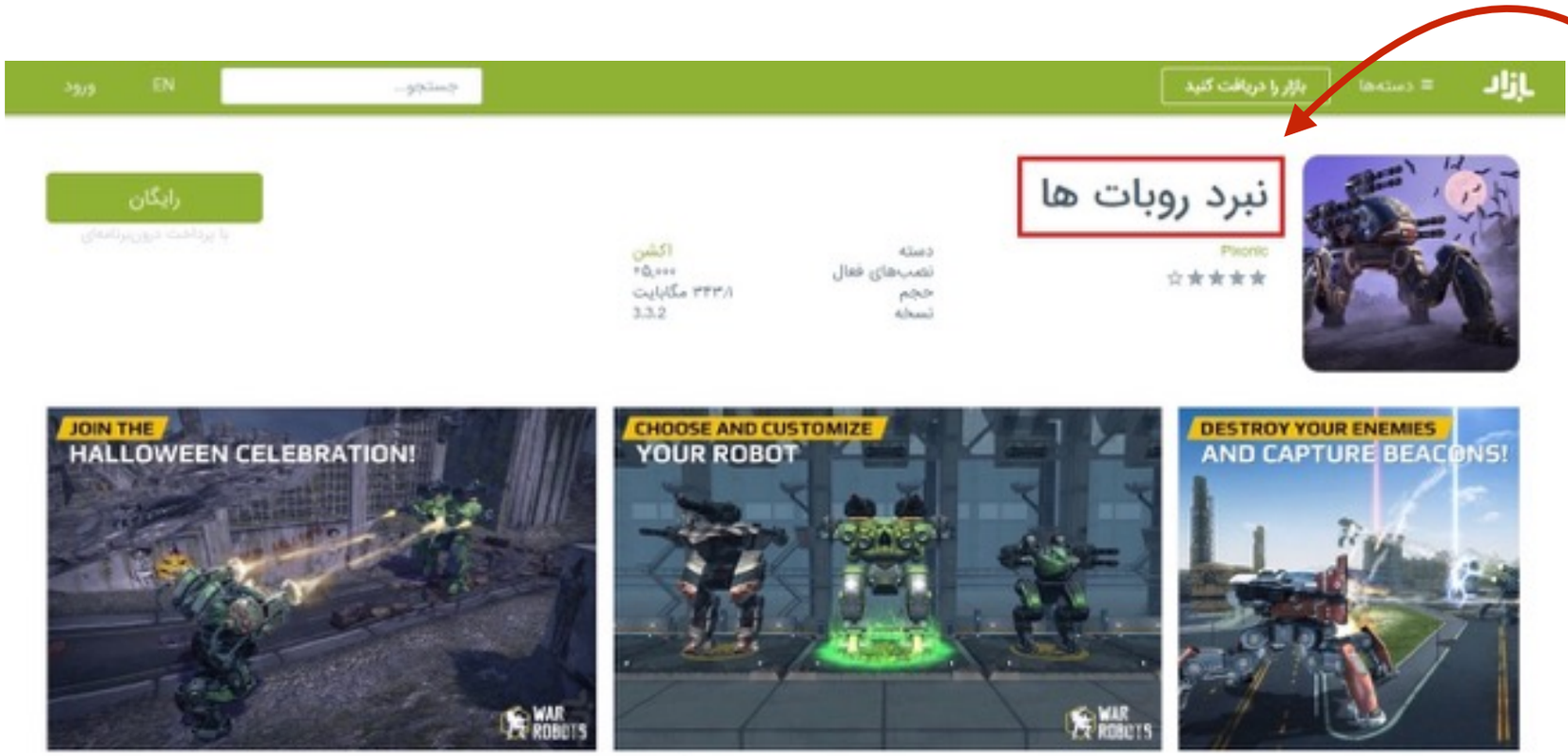
Cafebazaar Search



What do we do?

List of apps

What do we know about apps?



Name

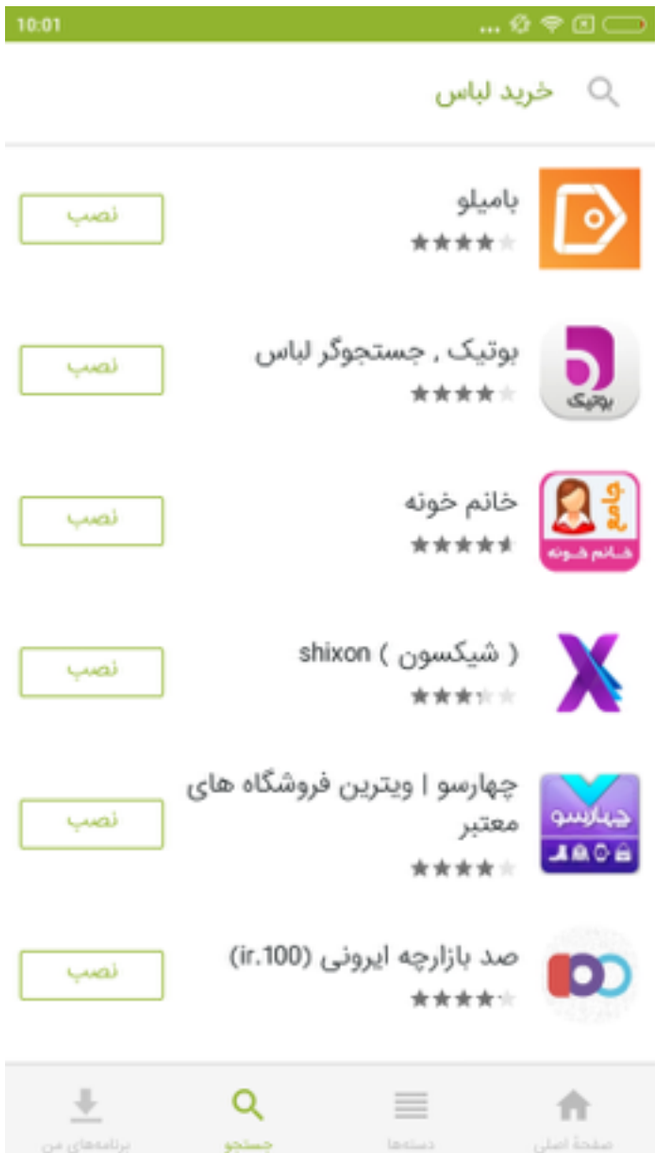
Description

How do we use this data?

Extract Keywords!

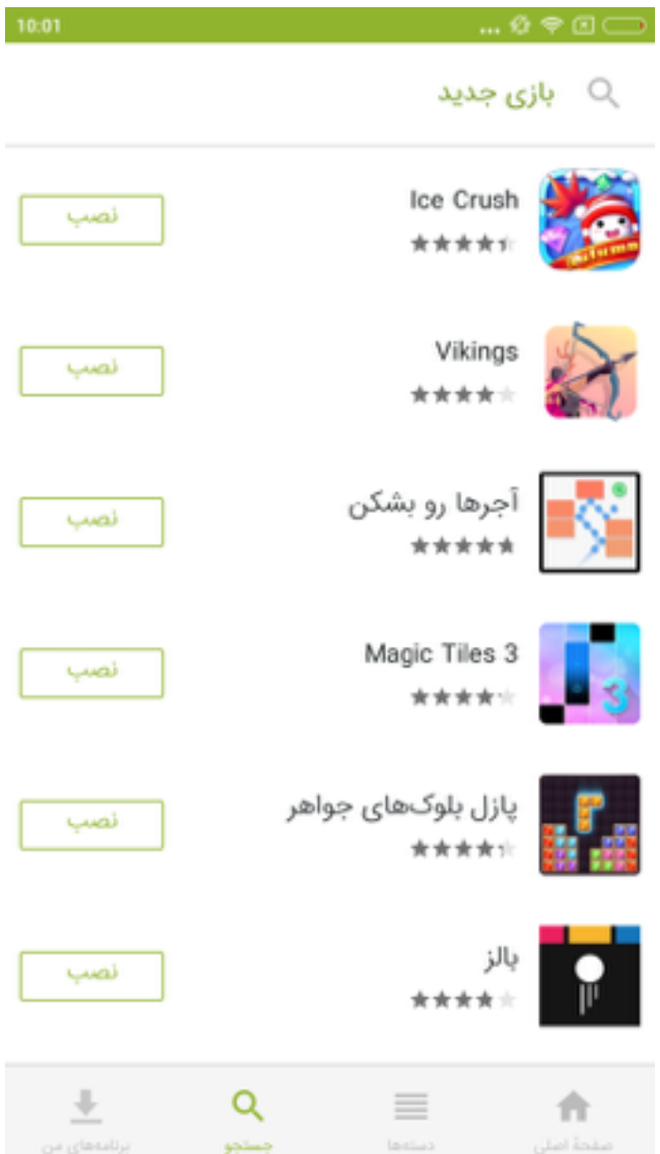
Search Example #1

Search Example #2



Search Example #3

Search Example #4



Users decide which apps are new!

There are two types of queries

1. Non-semantic queries
2. Semantic queries

Description problems

- Incomplete and not precise

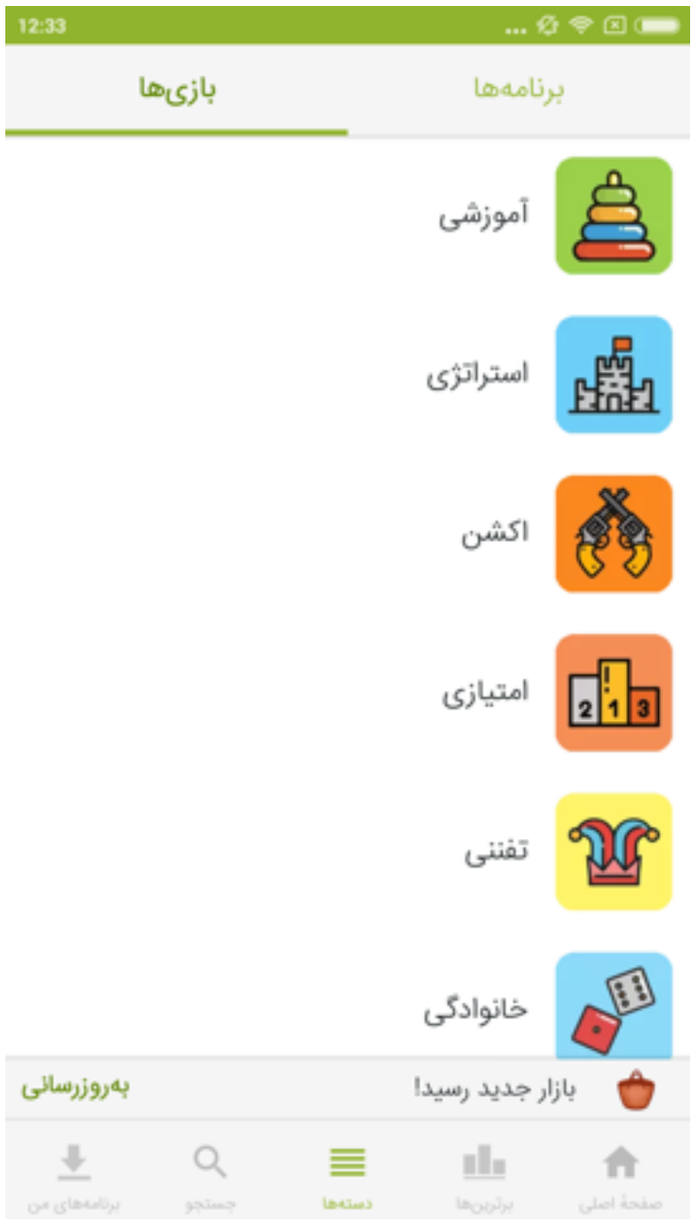
Description benefits

- support non-semantic queri

Besides description keywords,
how can we find semantic relations
between apps and queries?

The journey

Manual ways


12:33
برنامه‌ها
بازی‌ها
آموزشی
استراتژی
اکشن
امتیازی
تفننی
خانوادگی
بازار جدید رسید!
به‌روزرسانی
برنامه‌های من
جستجو
دسته‌ها
برترین‌ها
صفحهٔ اصلی


12:34
برنامه‌ها
بازی‌ها
آب و هوا
آشپزی و رستوران
آموزش
ابزارها
امور مالی
پیام‌رسان‌ها
خبرها و نشریات
برنامه‌های من
جستجو
دسته‌ها
صفحهٔ اصلی

