

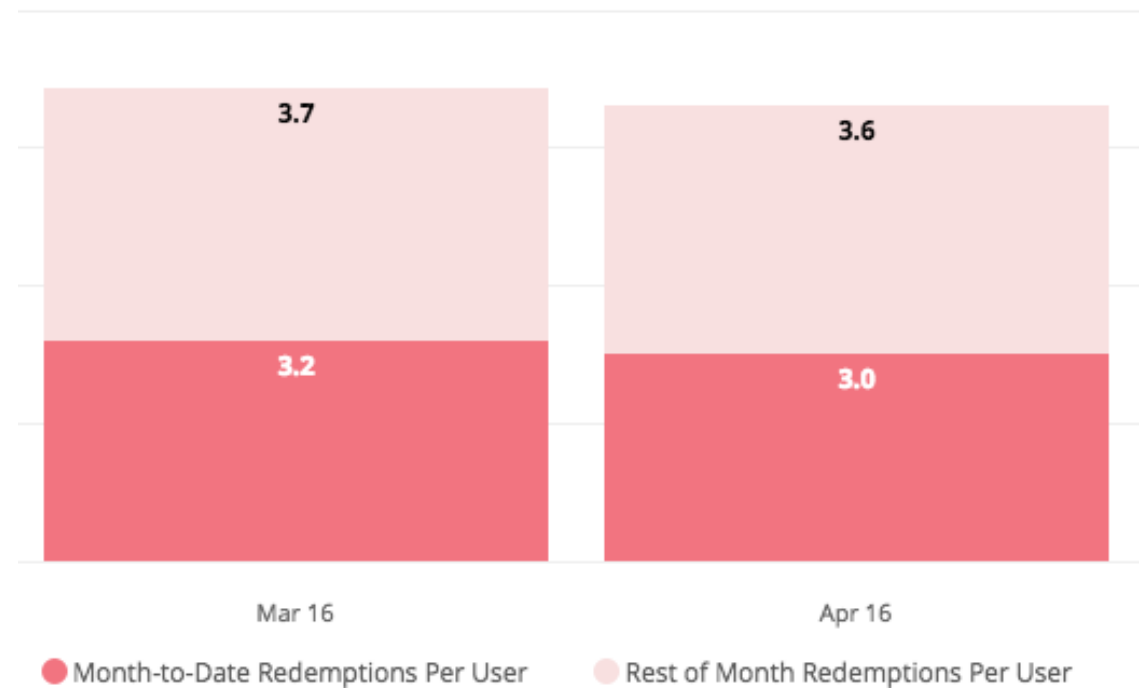
Recommendation System Overview

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Goals

- Motivation
 - Surface content of interest to a user
- KPI
 - Total offers redeemed by month
 - Total active redeemers by month
 - Redemptions per user by month
 - Total trips by month
 - Total trip customers by month
 - Trips per customer by month
 - Tracked on dashboard

Redemptions Per User By Month



Key Ideas

1. Recommendation as a search problem
2. Implicit feedback



Source: demotivateur.fr

Types of Recommender Systems

1. Similar users

- Demographic
- Facebook Ads



2. Similar items

- Content-based
- Google News



3. Hybrid approaches



Recommendations as Search

circle pong

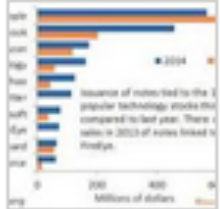
Web Images Shopping Videos Maps


About 1,180,000 results (0.30 seconds)


Circle Pong! on the App Store on iTunes - /
<https://itunes.apple.com/us/app/circle-pong/id905229/>
★★★★★ Rating: 4.5 - 4,433 votes - Free - iOS
Dec 3, 2014 - Read reviews, get customer ratings, see screenshots about **Circle Pong!** on the App Store. Download **Circle Pong!**

Circle-Pong on Scratch
scratch.mit.edu/projects/27109901/ ▾ Scratch ▾
Dec 7, 2014 - Featured! Thanks @speakvisually* :) - 8:51am
data high scores? I've done that before, but I really don't like
You visited this page on 12/28/14.

