

Kaggle – OTTO

Multi-Objective

Recommender System



Silver medal
Rank top 2%
(45 / 2587)

OTTO

Wonach suchst du?

ServiceMein KontoMerkzettelWarenkorb

Inspiration

Damen-Mode

Herren-Mode

Baby & Kind

Sport

Drogerie

Multimedia

Haushalt

Küche

Heimtextilien

Möbel

Baumarkt

Marken

%Sale%

10€ für App-Neukund*innen nur bis Mo., 20.02.

0€ Versand auf Hanseatic Highlights nur bis Mo., 27.02.

20% Matratzen & Lattenroste nur bis morgen, 23:59 Uhr

10% High nur

Empfehlungen für dich

TOM TAILOR POLO TEAM Sweatshirt (Set, 2-tlg., mit T...

UVP €59,99 €39,61

TEFAL Kontaktgrill GC722D OptiGril...

UVP €379,99 €169,90

MEDION® Heißluftfritteuse MD17320, 1...

UVP €429,99

SAMSUNG Side-by-Side RS8000 R56JA...

UVP €4.899,00

LACOSTE Boxershorts (Packing, 3-St., ...

€36,99

Featured Prediction Competition

OTTO – Multi-Objective Recommender System

Build a recommender system based on real-world e-commerce sessions

OTTO Otto (GmbH & Co KG) · 2,587 teams · 13 days ago

Recommended for you

\$30,000 Prize Money

Overview	Data	Code	Discussion	Leaderboard	Rules	Team	Submissions	Late Submission	...
43	▼ 1	KONG ZIYUAN					0.59066	24	14d
44	▼ 5	Saber					0.59065	25	13d
45	▲ 1	ChWen					0.59057	73	13d
46	▼ 1	Rhysie					0.59056	14	15d
47	▲ 1	Yosuke Yoshida					0.59033	86	14d
48	▲ 2	Chen Haodong					0.59018	61	14d
49	—	m_l_a_s					0.59008	90	14d
50	▲ 1	theta					0.58994	76	14d
51	▲ 5	leaderboard car					0.58983	77	13d
52	▼ 5	Sergey Parakhin					0.58972	8	14d

Ikkcharlie0126

Kaggle Novice
Taipei, Taiwan
New graduate

1 / 30

Dataset Description

```
{
  "session": 42,
  "events": [
    { "aid": 0, "ts": 1661200010000, "type": "clicks" },
    { "aid": 1, "ts": 1661200020000, "type": "clicks" },
    { "aid": 2, "ts": 1661200030000, "type": "clicks" },
    { "aid": 2, "ts": 1661200040000, "type": "carts" },
    { "aid": 3, "ts": 1661200050000, "type": "clicks" },
    { "aid": 3, "ts": 1661200060000, "type": "carts" },
    { "aid": 4, "ts": 1661200070000, "type": "clicks" },
    { "aid": 2, "ts": 1661200080000, "type": "orders" },
    { "aid": 3, "ts": 1661200080000, "type": "orders" }
  ]
}
```

(Session = User, Aid = Item)

Dataset	#sessions	#items	#events	#clicks	#carts	#orders
Train (week 1~4)	12,899,779	1,855,603	216,716,096	194,720,954	16,896,191	5,098,951
Test (week 5)	1,671,803	1,019,357	13,851,293	12,340,303	1,155,698	355,292

