

LightGCN for multi-objective recommender system

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Problem

Data: OTTO – Multi-Objective Recommender System

Goal: to train a model and predict items for users for different targets (clicks, carts, orders)

Plans:

- Try out GNN model for recommendations and compare it with strong baselines
- Try out different hypothesis to use information about some targets to predict other targets so that we will see gain in metrics

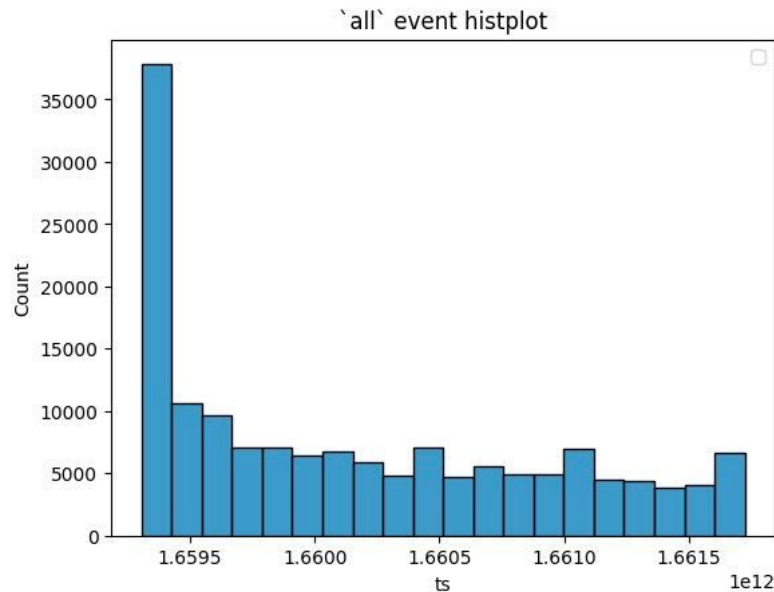
Methodology

Preprocessing data

Warm-start

Special holdout construction

Metrics: HR@200, MRR@200, Recall@200



Events histplot from data

LightGCN

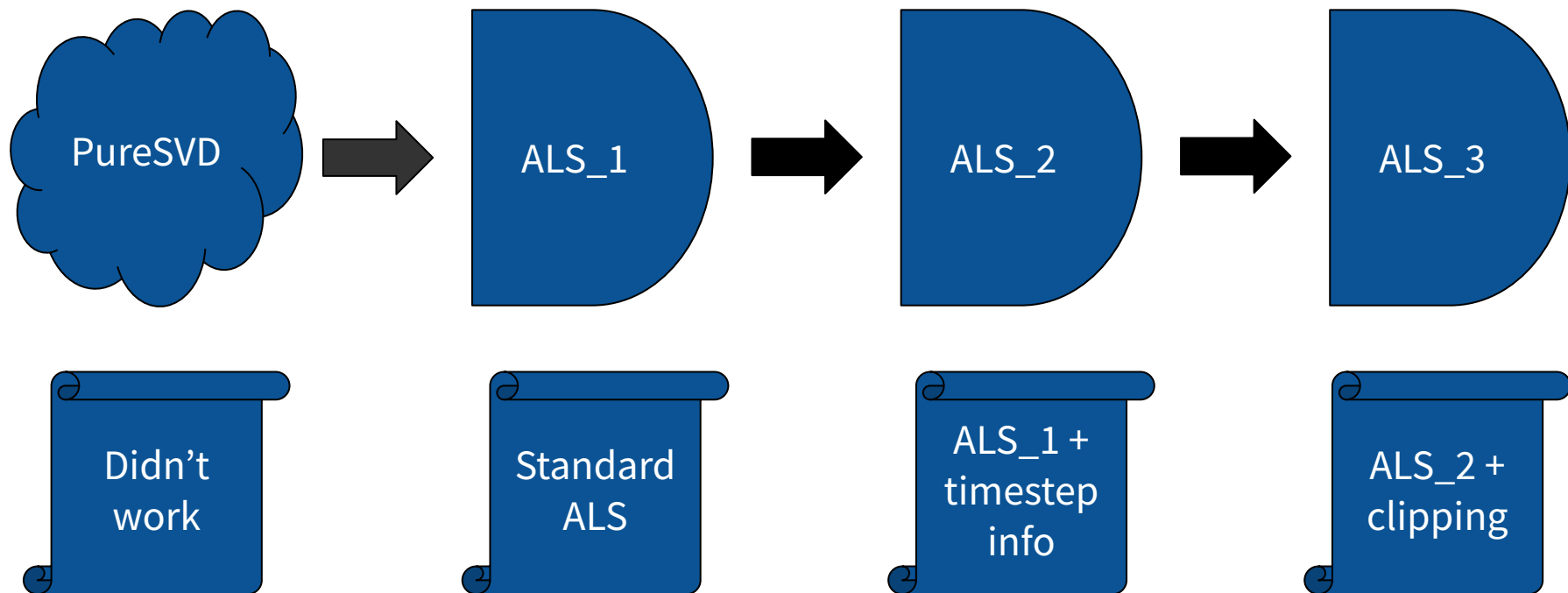
SOTA in
GNN-based
recommendations
at the moment of
publication

Includes
neighborhood
aggregation for
collaborative
filtering.