Manual ways

- Precise
- Incomplete

Manual ways

- Precise
- Incomplete

Automatic solutions

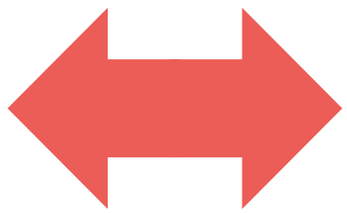
Automatic solutions

For finding semantic relations
between apps and queries

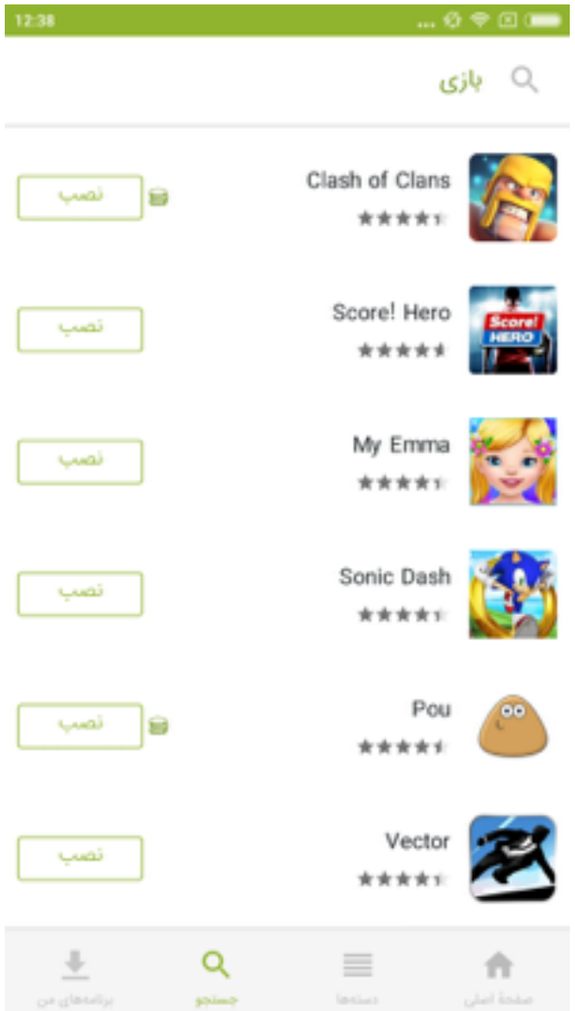
App  Keywords  Query

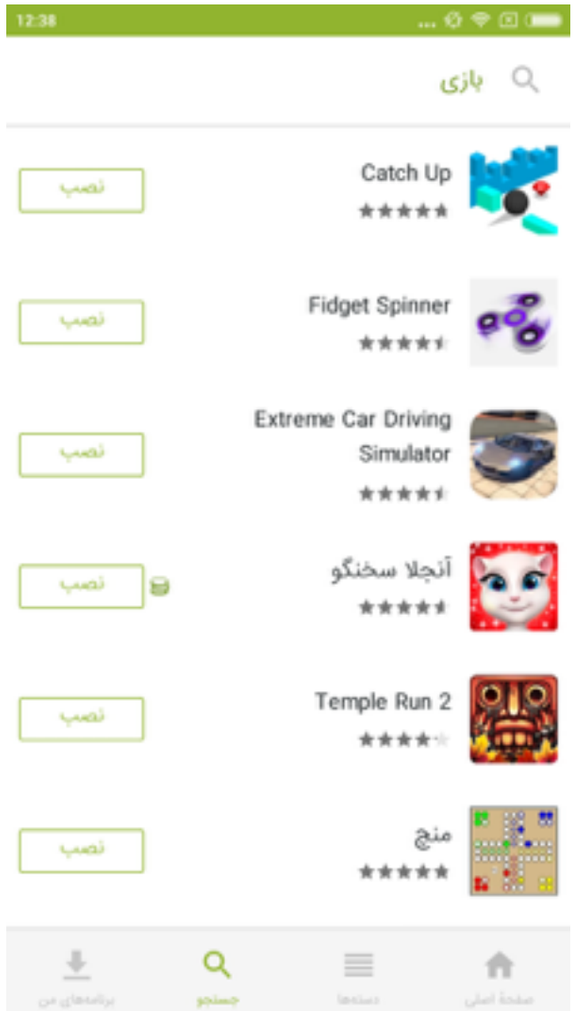
Automatic solutions

For finding semantic relations
between apps and queries

App  Query

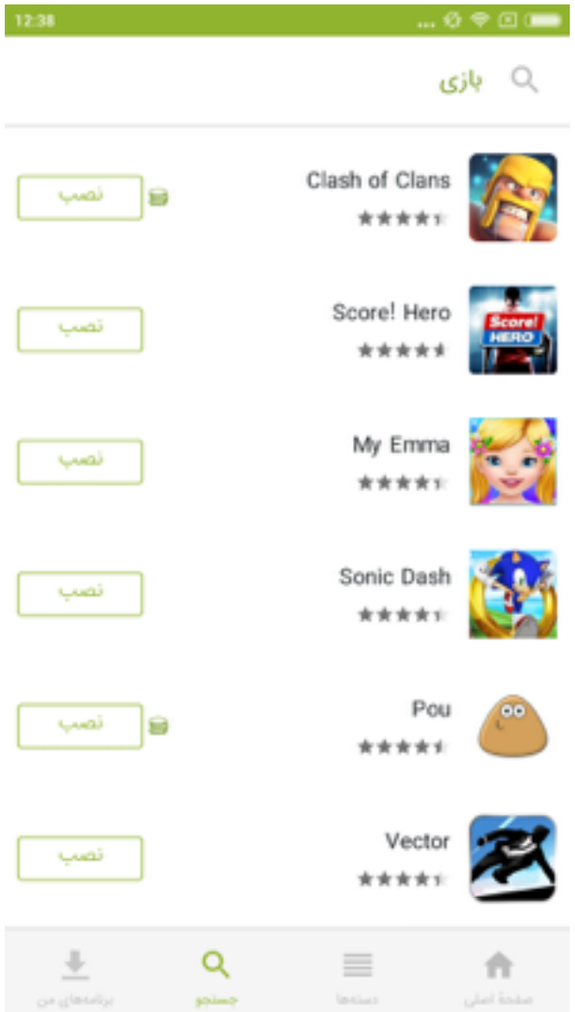
Query-Apps Semantic relations

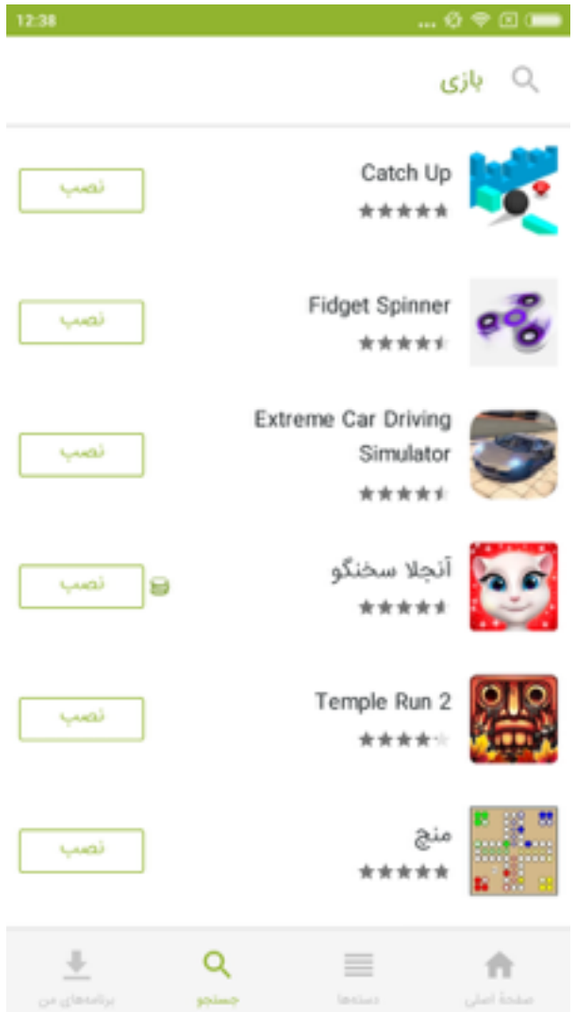




Which one is better? 🤔

Query-Apps Semantic relations





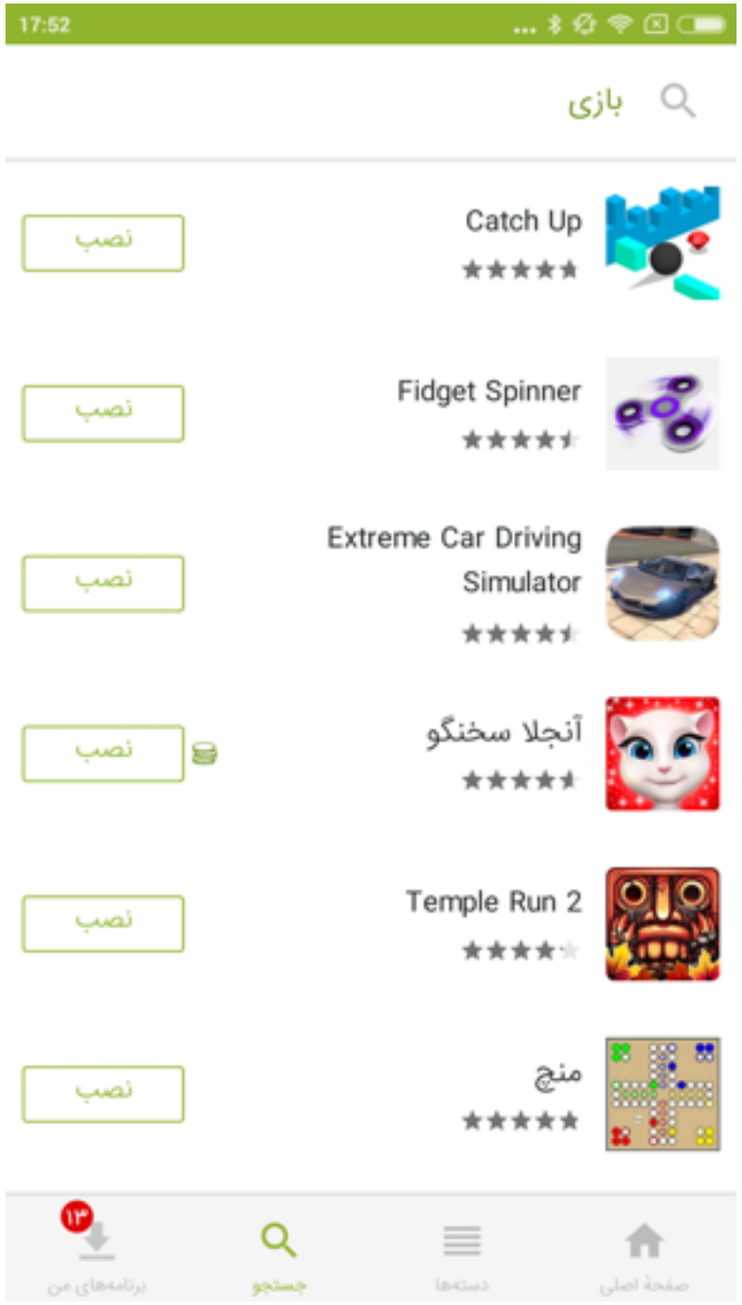
Which one is better? **Users decide!**

User feedbacks

Let’s see an example…

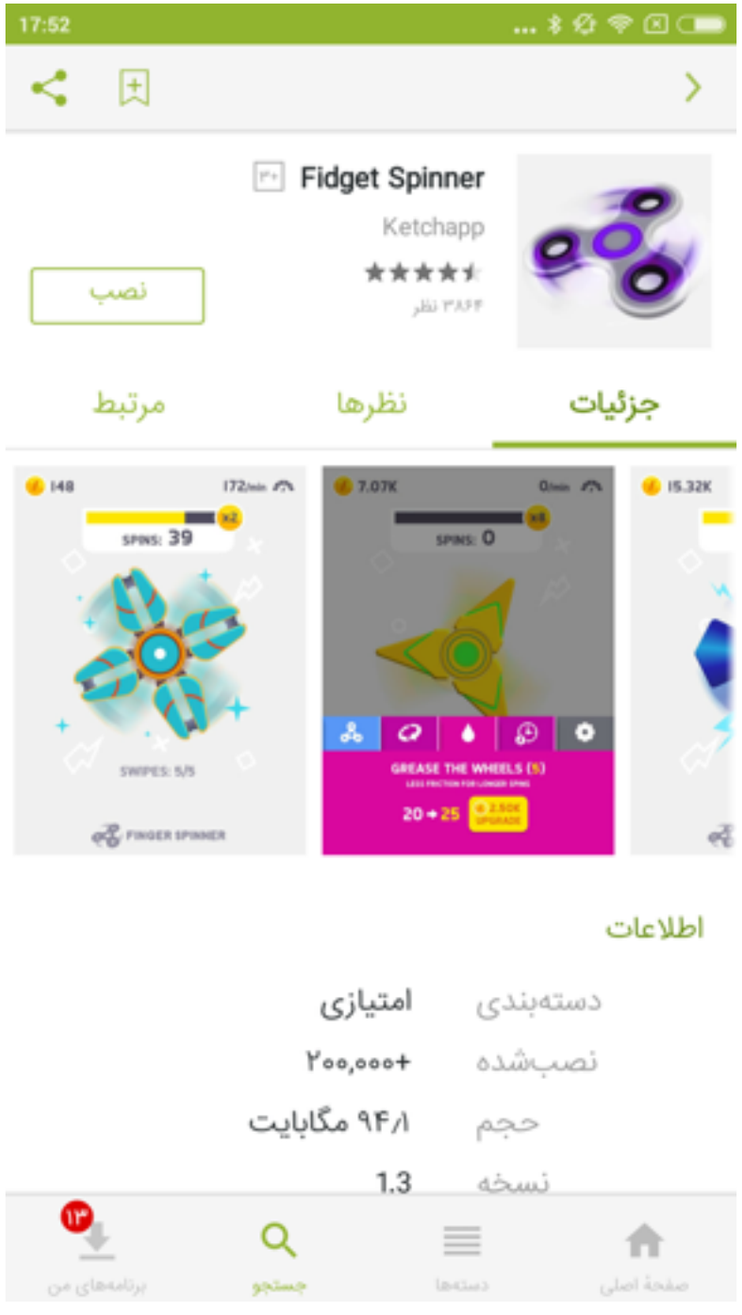
User feedbacks

Action: Search



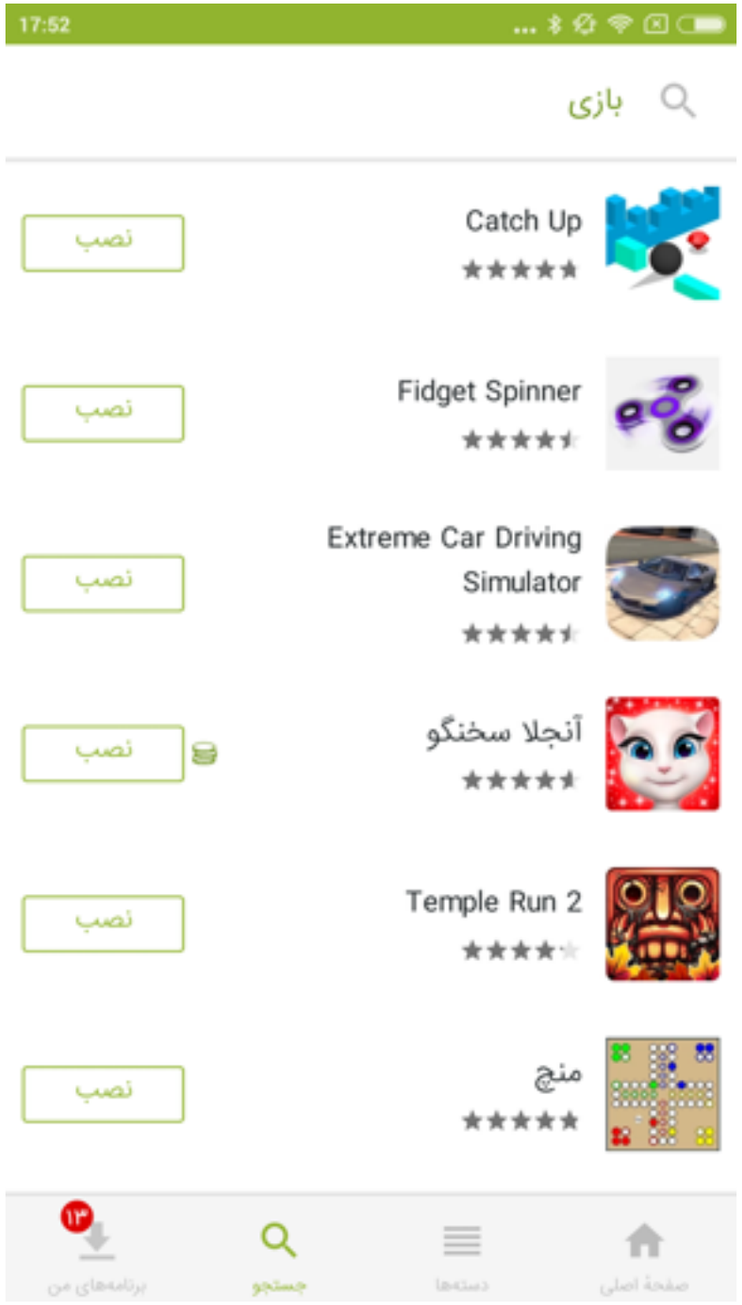
User feedbacks

Action: View



User feedbacks

Action: Move back

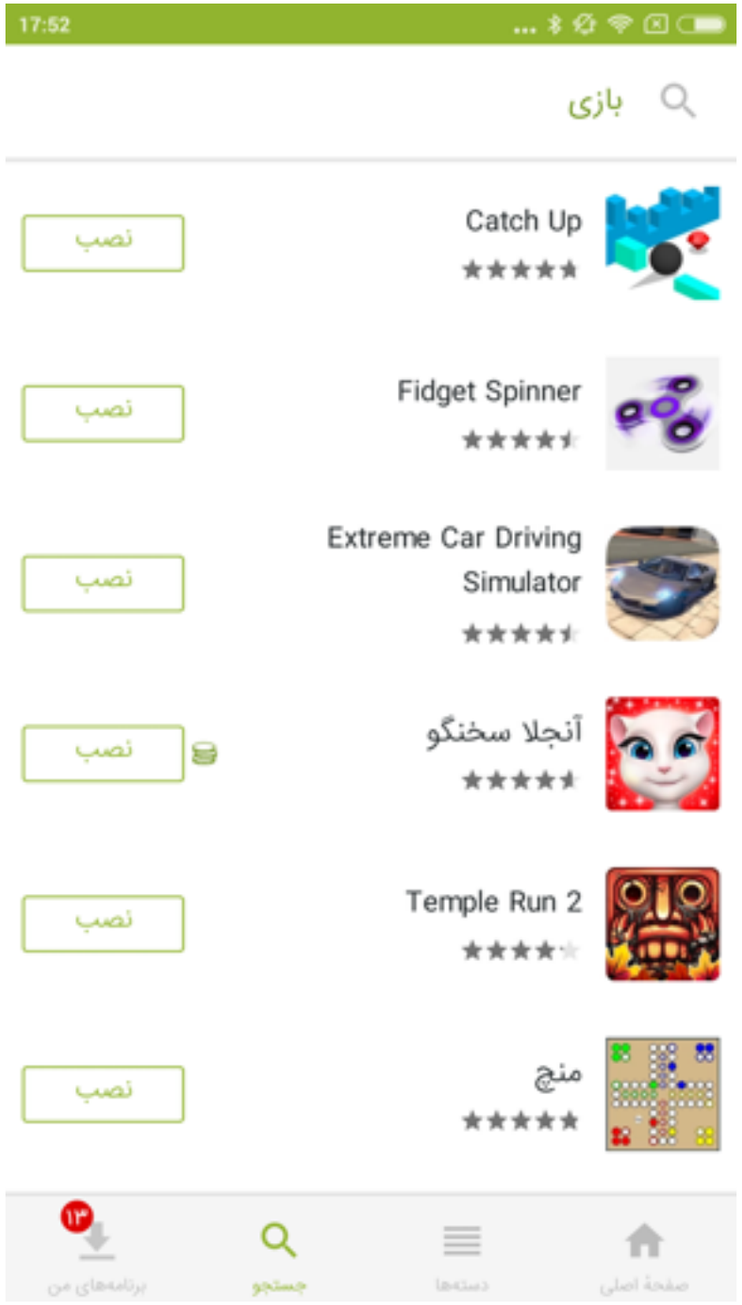


User feedbacks

Action: Install

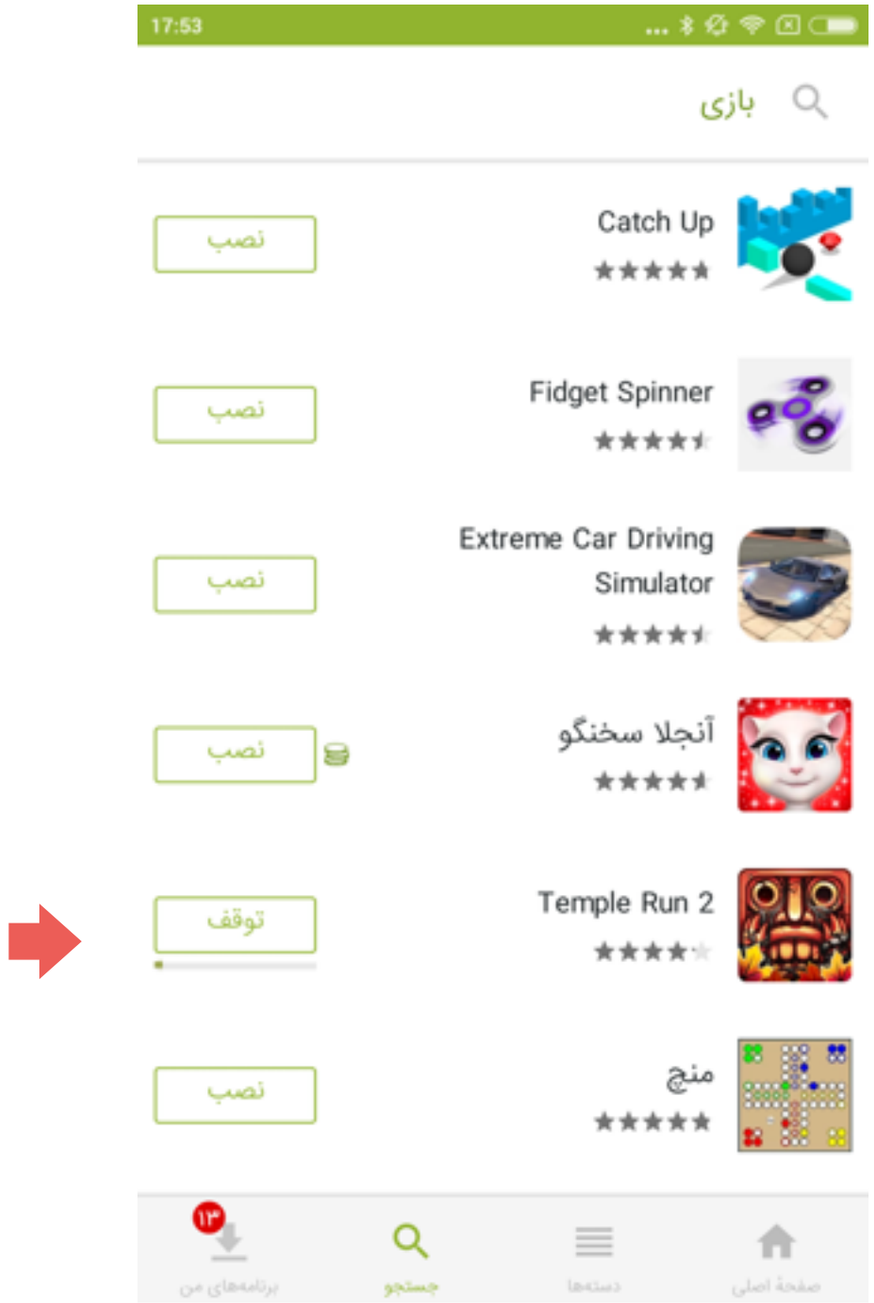
User feedbacks

Action: Move back



User feedbacks

Action: Install



How to use this data





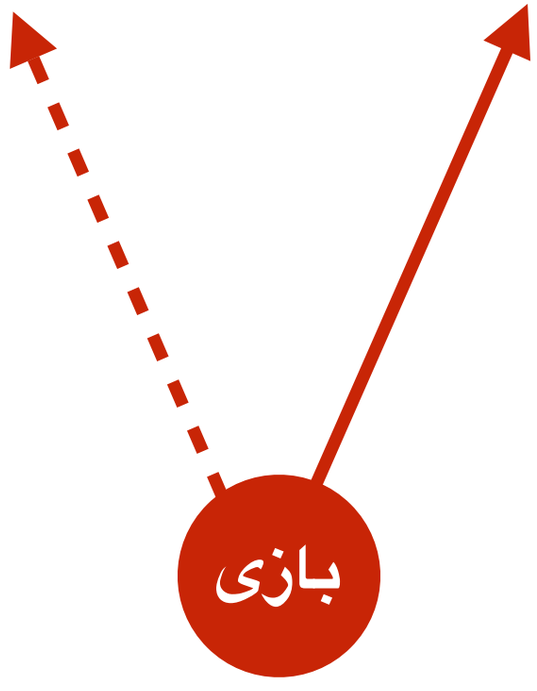
بازی

View/Install