Cold Start

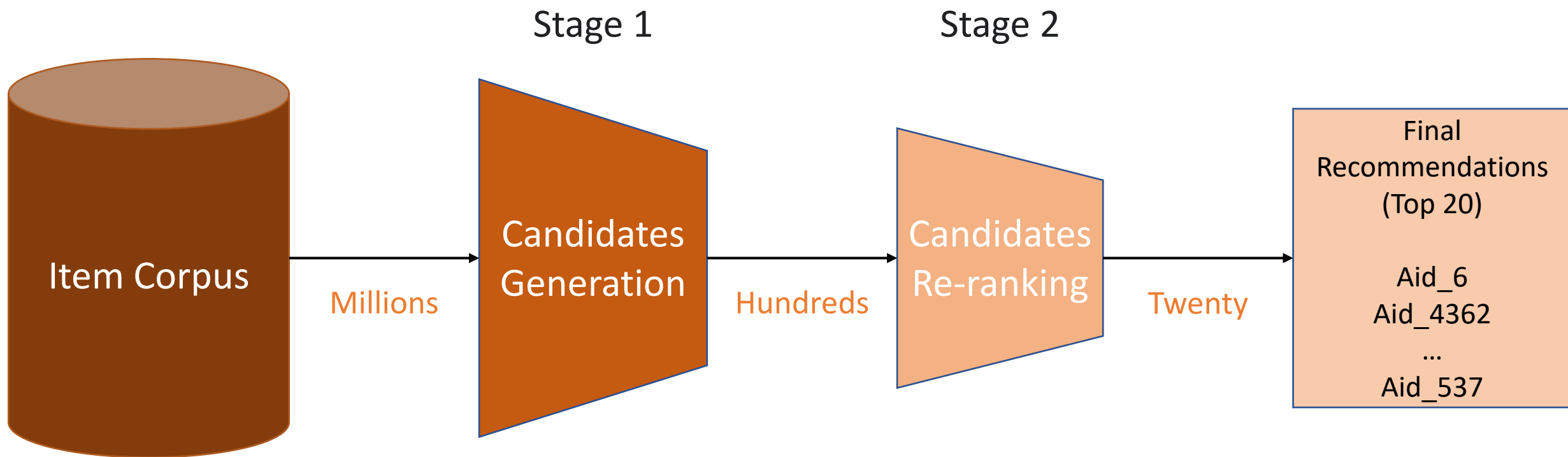
Evaluation Metric

Weighted Recall@20

$$R_{type} = \frac{\sum_i^N |\{\text{predicted aids}\}_{i,type} \cap \{\text{ground truth aids}\}_{i,type}|}{\sum_i^N \min(20, |\{\text{ground truth aids}\}_{i,type}|)}$$

$$score = 0.10 \cdot R_{clicks} + 0.30 \cdot R_{carts} + 0.60 \cdot R_{orders}$$

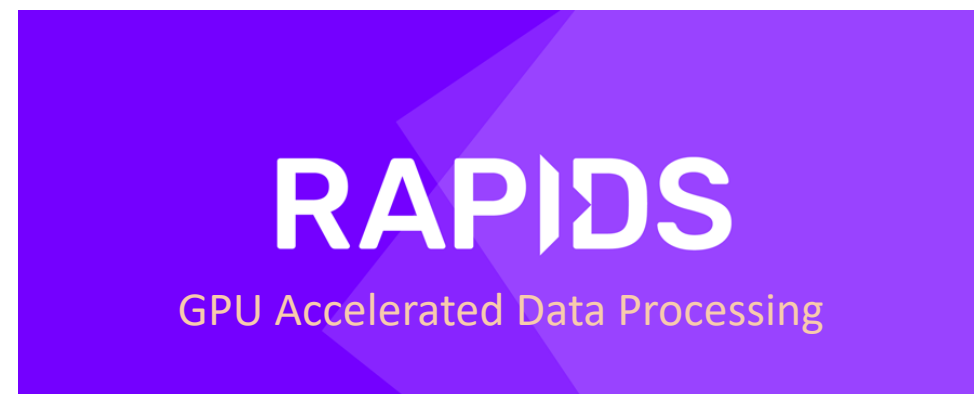
Flow Chart



Candidates Generation

Generate 100 item candidates for each user based on following logics:

- Visited aids in session
(User's history events)
- Co-visitation matrix
 - Click2Click (in 5mins) (time-weighted)
 - Click2Cart (in 30 mins) (time-weighted)
 - Click2Order (in 60 mins) (time-weighted)
 - Any2Click (in 1 day) (time-weighted)
 - Any2Buy (in 1 day) (type-weighted)
 - Buy2Buy (in 14 days)
- Item-item Word2Vec similarity
 - (weighted by w2v similarity with the last aid in session)
- Popular items in the last week



25x faster!