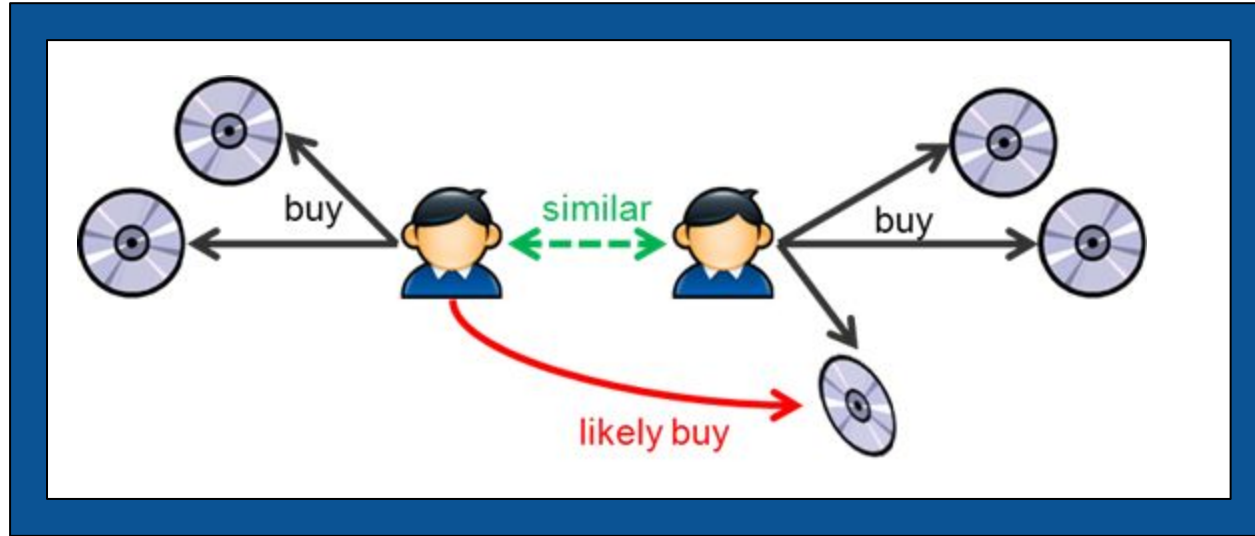
$$\mathbf{e}_u^{(k+1)} = \sum_{i \in \mathcal{N}_u} \frac{1}{\sqrt{|\mathcal{N}_u|} \sqrt{|\mathcal{N}_i|}} \mathbf{e}_i^{(k)},$$
$$\mathbf{e}_i^{(k+1)} = \sum_{u \in \mathcal{N}_i} \frac{1}{\sqrt{|\mathcal{N}_i|} \sqrt{|\mathcal{N}_u|}} \mathbf{e}_u^{(k)}.$$

The whole process in equations

Alternating Least Squares



KNN Approach



The idea is to find users who are similar to the target user based on their preferences and recommend items that these similar users have liked.

Comparison

	clicks			carts			orders		
	HR @200	MRR @200	Recall @200	HR @200	MRR @200	Recall @200	HR @200	MRR @200	Recall @200
LightGCN	0.0403	0.004	0.0002	0.0592	0.0086	0.0152	0.0577	0.0059	0.0132
Random	0.0008	0.0002	0.0002	0.0022	0.0004	0.0004	0.0024	0.0005	0.0005
ALS_1	0.2355	0.0202	0.0018	0.1049	0.0141	0.0309	0.0616	0.0098	0.0155
ALS_2	0.302	0.0251	0.0024	0.1537	0.0203	0.0469	0.1017	0.014	0.026
ALS_3	0.2875	0.0236	0.0023	0.1501	0.0198	0.0455	0.1017	0.014	0.0261
KNN	0.0411	0.0049	0.0003	0.0223	0.0032	0.0001	0.0097	0.0014	0.0001
KNN_norm	0.043	0.0056	0.0003	0.022	0.0032	0.0001	0.0095	0.0013	0.0001

Additional hypotheses

It is natural to assume that targets are sequential. The sequence goes as follows:

- 1) Click
- 2) Add to cart
- 3) Order

	fraction
$\text{orders_with_prev_cart} / \text{orders}$	0.776207
$\text{orders_with_prev_click} / \text{orders}$	0.434138
$\text{orders_with_prev_cart_and_prev_click} / \text{orders}$	0.260690
$\text{carts_with_prev_clicks} / \text{carts}$	0.382738

Some statistic from data

Additional hypotheses

Merging recommendations

LightGCN model	HR @200	MRR @200	Recall @200
Orders	0.0577	0.0059	0.0132
Orders Carts	0.0512	0.0056	0.0117

Not confirmed

Transfer of information

KNN model	HR @200	MRR @200	Recall @200
Carts	0.0223	0.0032	0.0001
Carts + Orders	0.011	0.0006	0.0001

Not confirmed

Conclusion

- LightGCN was worse than baseline models (but better than random)
 - Metrics are lower
 - Speed is lower
- Both hypotheses about using information from other targets were not confirmed

Thank you for your attention!