How to use this data

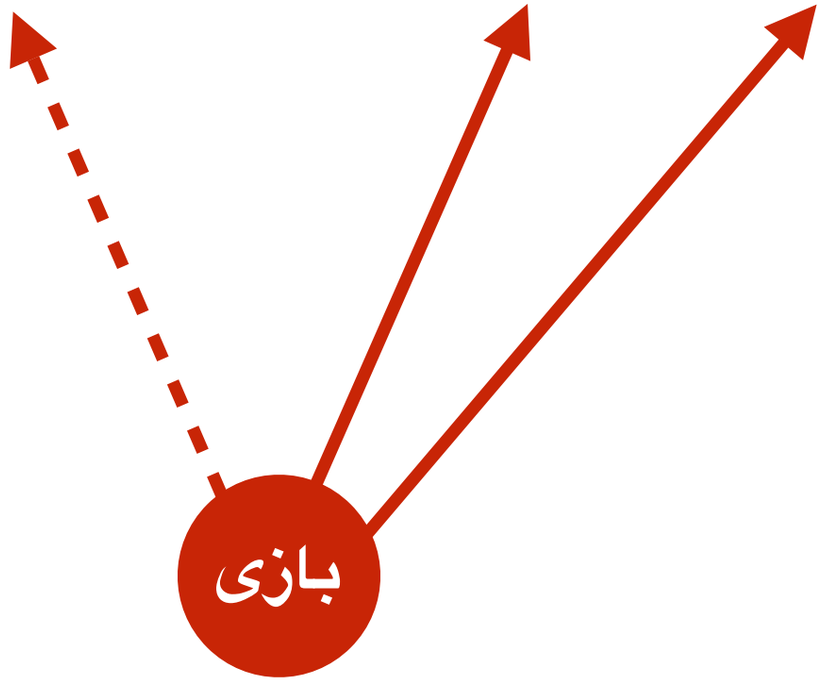
View/Install

How to use this data



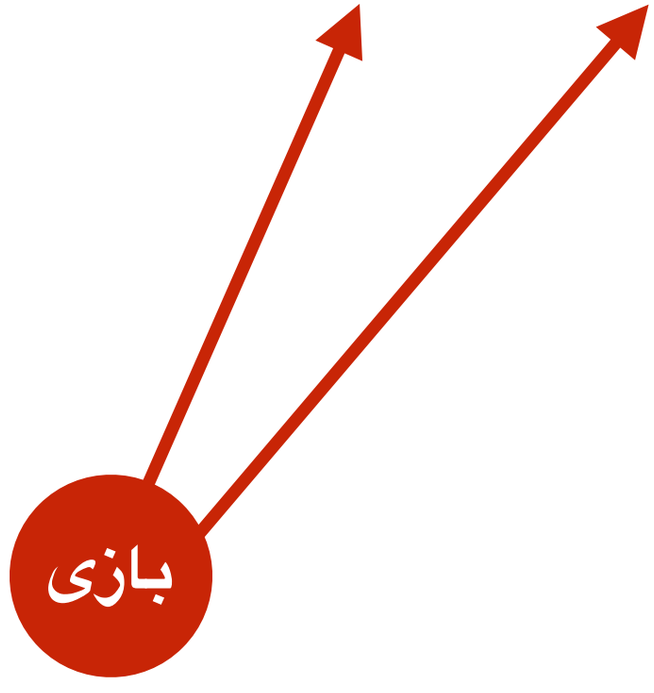
View/Install

How to use this data



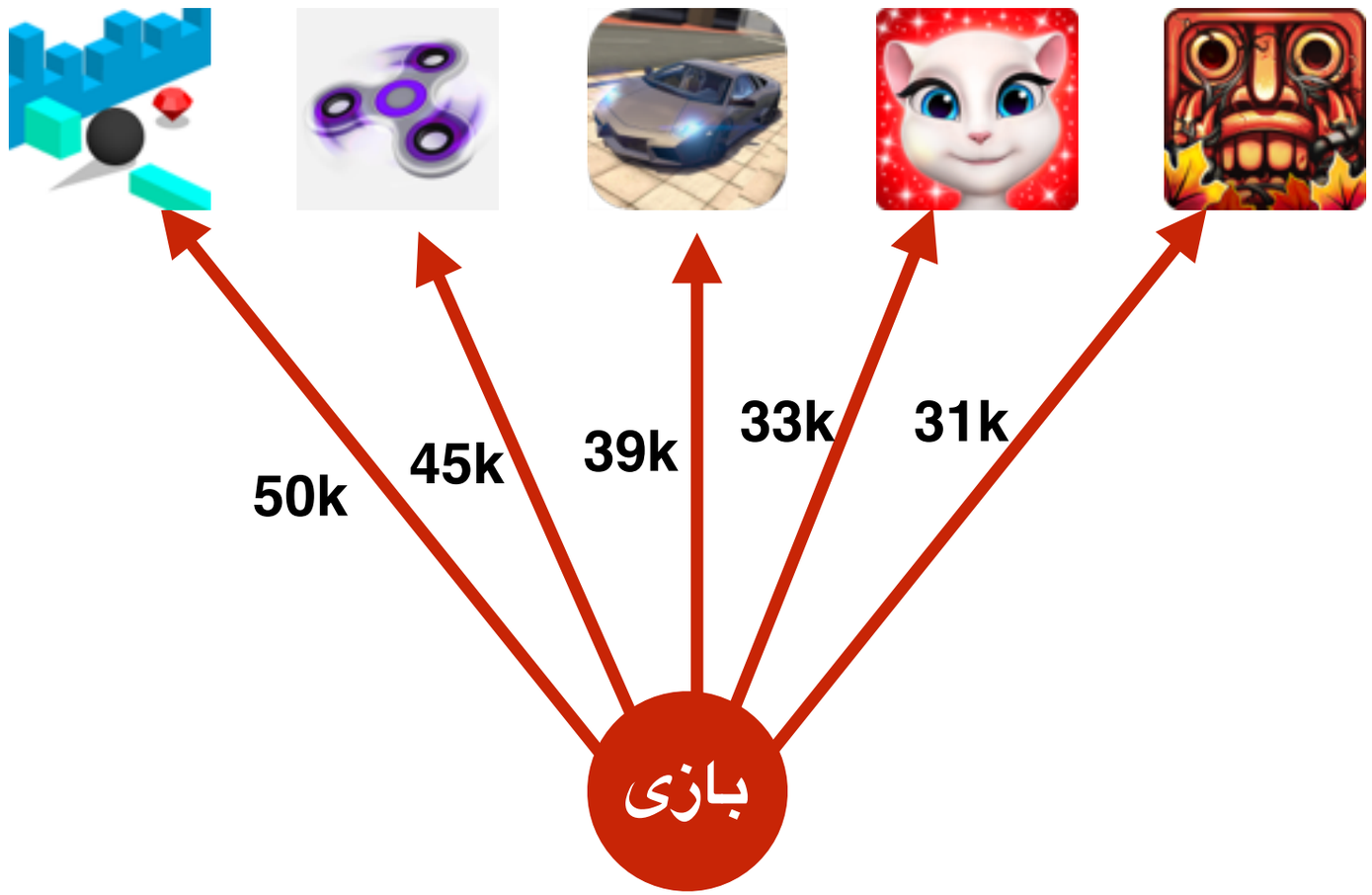
View/Install

How to use this data

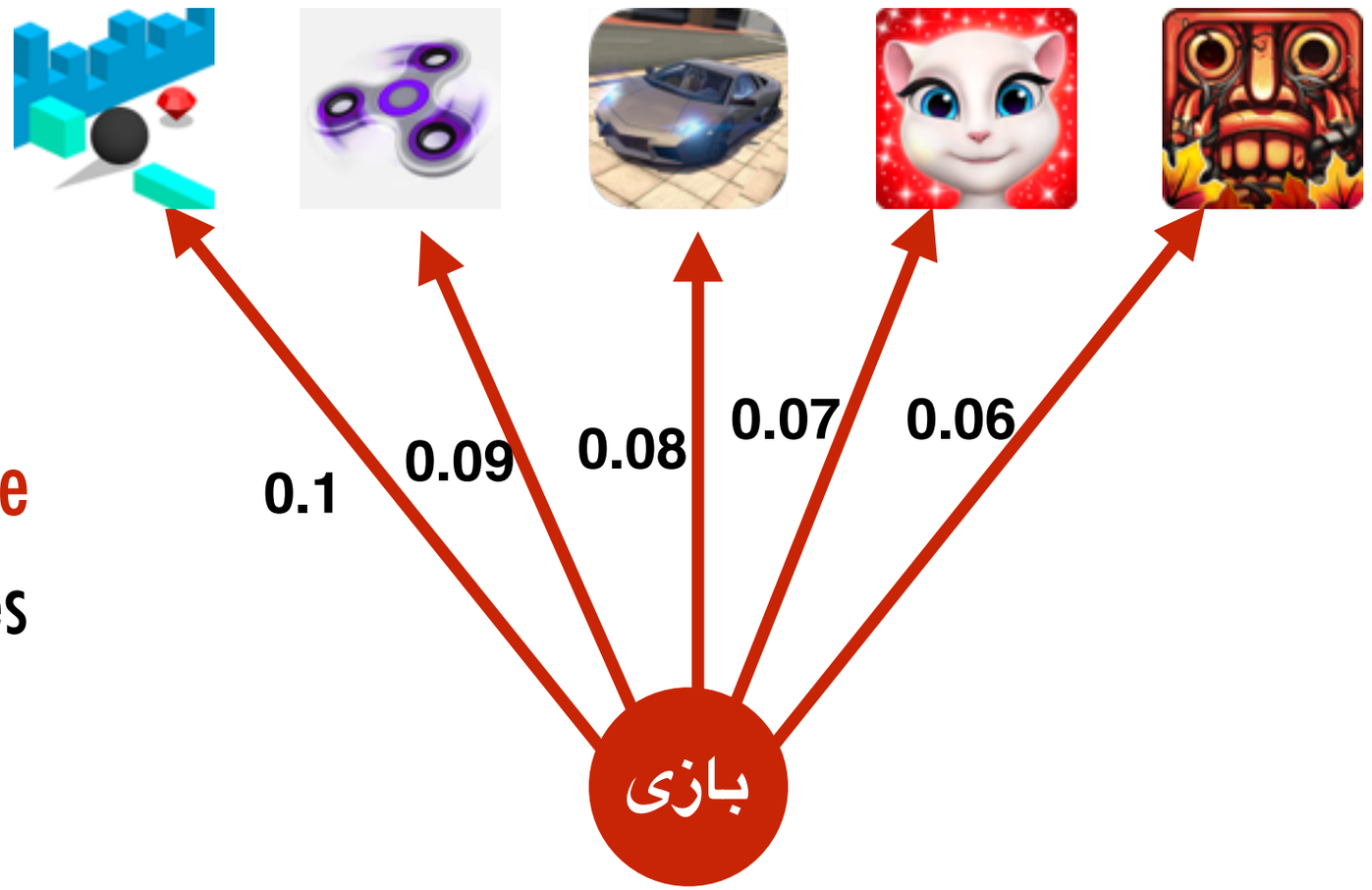


Install

User feedbacks graph



User feedbacks graph



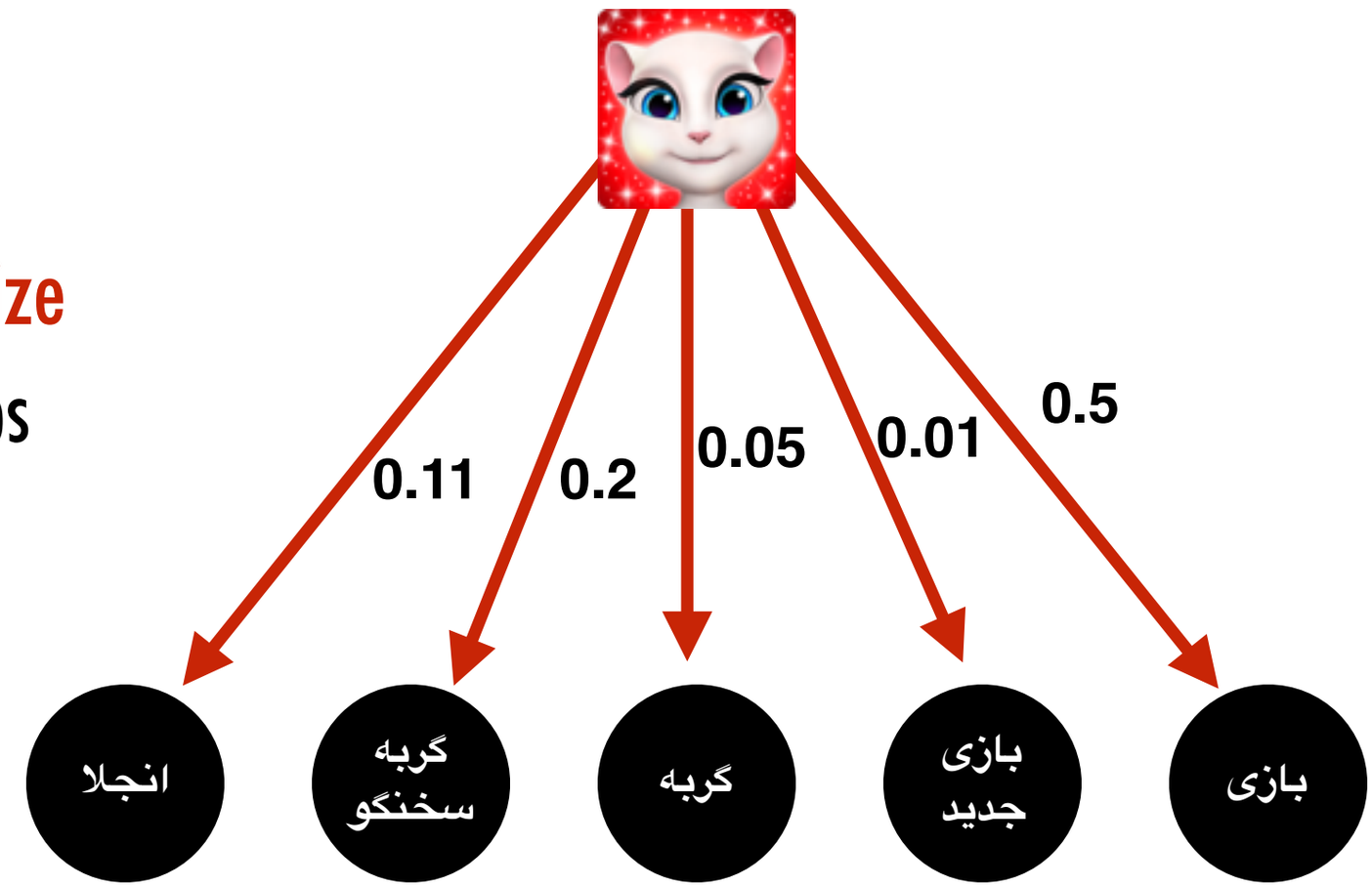
Normalize

for queries

User feedbacks graph

Normalize

for apps

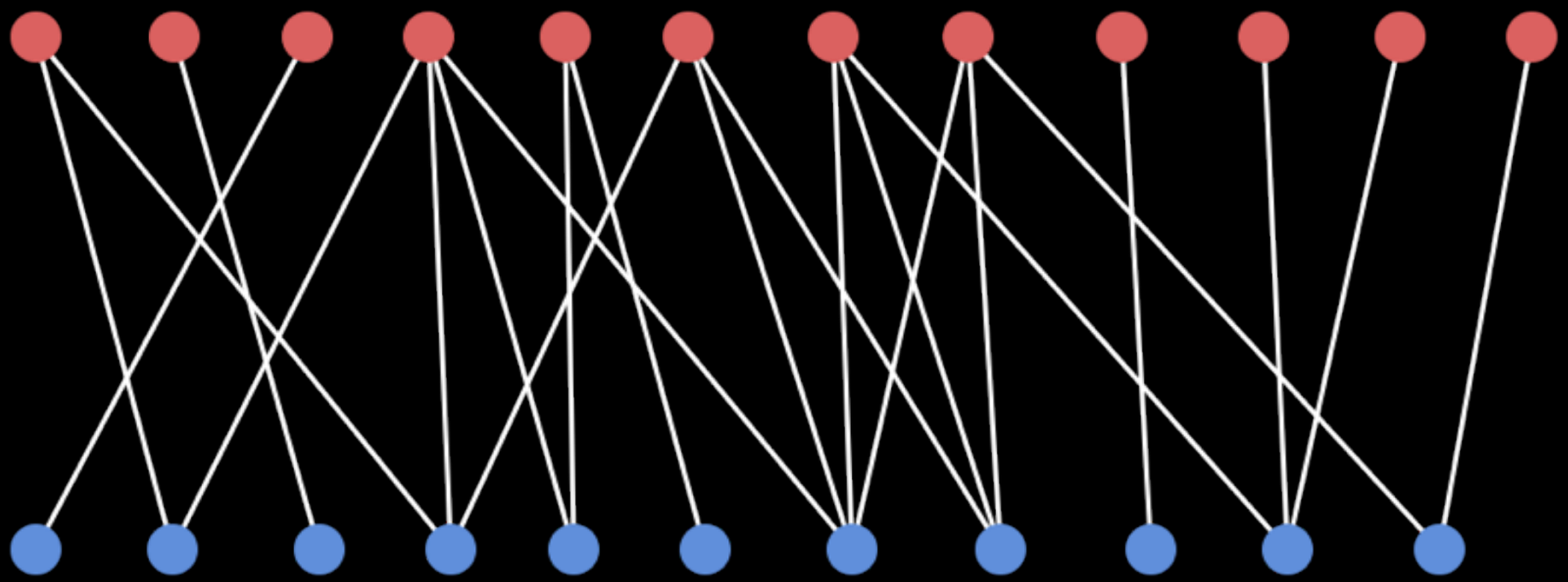


User feedbacks graph

Number of apps: 150000

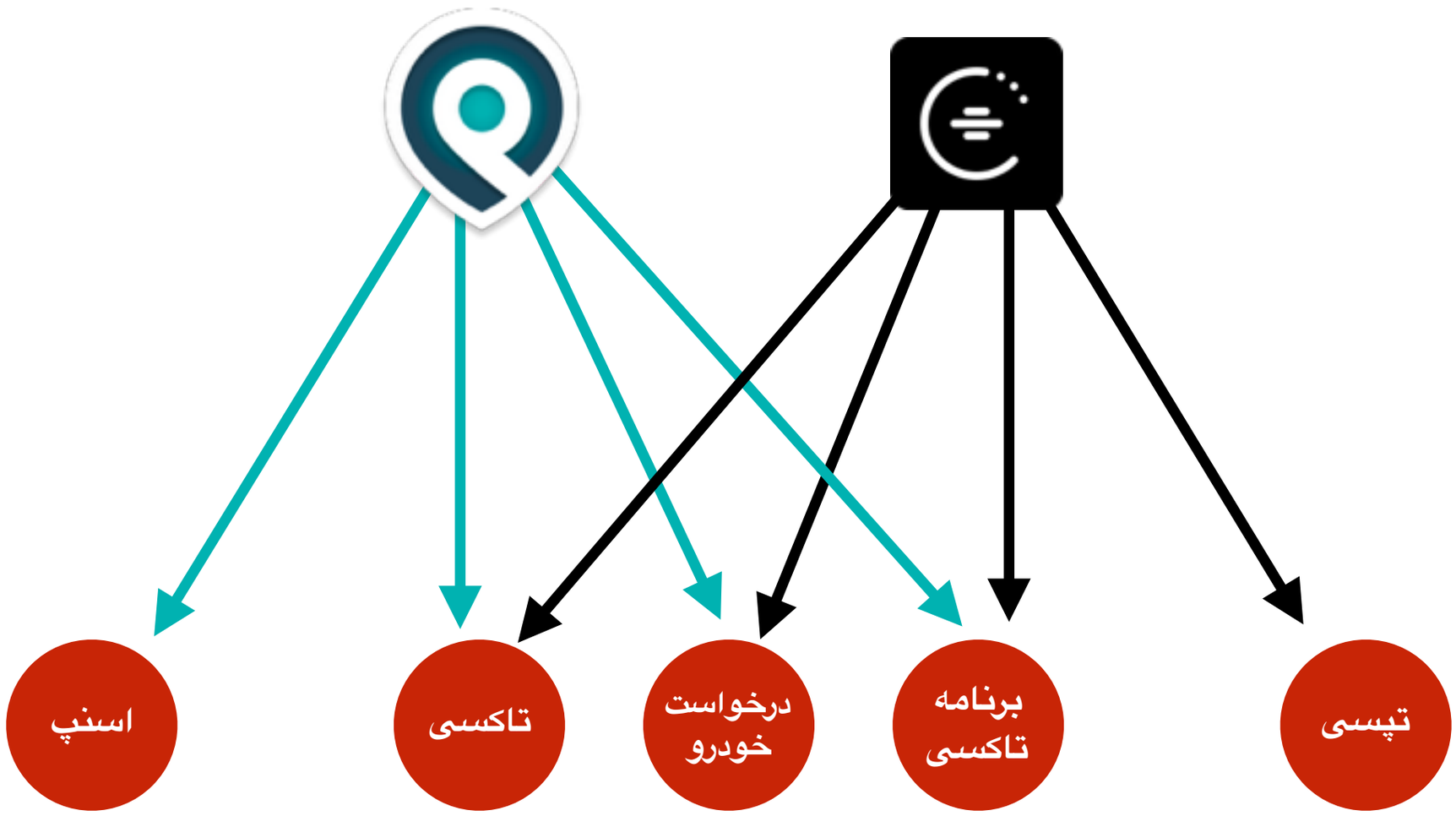
Number of queries: 800000

Number of edges: 2500000



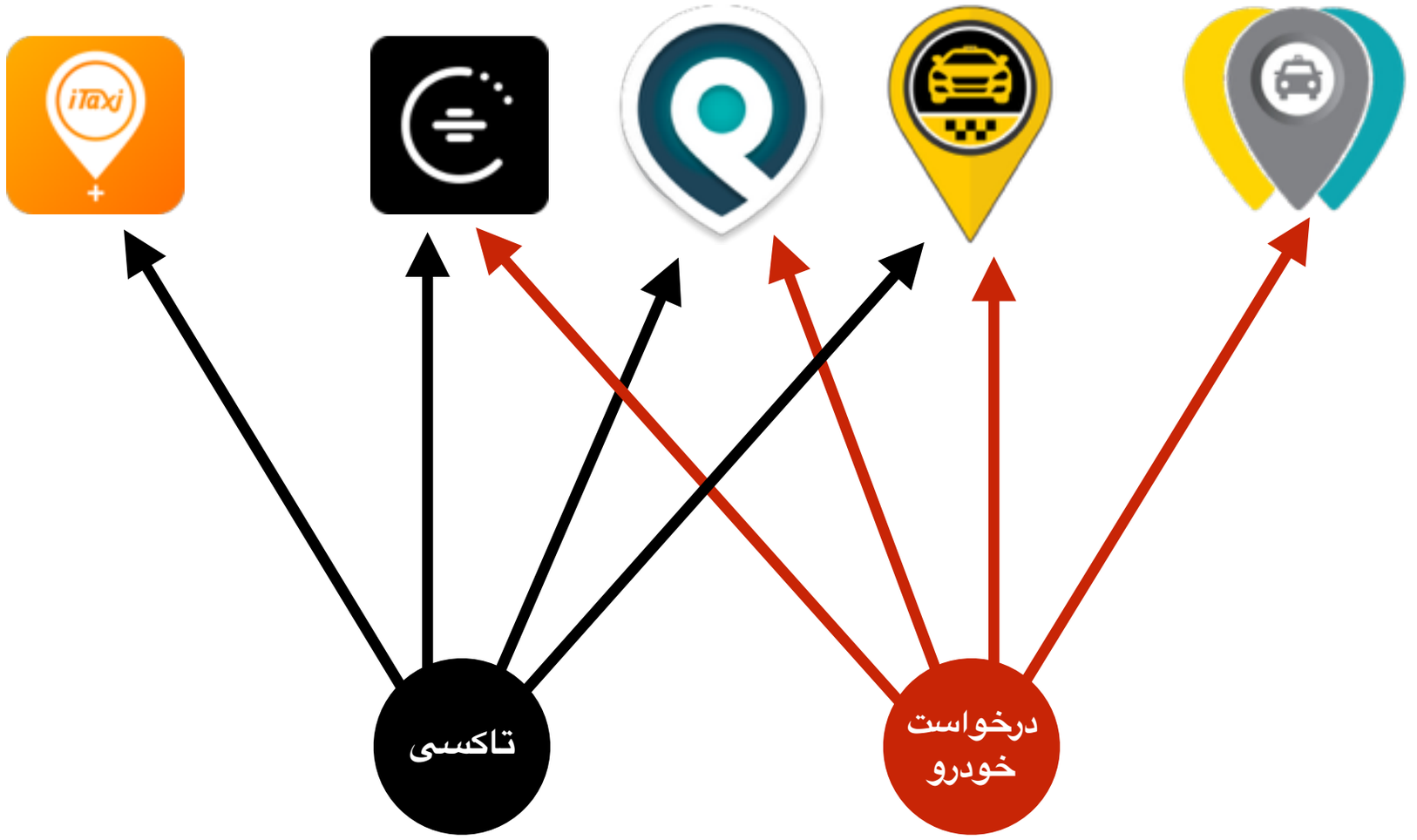
Similarity Facts

for apps

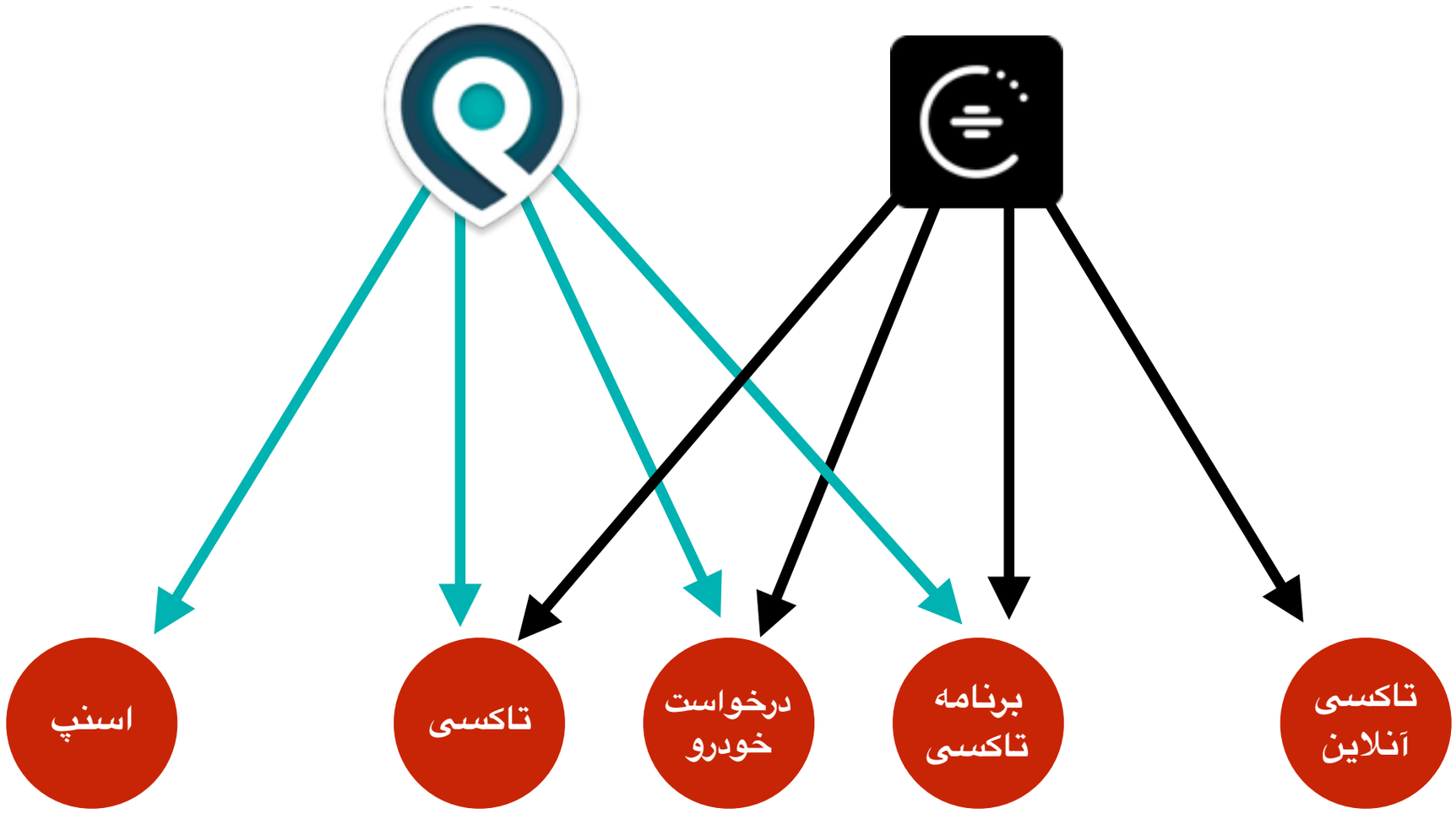


Similarity Facts

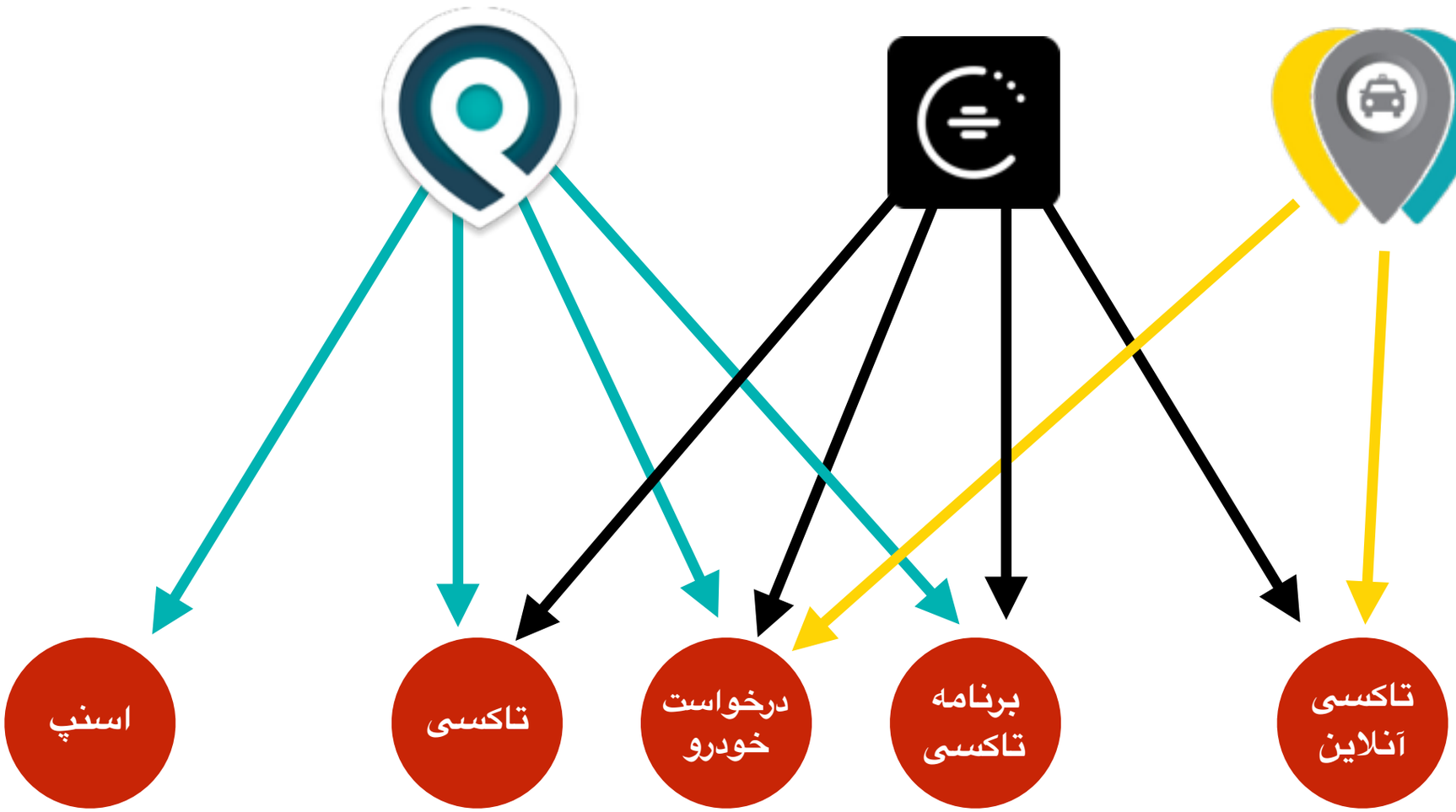
for queries



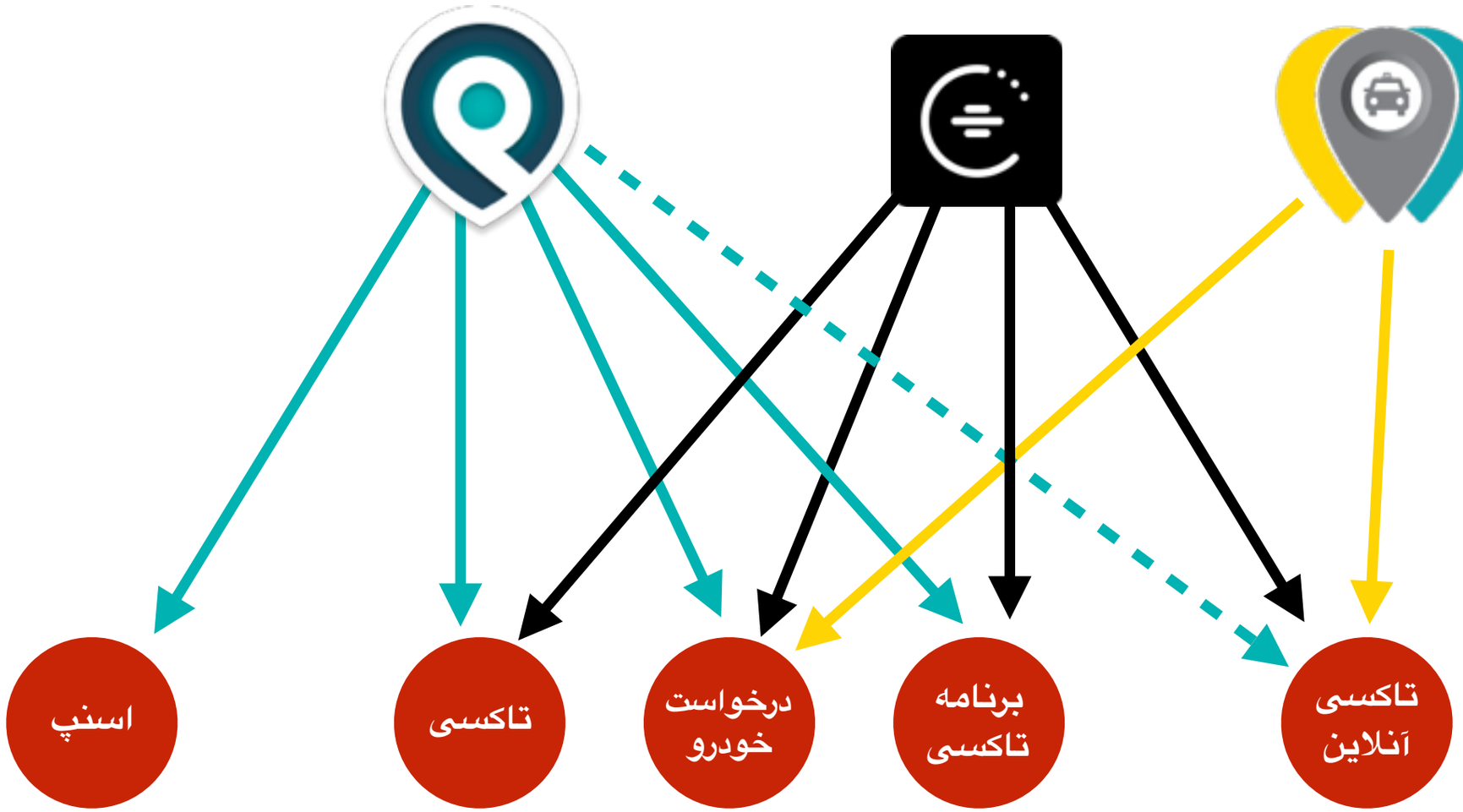
Predict missing edges



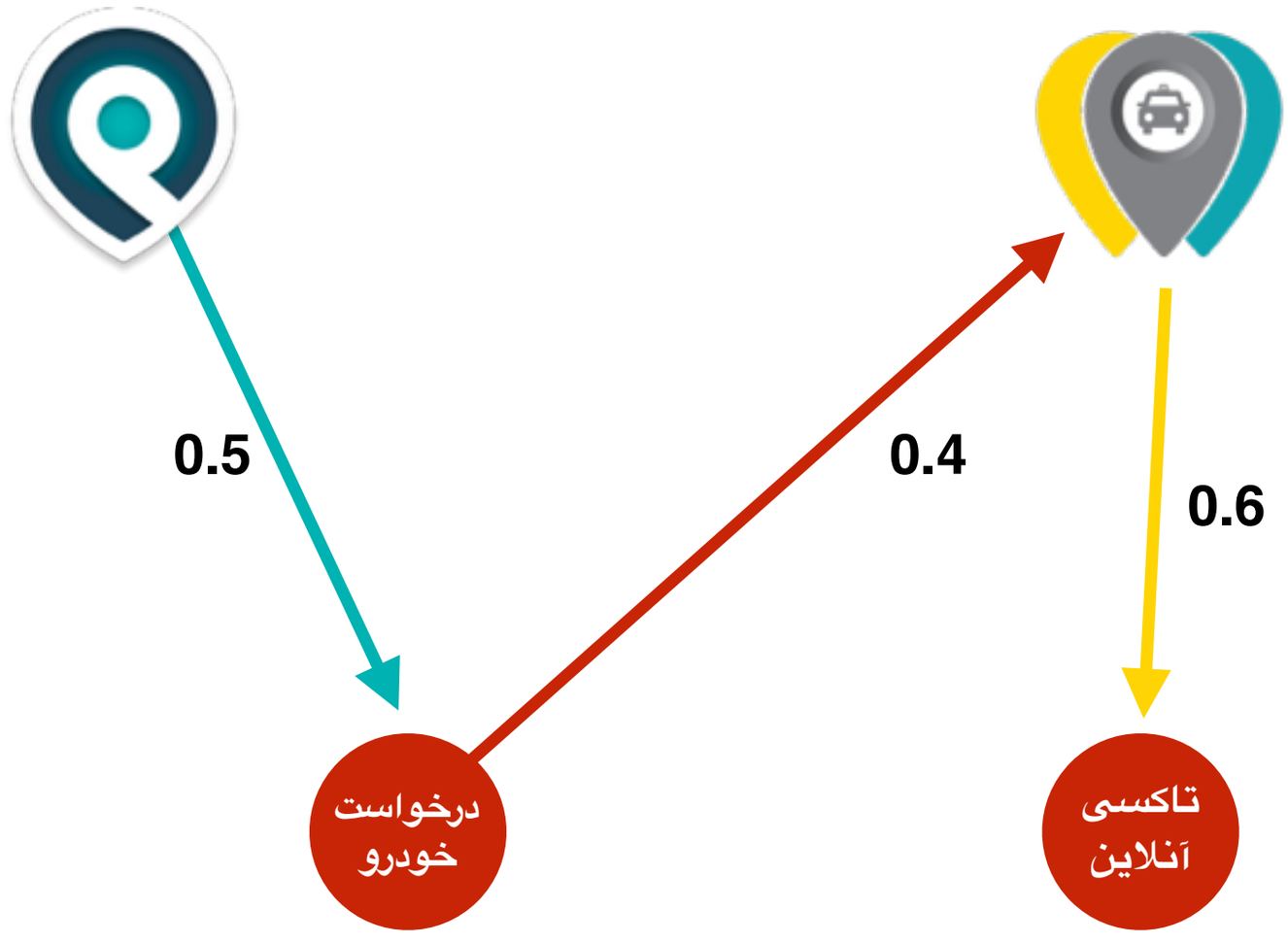
Predict missing edges



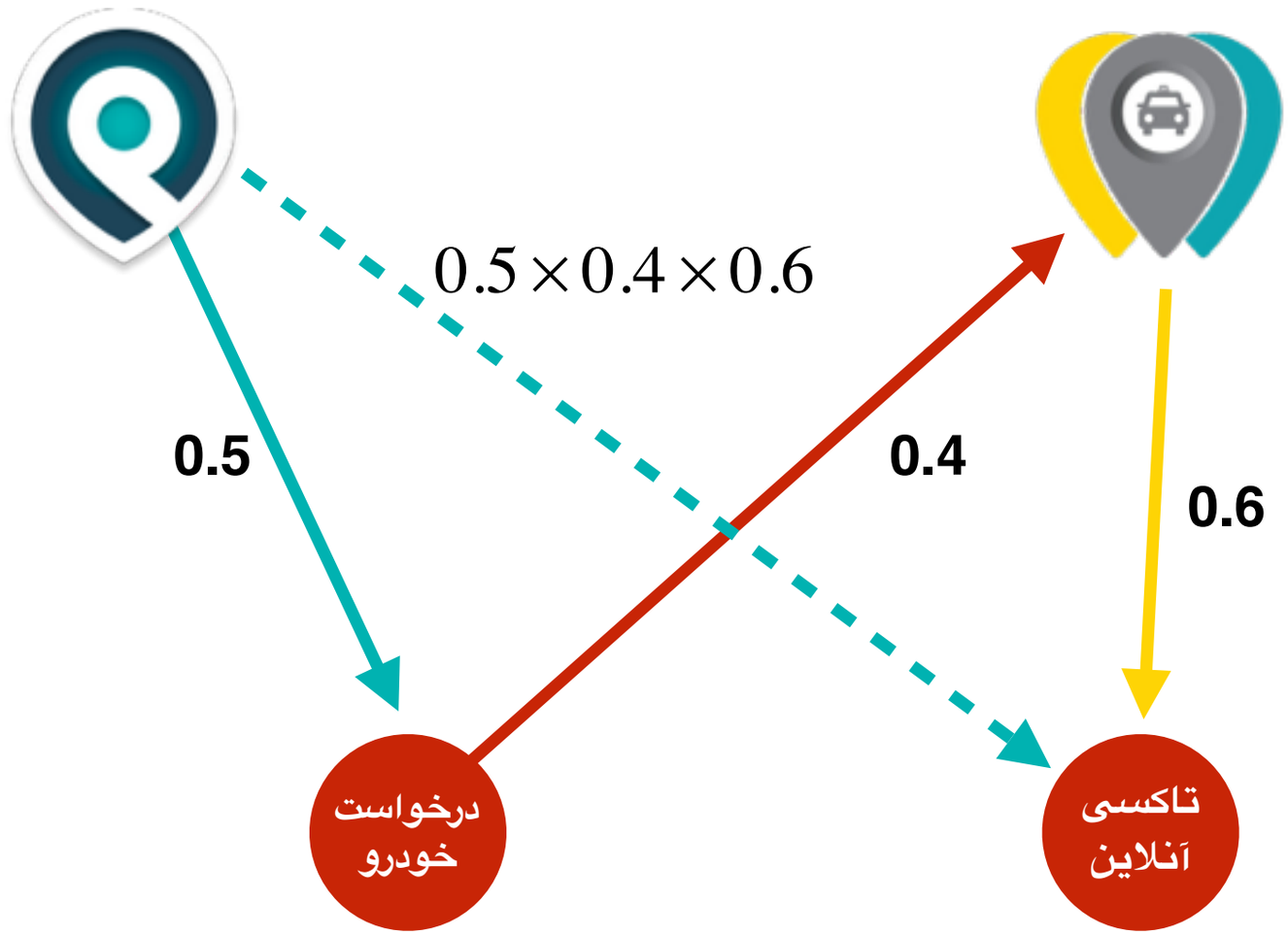
Predict missing edges



Semantic relation score



Semantic relation score



How can we infer indirect semantic relations from user feedbacks graph?

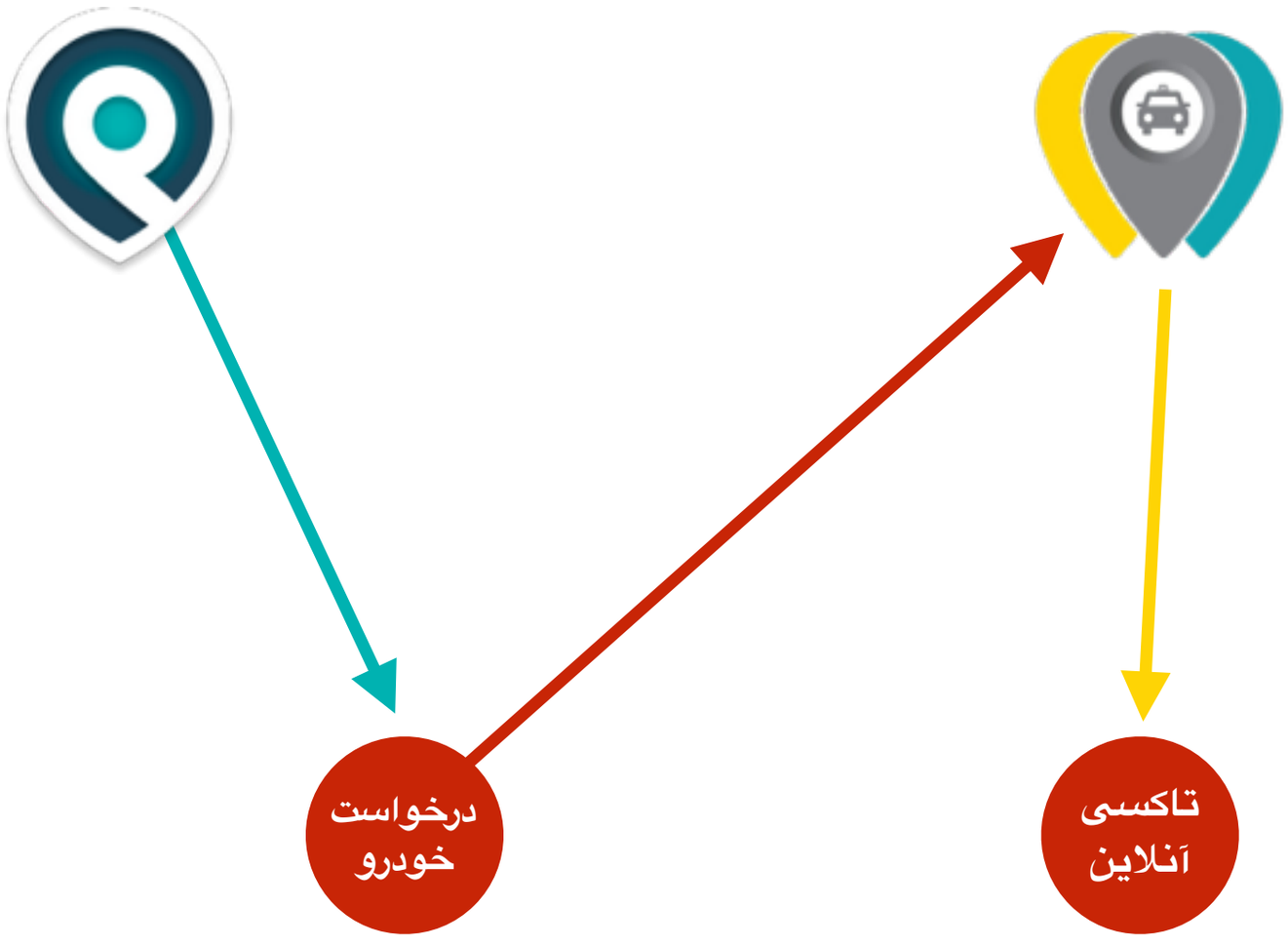
OR

How can we find closest semantic queries to a single app?

Solution

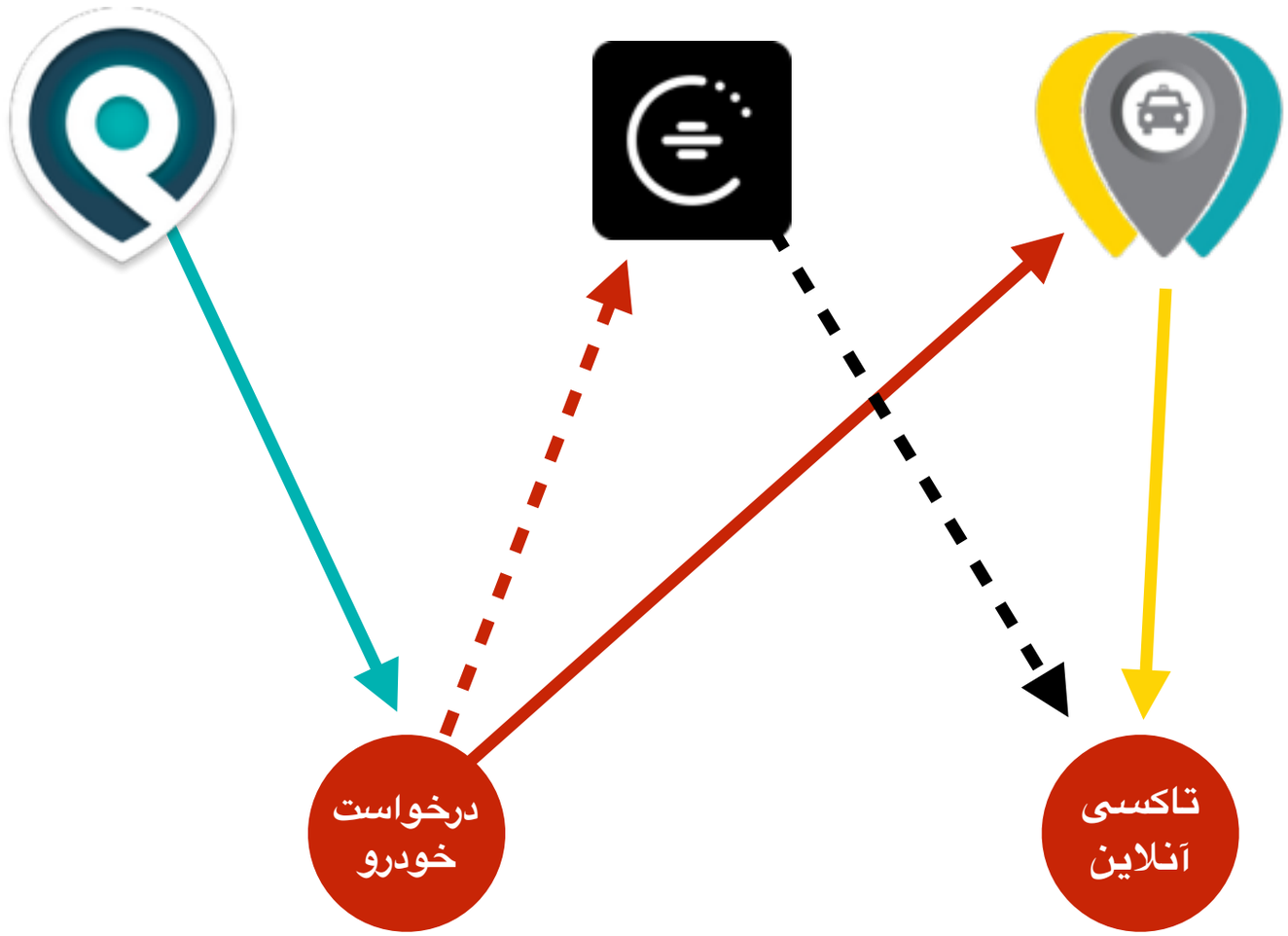
Dijkstra

Dijkstra problems

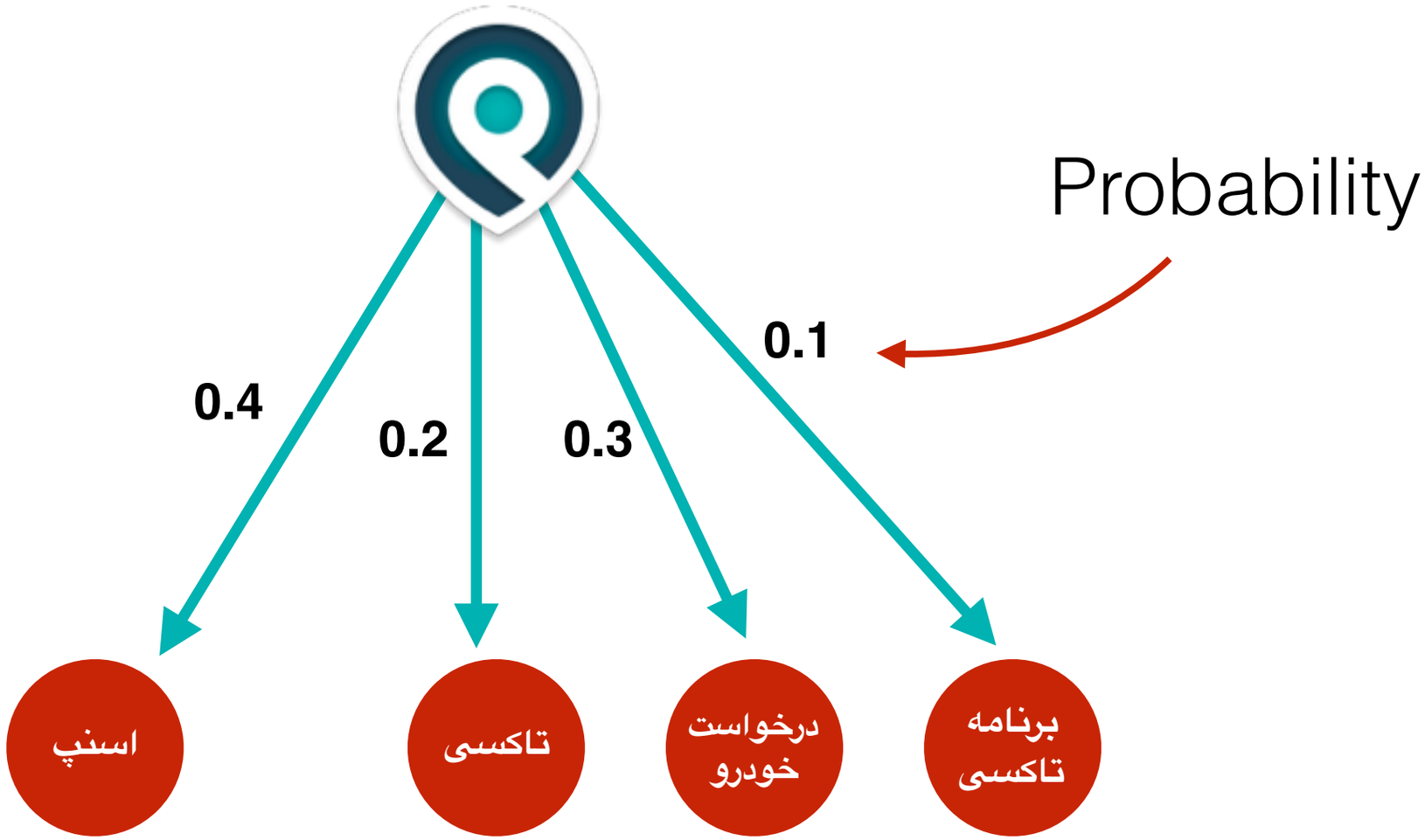


Dijkstra problems

Multiple Paths



Random Walker



Random Walker

- Cover multiple paths

random walker slow

How do we use random walkers

1. Put 1000 random walkers on the starting app
2. Stop them after a number of steps
3. Count the number of random walkers on each query

Random Walker Animation

What do we want?

Same Result

What do we want?

Same Result

Too many steps!

Markov chain

- Unique Stationary Distribution
- Independent of starting vertex

Markov chain

- Unique Stationary Distribution
- Independent of starting vertex

We don't want this!

Random Walker Animation

Teleportation

teleportation slow

teleportation animation

PageRank

Difference with Classic PageRank

- Classic PageRank
  - Goal: Finding a measure for importance of websites
  - Teleport:
    - Guaranteeing the existence of answer
    - Avoid localization

Final Solution

Problem: Finding semantic queries for an app

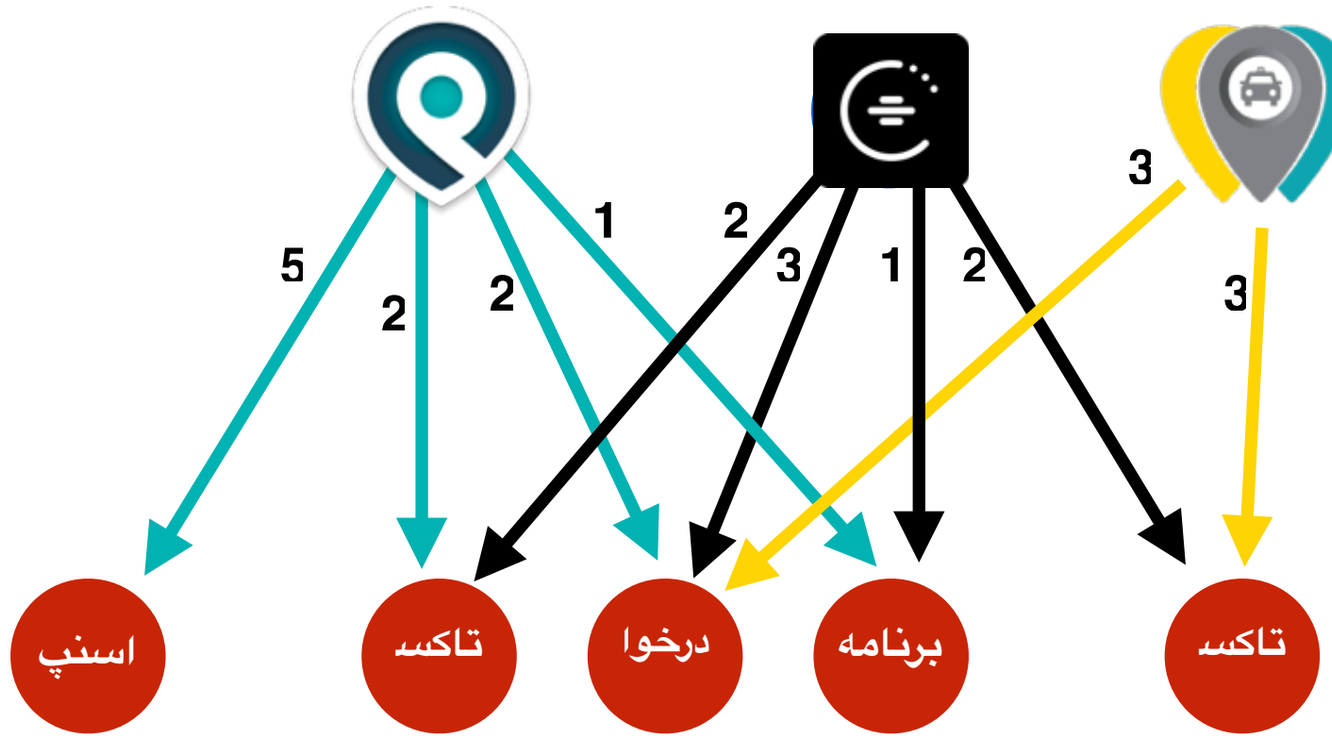
Solution: Random walkers teleporting to starting point

How can we implement Random Walkers?

Implementation

Simulating Random Walkers

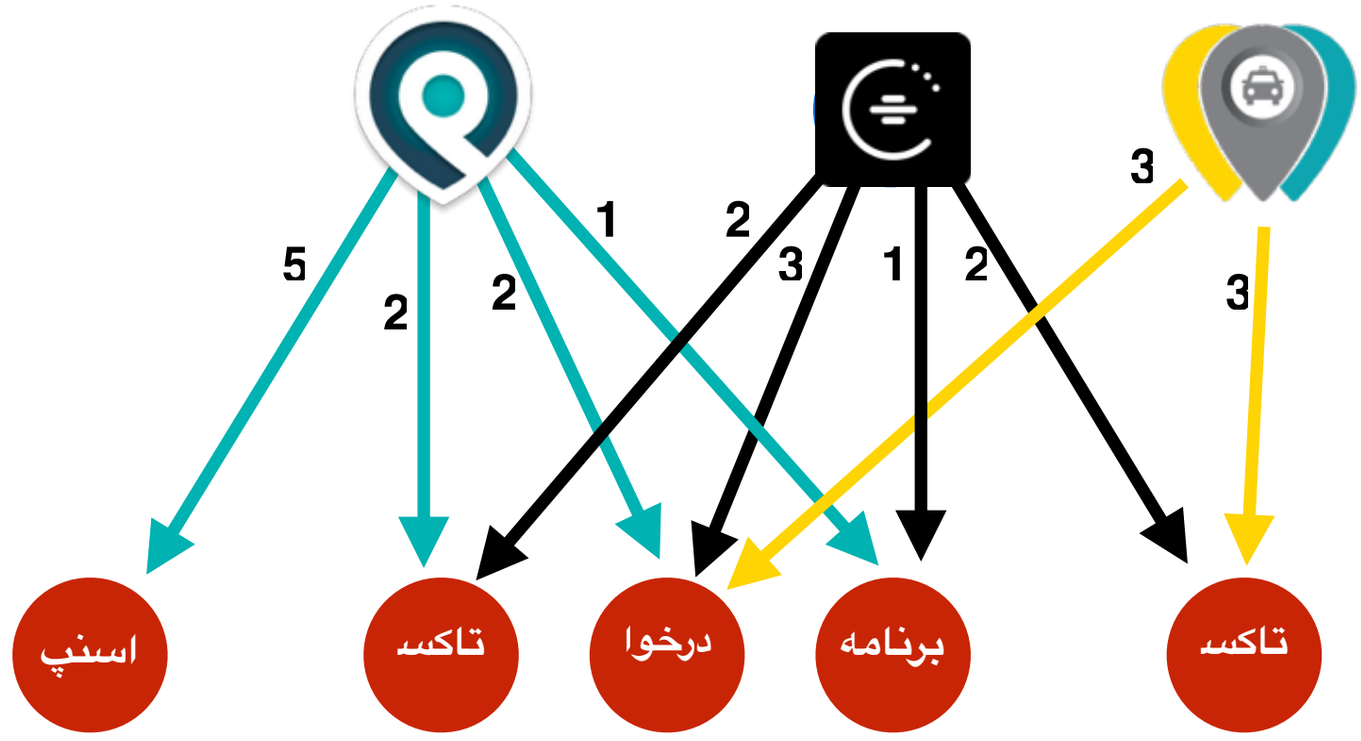
$$\mathcal{M} = \begin{array}{|c|c|c|}\hline 5 & 0 & 0 \\ \hline 2 & 2 & 0 \\ \hline 2 & 3 & 3 \\ \hline 1 & 1 & 0 \\ \hline 0 & 2 & 3 \\ \hline \end{array}$$



Simulating Random Walkers

$$\mathcal{M}_a =$$

0.5	0	0
0.2	0.25	0
0.2	0.375	0.5
0.1	0.125	0
0	0.25	0.5



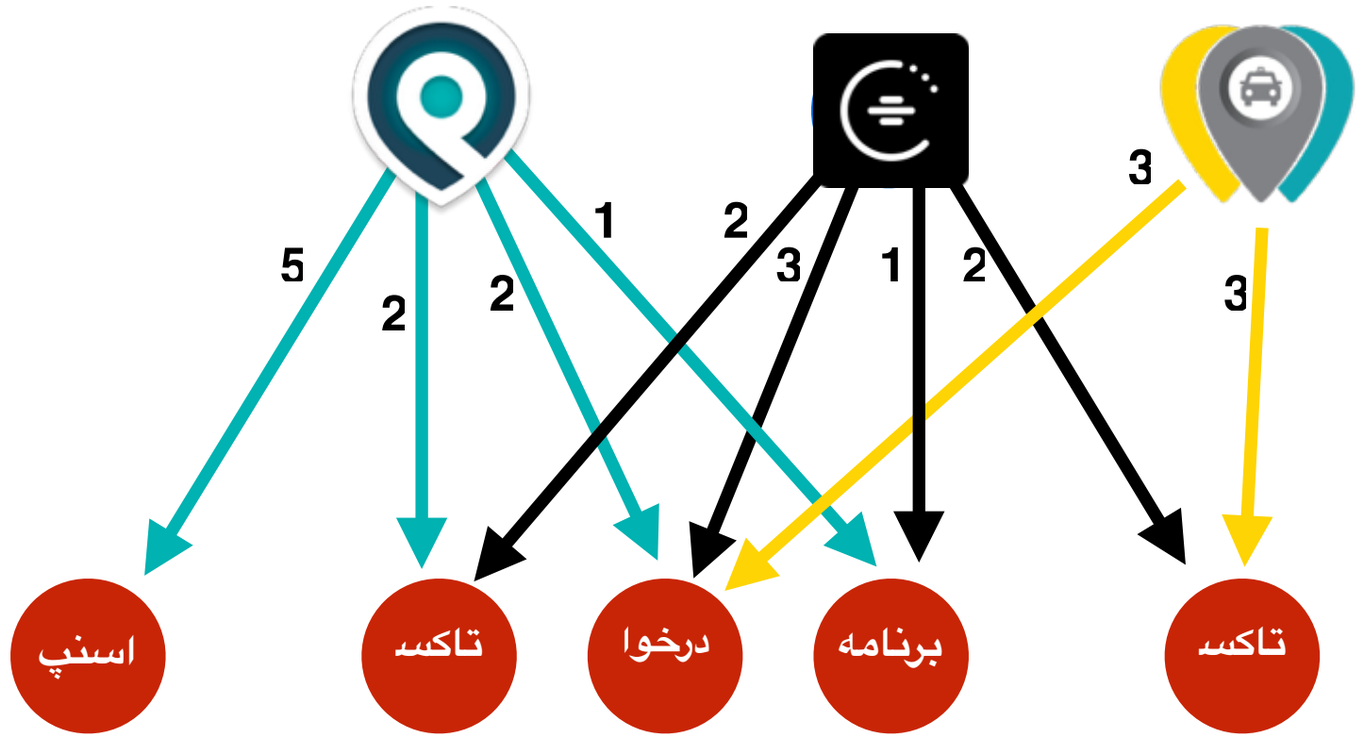
$$\mathcal{M}_q =$$

1	0.5	0.25	0.5	0
0	0.5	0.375	0.5	0.4
0	0	0.375	0	0.6

Simulating Random Walkers

$$a = \begin{bmatrix} 1000 \\ 0 \\ 0 \end{bmatrix}$$

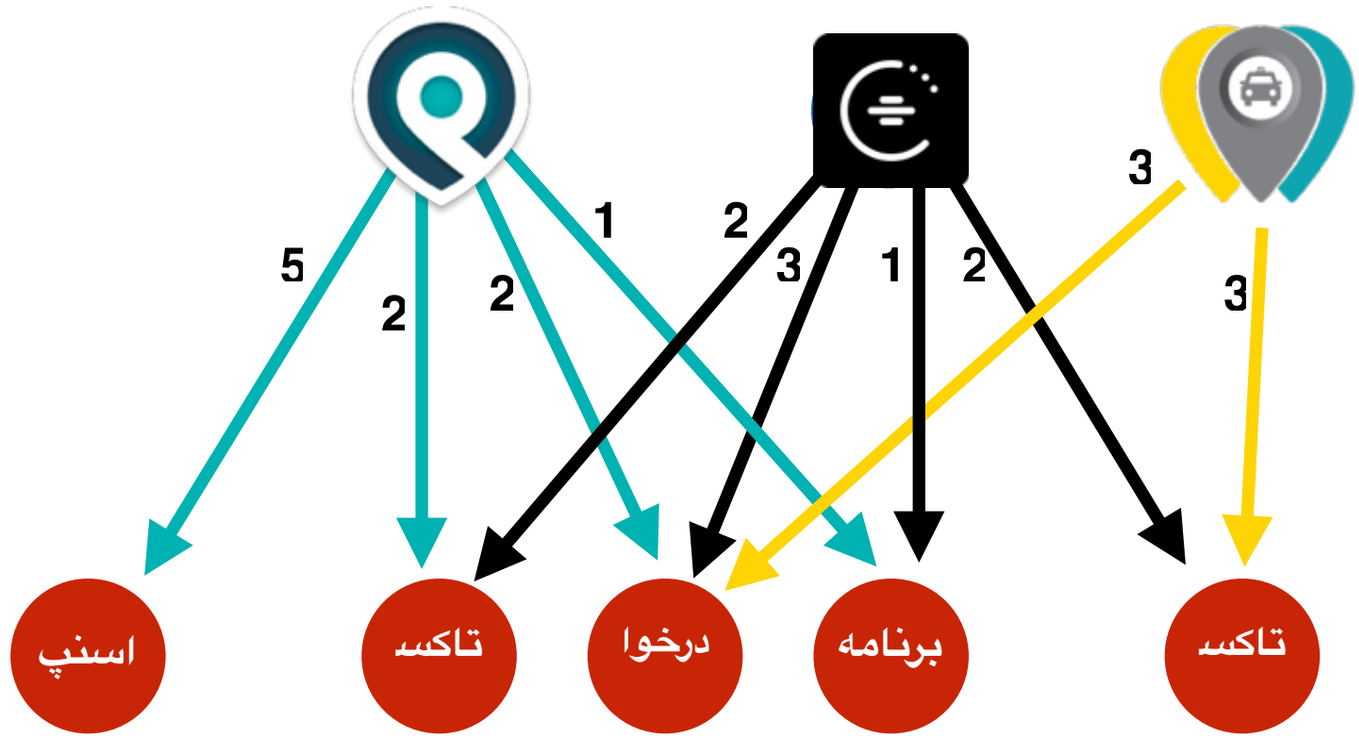
$$q = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$



Simulating Random Walkers

$$a = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

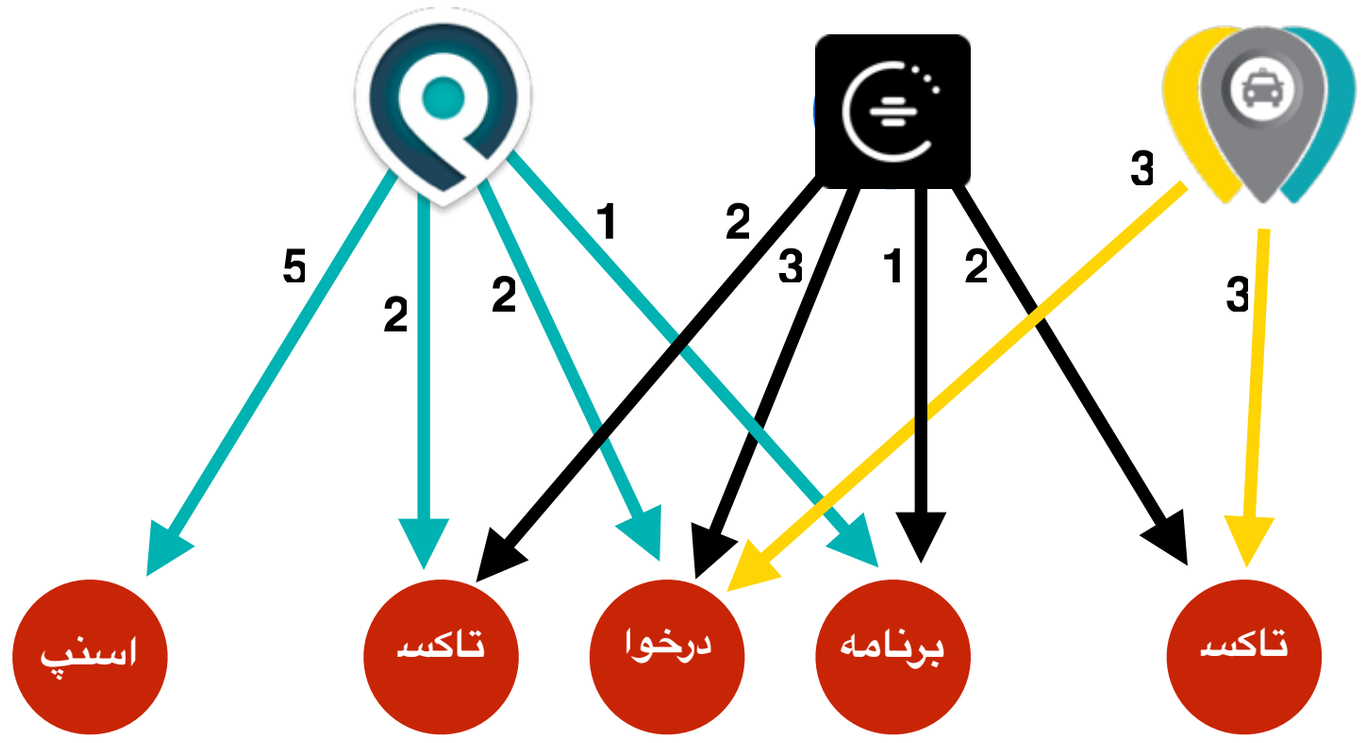
$$q = \begin{bmatrix} 521 \\ 213 \\ 197 \\ 69 \\ 0 \end{bmatrix}$$



Simulating Random Walkers

$$a = \begin{bmatrix} 683 \\ 221 \\ 96 \end{bmatrix}$$

$$q = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$



Simulating Random Walkers

- The result is still random and thus not precise.
- The process is inefficient

Simulating Random Walkers

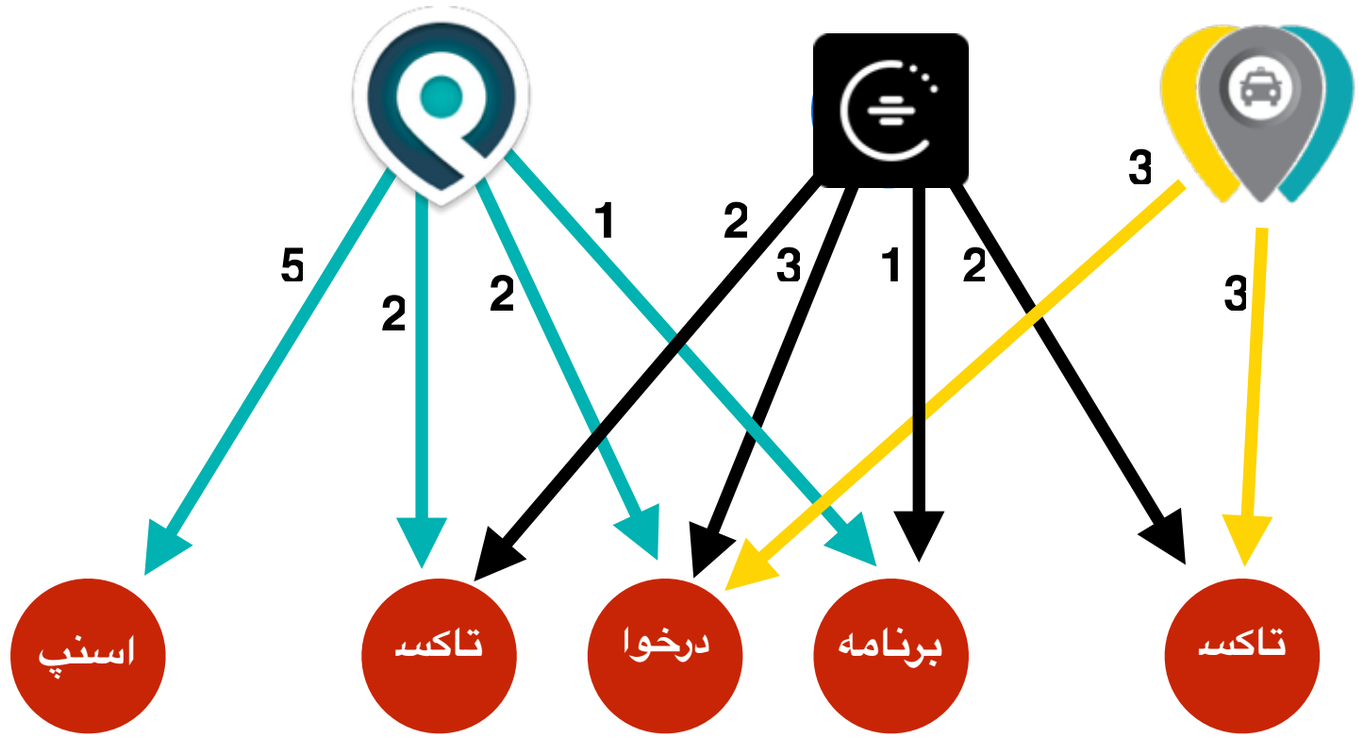
- The result is still random and thus not precise.
- The process is inefficient

Infinite random walkers!

More Precise Solution

$$a = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

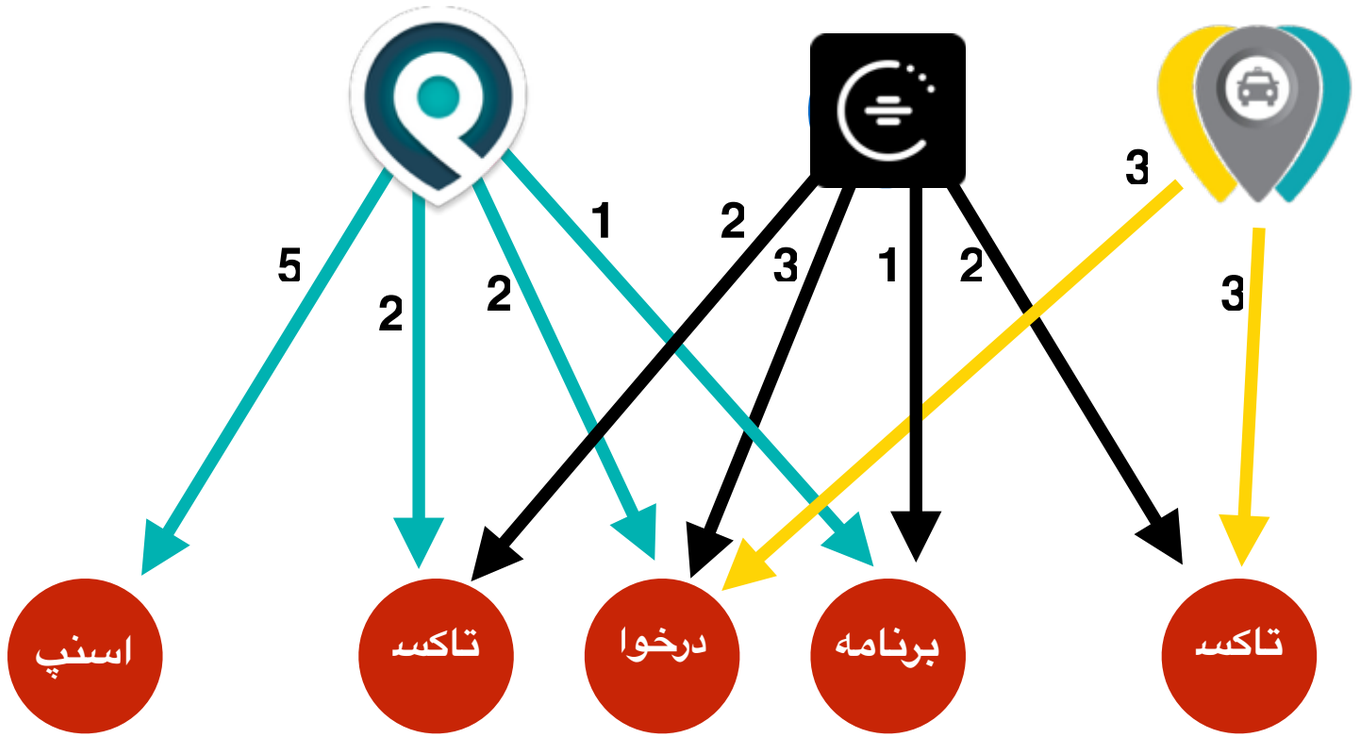
$$q = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$



More Precise Solution

$$a = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

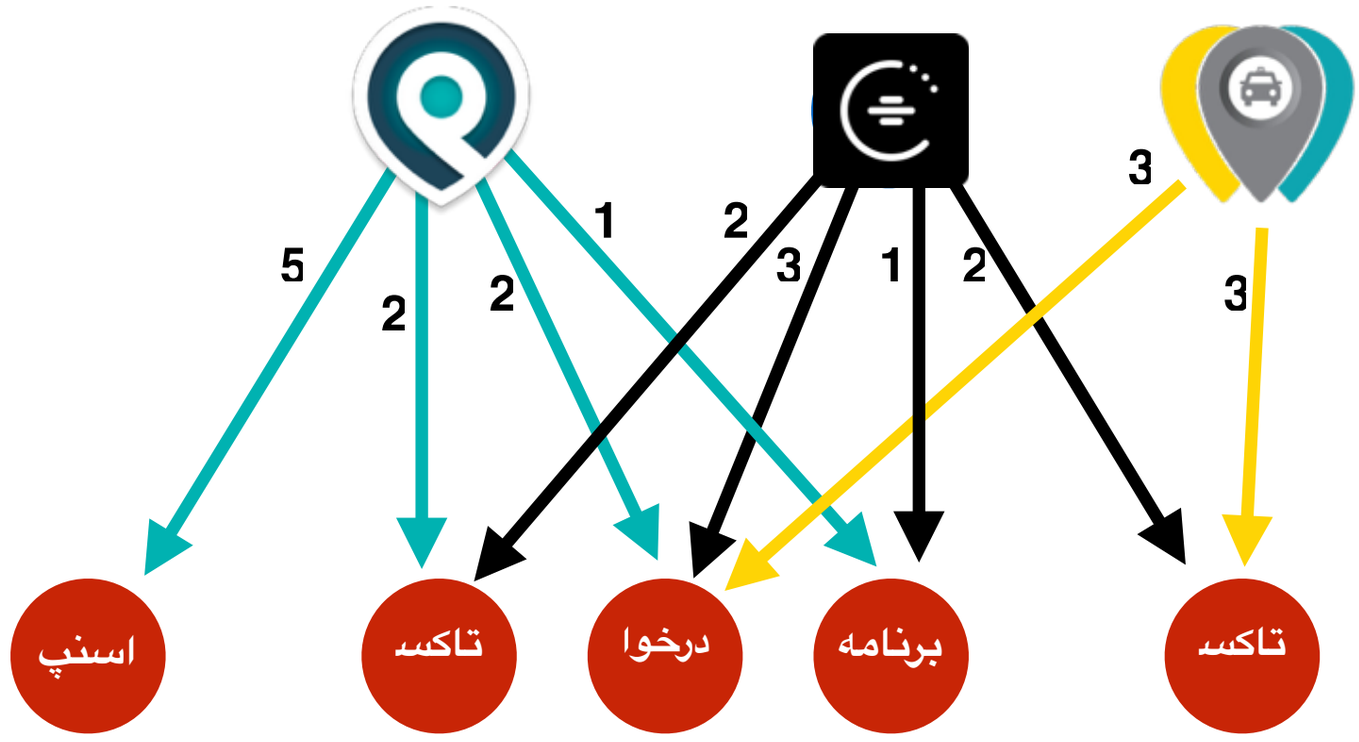
$$q = \begin{bmatrix} 0.5 \\ 0.2 \\ 0.2 \\ 0.1 \\ 0 \end{bmatrix}$$



More Precise Solution

$$a = \begin{bmatrix} 0.7 \\ 0.225 \\ 0.075 \end{bmatrix}$$

$$q = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$



Dynamic Programming

$$a_0 = \langle 0,...,0,1,0,...,0 \rangle$$

$$q_i = a_i \times M_a$$

$$a_{i+1} = q_i \times M_q$$

Dynamic Programming

with teleportation

$$a_0 = \langle 0,\ldots,0,1,0,\ldots,0 \rangle$$

$$q_i = a_i \times M_a$$

$$a_{i+1} = (1-\alpha) \times q_i \times M_q + \alpha \times a_0$$

Error

- Repeat the procedure k times
- Error is proportional to $(1-\alpha)^k$

$$\alpha = 0.15 \quad \Rightarrow \quad k = 10$$

Complexity

- Total order: $O(n_a \times k \times n_a \times n_q)$

Complexity

- Total order: $O(n_a \times k \times \mathcal{L})$

Sparse Matrix

Distributed processing

- Calculating similar queries is independent for each app

Is this sufficient?

The Full Framework

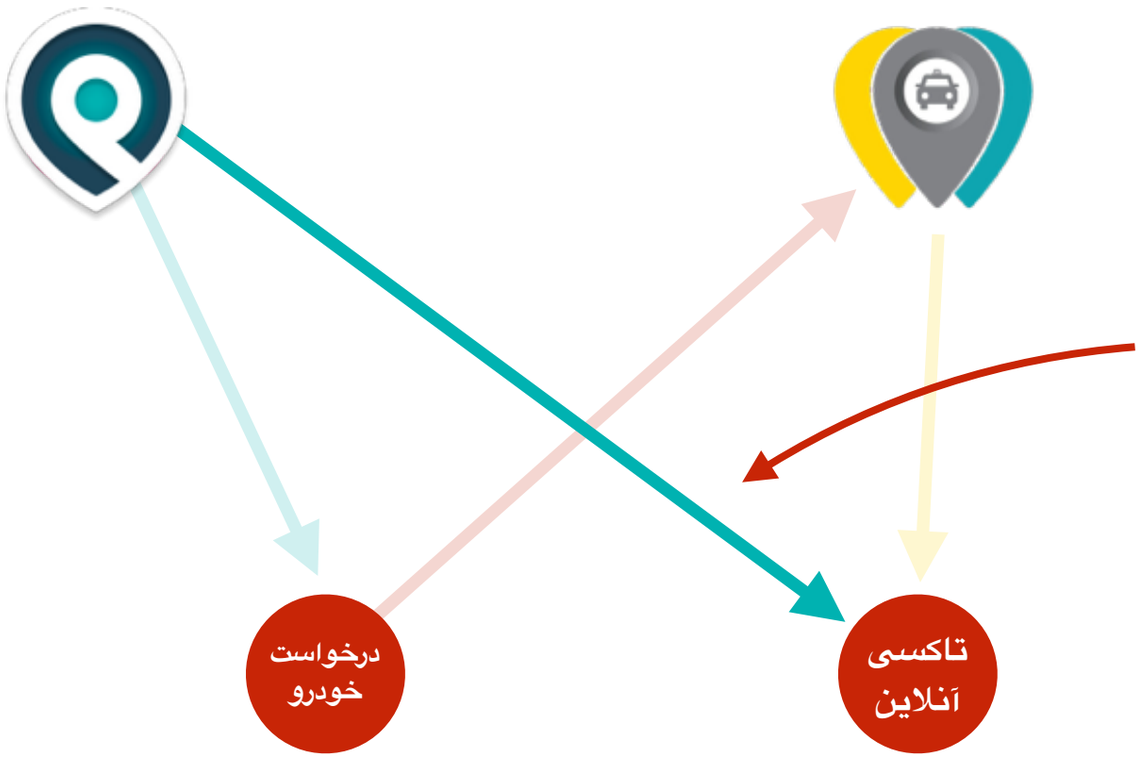
Why this is not sufficient?

- Not prefect outcome

What can we do?

Do it every day

Self-correction



Predicted Edge

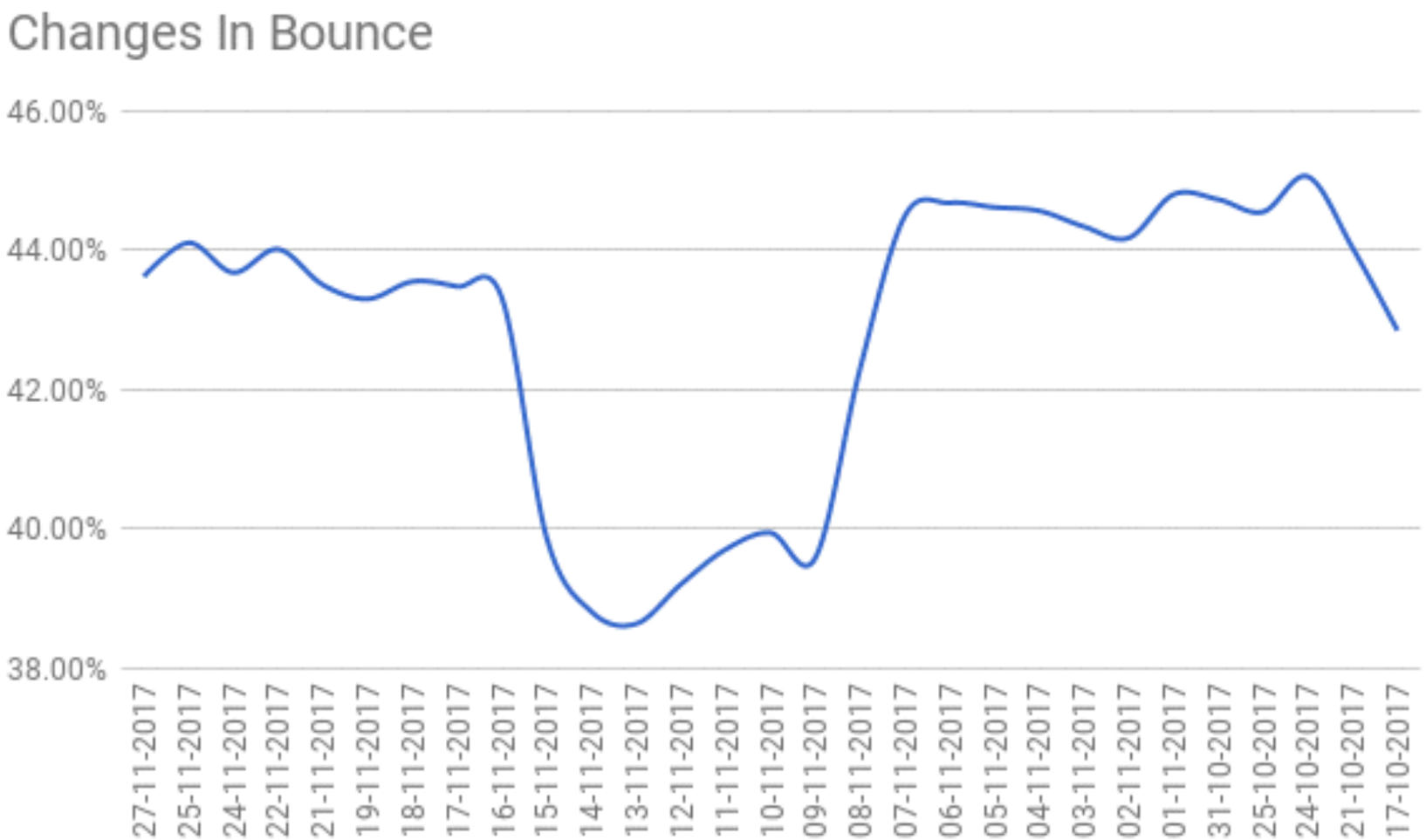
User feedbacks decrease weights which are increased incorrectly.

Trends

- Special Occasions
  - Nowrouz
- New apps

Conclusion

Our Result


Changes In Bounce
46.00%
44.00%
42.00%
40.00%
38.00%
27-11-2017
25-11-2017
24-11-2017
22-11-2017
21-11-2017
19-11-2017
18-11-2017
17-11-2017
16-11-2017
15-11-2017
14-11-2017
13-11-2017
12-11-2017
11-11-2017
10-11-2017
09-11-2017
08-11-2017
07-11-2017
06-11-2017
05-11-2017
04-11-2017
03-11-2017
02-11-2017
01-11-2017
31-10-2017
25-10-2017
24-10-2017
21-10-2017
17-10-2017

Future Plan

1. Manipulate teleportation vector
    - Current similarity measures
2. Use other metrics
    - Search result index
    - View / Buy

Thank you!

Any questions? 🤔