Features Generation

Generate 80+ features by only **user_id**, **item_id**, **type**, and **timestamp**

- **User-based (14)**
 - number of events (1)
 - number of each event (3)
 - number of unique aids (1)
 - buy ratio of user (1)
 - type statistics of user (2)
 - time statistics of user (4)
 - time spend on each item (2)
- **Item-based (28) (train + test)**
 - count of (any/click/cart/order) (4)
 - number of unique users (1)
 - bought ratio of item (1)
 - type statistics of item (2)
 - time statistics of item (4)
 - user staying time (2)
- **User-Item interaction (4)**
 - number of item (clicked/carted/ordered) by user (3)
 - Ranking of rule-based ranker (1)
- **Collaborative filtering similarity (5)**
 - average CF cosine similarity with all aids (1)
 - weighted average CF cosine similarity with all aids (1)
 - CF cosine similarity with last 3 aids (3)
- **Word2Vec (14)**
 - w2v embedding (8)
 - average w2v cosine similarity with all aids (1)
 - weighted average w2v cosine similarity with all aids (1)
 - w2v cosine similarity with last 4 aids (4)
- **Co-visitation score (18)**
 - weighted average co-visitation score with all aids (1 * 6)
 - co-visitation score with last 2 aids (2 * 6)

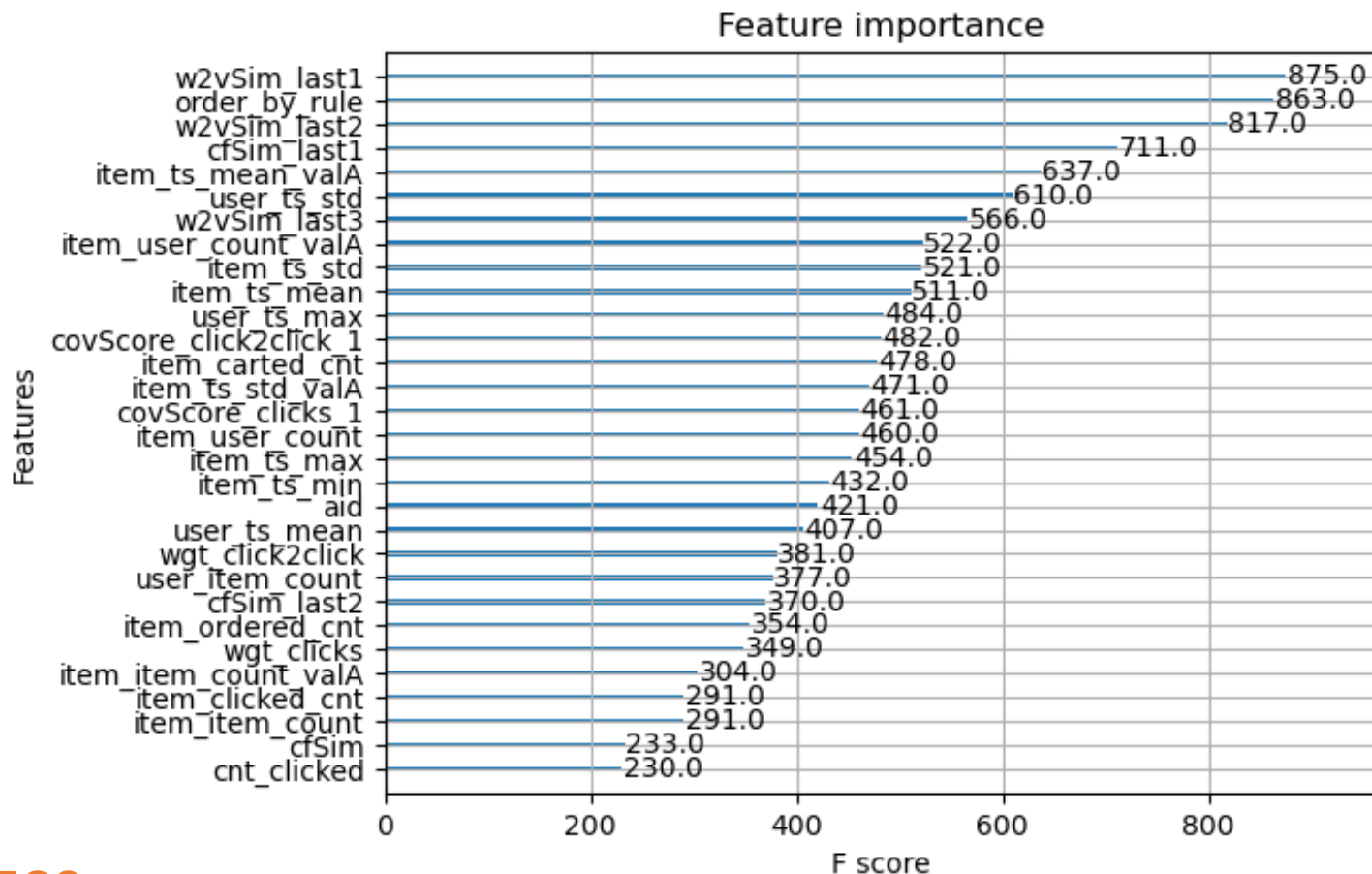
Candidates Re-ranking

Ranker: **XGBoost ranker**

Negative sampling rate: **4%**

Loss: **Pairwise**

Regularization: **L1 & L2**



Single XGBoost ranker: **LB 0.589**

Ensemble of 5 XGBoost rankers with different hyperparameters : **LB 0.590**

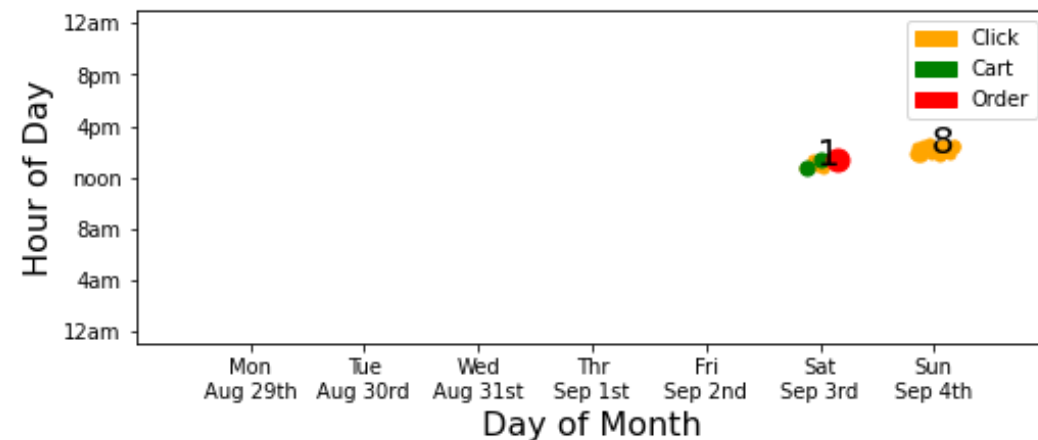
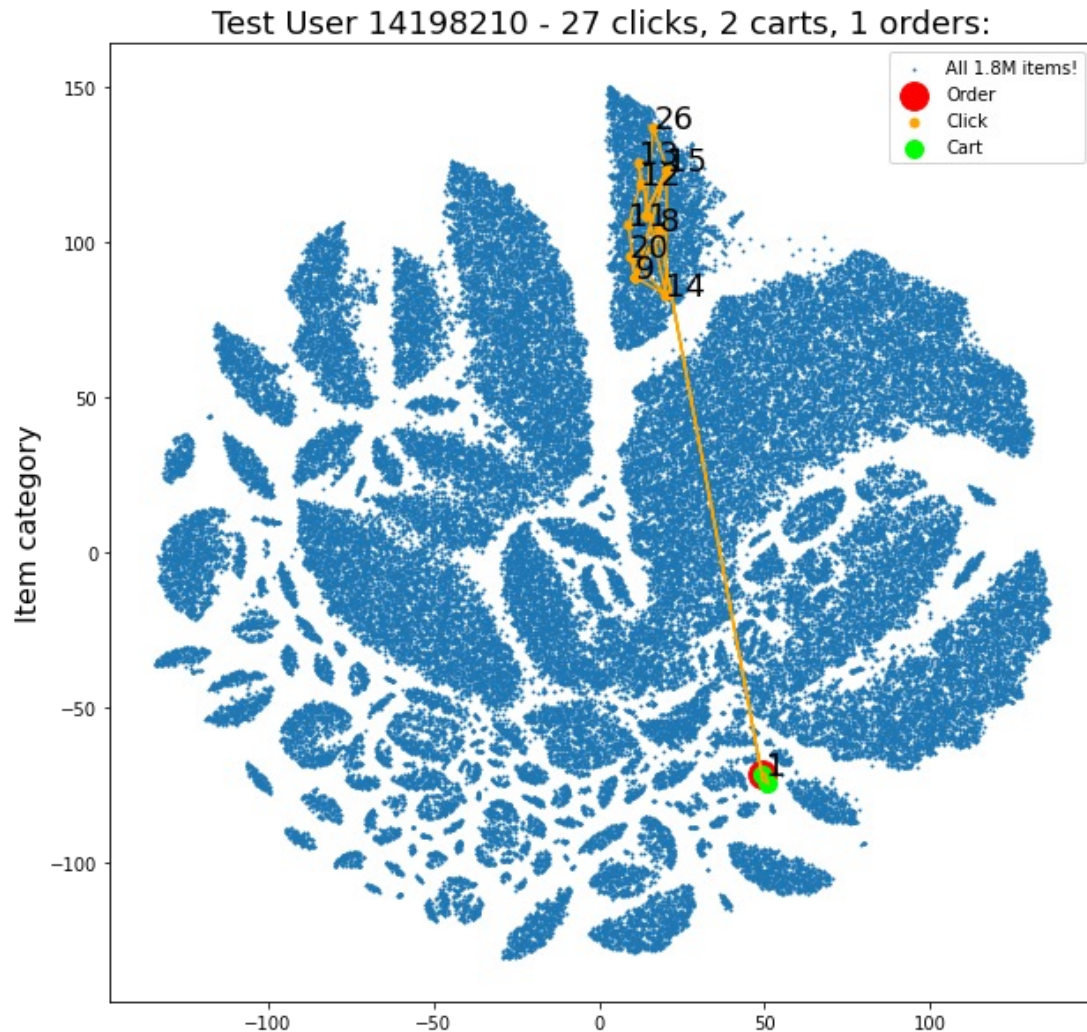
What improved:

- Rule-based only: 0.5749
- **XGB re-ranker: 0.5776**
- **[Prevent XGB over-fitting]** not shared co-visitation mat: 0.5784
- **[Tune rule-based]** Tune co-visitation mat hyperparameter: 0.5807
- **[Add XGB feature]** Add co-visitation score with all aids: 0.5829
- **[Tune XGB]** Tune XGB hyperparameter: 0.5834
- **[Add XGB feature]** w2v similarity with all aids: 0.5835
- **[New rule-based logic]** More co-visitation mat : 0.5849
- **[More candidates]** 50 -> 100 candidates: 0.5854
- **[Add XGB feature]** CF similarity: 0.5865
- **[Add XGB feature]** time weighted CF & w2v similarity: 0.5867
- **[Add XGB feature]** CF & w2v similarity & co-visitation score with last aids: 0.5893
- **[New rule-based logic]** consider w2v similarity in rule-based: 0.5903
- **[Ensemble]** 5 XGB models: 0.5906