Suggested for you »


ValueWalk
Sales of U.S. Structured Notes Tied to
ValueWalk - 8 hours ago
The sales of U.S. structured notes tied to the stock market, according to reports, are showing a significant increase in volatility associated with it, according to reports.
You said you were interested in **FB** | [Not interested](#)


Netflix Life
'Parks and Recreation' cast explains
Entertainment Weekly - 2 hours ago
Over six seasons on Parks and Recreation, a lot of people have been asking about the cast. But according to Aziz Ansari, it's all just been one long joke.
You said you were interested in **Parks and Recreation** | [Not interested](#)


FanSided
Colin Kaepernick Leads San Francisco
FanSided - 2 hours ago
Jersey sales for Kaepernick started out strong this week. Despite that, Colin Kaepernick is the most popular player in the NFL.
Interested in **Colin Kaepernick**? [Yes](#) | [No](#)

Implicit Feedback

- Explicit feedback (ratings) allows you to predict how much a user will like an item
- Without explicit feedback, must rely on other signals
- We are starting with activated and verified offers

UNDERSTANDING ONLINE STAR RATINGS:



How a Recommendation Gets Made

1. Redshift unload for customer activity
2. Mahout + Spark job
3. Offer similarity imported to ElasticSearch
4. Rails App
5. Tracking

How a Recommendation Gets Made

1. Redshift unload for customer activity

2. Mahout + Spark job

3. Offer similarity imported to ElasticSearch

4. Rails App

5. Tracking

```
SELECT co.customer_id,  
       (CASE WHEN activated IS NOT NULL  
            THEN 'activated'  
            ELSE ''  
            END),  
       co.offer_id  
FROM customer_offers...
```


How a Recommendation Gets Made

1. Redshift unload for customer activity

2. Mahout + Spark job

3. Offer similarity imported to ElasticSearch

`$ mahout spark-itemsimilarity`

4. Rails App

5. Tracking

How a Recommendation Gets Made

1. Redshift unload for customer activity
2. Mahout + Spark job
- 3. Offer similarity imported to Elasticsearch**
4. Rails app
5. Tracking

```
def process_row(self, row, out):  
    ...  
    # write row data  
    similars = []  
    for datum in data.split(self.ELEMENT_DELIM):  
        item, _, score = datum.partition(...)  
        similars.append(item)  
    if self.es_action == 'update':  
        details = { 'doc': ... }  
    else:  
        details = {self.detail_key: similars}  
    dump(details, out)  
    out.write("\n")
```

How a Recommendation Gets Made

1. Redshift unload for customer activity
2. Mahout + Spark job
3. Offer similarity imported to ElasticSearch
- 4. Rails App**
5. Tracking

```
{  
  "query": { ... },  
  "fields": ["id"],  
  "aggs": {  
    "bestMatch": {  
      "terms": {  
        "field": "similar_verified",  
        "exclude": ["41163", "32663"],  
        "min_doc_count": 1  
      }  
    }  
  }  
}
```

How a Recommendation Gets Made

1. Redshift unload for customer activity
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```
def sanitize
  out = super
  out[:score] = @event[:score].
              try(:to_f)
  out[:variant] = @event[:variant]
  out
end
```

Recommendations: The Fun Parts



elastic

Mahout + Spark

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
User 1	X		X		X	
User 2		X	X			
User 3				X		X
User 4					X	
User 5	X	X		X		X
User 6			X	X		
User 7	X	X	X		X	X
User 8		X		X		
User 9			X			

R

	UF1	UF2
User 1		
User 2		
User 3		
User 4		
User 5		
User 6		
User 7		
User 8		
User 9		

U

\approx

X

V

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
IF1						
IF2						

Mahout + Spark

4105665	activated	36198
2257195	verified	40521
5239635	verified	42327
4872750	activated	42982
9625635	activated	43947

```
mahout spark-itemsimilarity \  
  --recursive \  
  --filenamePattern "\d+_part_\d+" \  
  --master yarn \  
  --input /user/hadoop/input/verified/ \  
  --input2 /user/hadoop/input/activated/ \  
  --output /user/hadoop/output/ \  
  --inDelim "\t" \  
  --filter1 verified \  
  --filter2 activated \  
  --rowIDColumn 0 \  
  --filterColumn 1 \  
  --itemIDColumn 2 \  
  --maxSimilaritiesPerItem 25 \  
  --omitStrength \  
  --randomSeed 2016
```

ElasticSearch

```
{
  "_index": "similarity",
  "_type": "offer",
  "_id": "43375",
  "_score": 1,
  "_source": {
    "similar_verified": [
      "43371",
      "43372",
      "43376",
      "43374",
      "43378",
      "43370",
      "44271",
      "42645",
      "42555",
      "44821"
    ],
    "similar_activated": [
      "43375",
      "43376",
      "43374",
      "28219",
      "43372",
      "43503",
      "43371",
      "43370",
      "43378",
      "44271",
      "38079",
      "43341",
      "46654",
      "42556",
      "37600",
      "42555",
      "42645",
      "48191",
      "42603",
      "44492",
      "46807",
      "46884",
      "45732",
      "43391",
      "42256"
    ]
  }
}
```

```
{
  "_index": "similarity",
  "_type": "customer_recommendation",
  "_id": "47",
  "_score": 1,
  "_source": {
    "recommendations": [
      {
        "offer_id": 47330,
        "score": 12
      },
      {
        "offer_id": 46587,
        "score": 11
      },
      {
        "offer_id": 43947,
        "score": 10
      },
      {
        "offer_id": 46588,
        "score": 10
      },
      {
        "offer_id": 46591,
        "score": 10
      },
      {
        "offer_id": 47331,
        "score": 10
      },
      {
        "offer_id": 47136,
        "score": 9
      },
      {
        "offer_id": 47243,
        "score": 8
      },
      {
        "offer_id": 46585,
        "score": 7
      },
      {
        "offer_id": 41326,
        "score": 6
      }
    ]
  }
}
```


ElasticSearch

```
{
  "query" : {
    "constant_score" : {
      "filter" : {
        "bool" : {
          "should" : [
            { "term" : { "similar_activated" : "41163"}},
            { "term" : { "similar_verified" : "32663"}},
            { "term" : { "similar_activated" : "32663"}}
          ],
          "must_not" : [
            { "term" : { "_id" : "41163"} },
            { "term" : { "_id" : "32663"} }
          ]
        }
      }
    }
  },
  "fields": ["id"],
  "aggs": {
    "bestMatch": {
      "terms": {
        "field": "similar_verified",
        "exclude": ["41163", "32663"],
        "min_doc_count": 1
      }
    }
  }
}
```

Working with Recommendations

- **CustomerOfferPresenter**
 - Passing recommendations to app
- **RecommendationService**
 - Retrieving recommendations
- **RecommendationSystemHelper**
 - Building ES queries
 - Fetching documents
 - Caching
- **OfferScorableMsg**
 - Tracking

Recommendations		
ID	NAME	SCORE
25995	a2 Milk	2
33930	DayQuil™/NyQuil™ SEVERE Cold & Flu Relief Co-Pack	2
34080	StarKist Tuna Creations® Hot Buffalo Style Tuna Pouch	2
35209	GO VEGGIE® Cheese Alternatives	2
35959	CLR® Calcium, Lime, & Rust Remover	2
36099	Vicks® VapoRub™ Topical Cough Rub	2
38279	Annie's® Yogurt	4
38966	Pacific Foods Non- Dairy Beverage	3
42623	SWEDISH FISH	3
47284	Carrots - Any Brand	3

Next Steps

- Additional user activity
 - Likes
 - Shopping List
 - Purchase of product
- Variations of search query
- A/B Testing