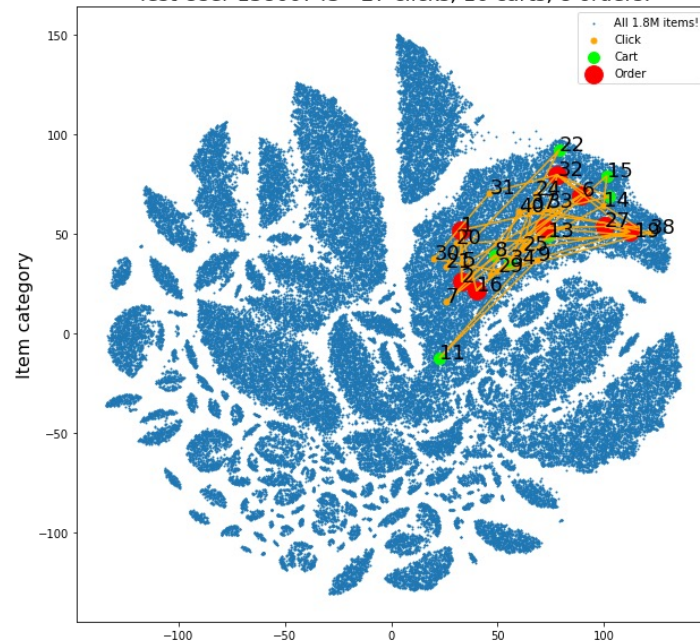
What didn't work:

- feature selection
- 100 -> 200 candidates
- w2v embedding as features

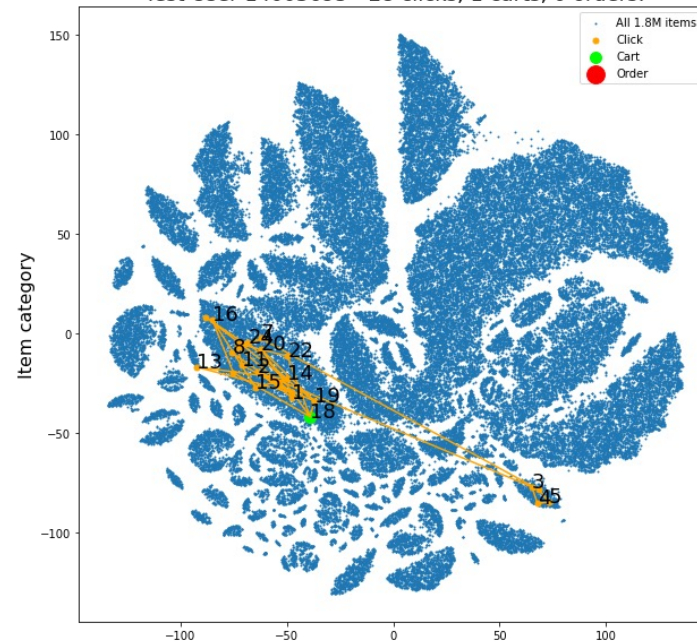
Visualize of User Behavior & Item Matrix Factorization by TSNE



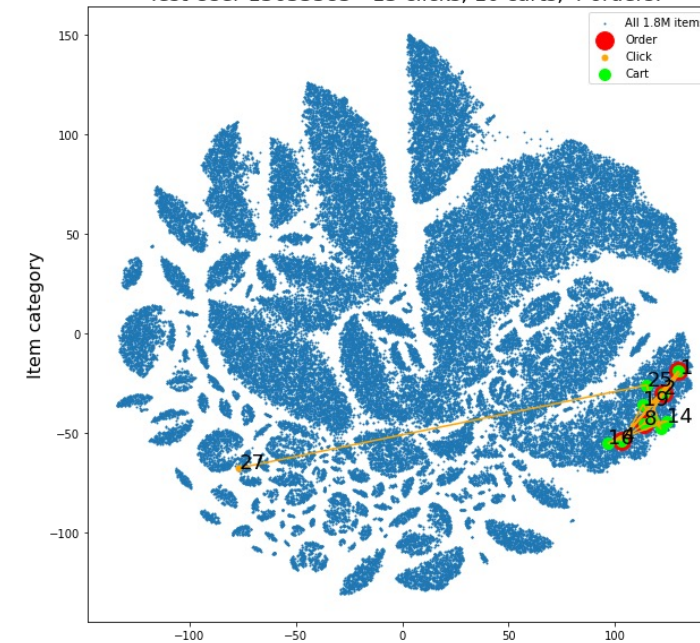
Test User 13866743 - 27 clicks, 16 carts, 8 orders:



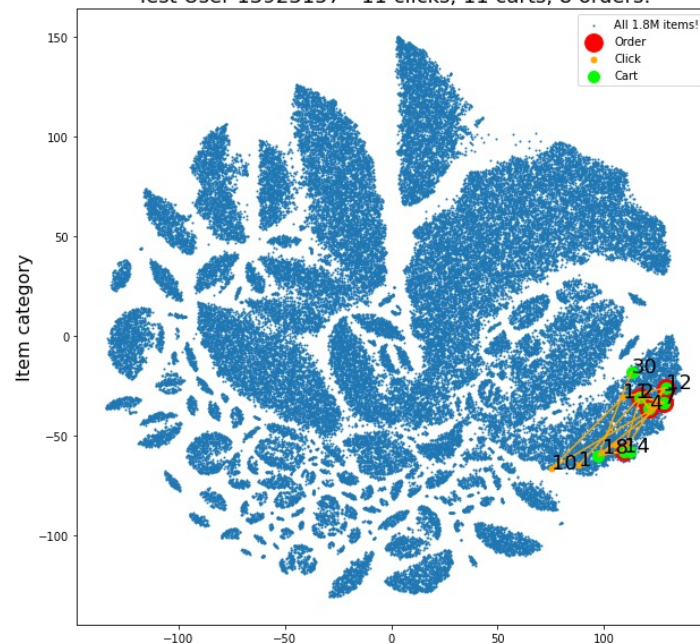
Test User 14003695 - 28 clicks, 1 carts, 0 orders:



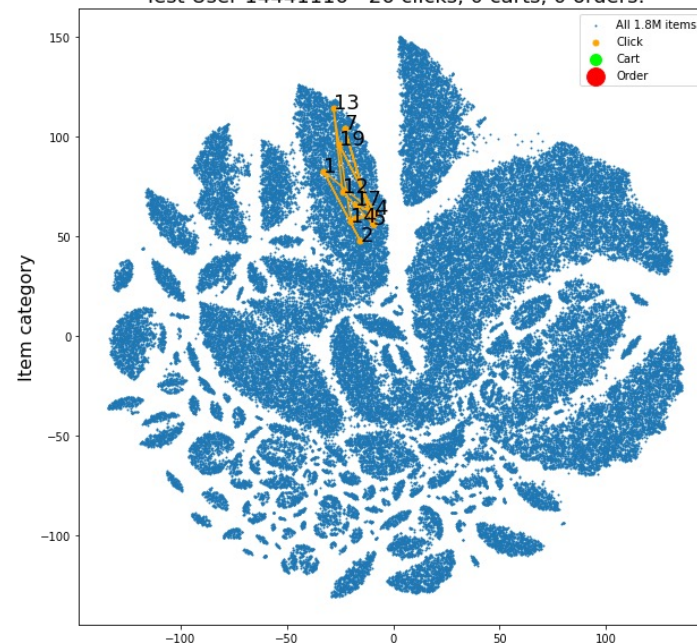
Test User 13633383 - 13 clicks, 10 carts, 4 orders:



Test User 13923157 - 11 clicks, 11 carts, 8 orders:



Test User 14441116 - 26 clicks, 0 carts, 0 orders:



Test User 12975893 - 58 clicks, 14 carts, 0 orders:

