

# Towards Employing Recommender Systems for Supporting Data and Algorithm Sharing

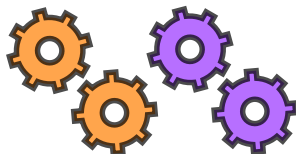
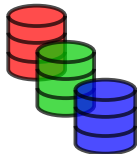
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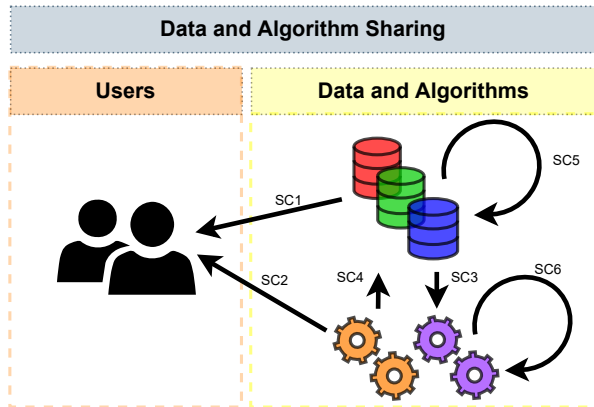
# Motivation

- Data and algorithm sharing important for a data and AI-driven economy
- E.g., a company gains access to a dataset to enhance its AI pipeline
- Three key-players: Data Providers, Algorithm Providers, and Users
- Many datasets + many algorithms = Choice Overload  
⇒ **Recommender Systems for Data and Algorithm Sharing**



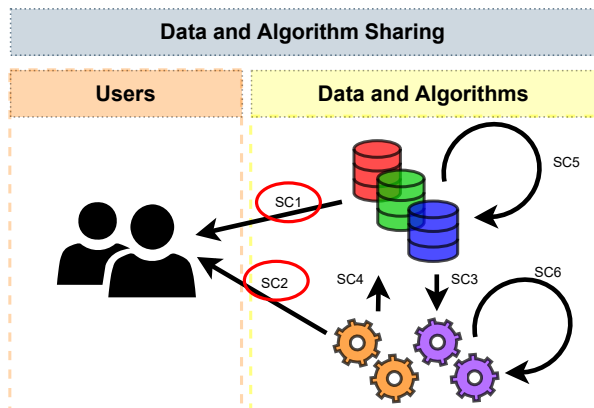
# Data and Algorithm Sharing Platforms

- Comprises users and items (i.e., datasets and algorithms)
- Item-to-user and item-to-item recommendations possible



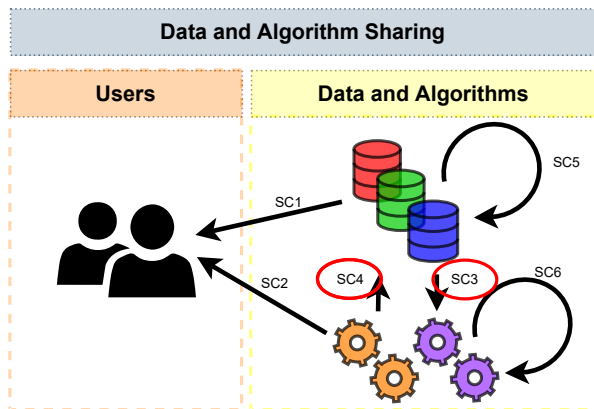
# Six Recommendation Scenarios

- **Datasets to Users (SC1), Algorithms to Users (SC2)**
- Datasets to Algorithms (SC3), Algorithms to Datasets (SC4)
- Datasets to Datasets (SC5), Algorithms to Algorithms (SC6)



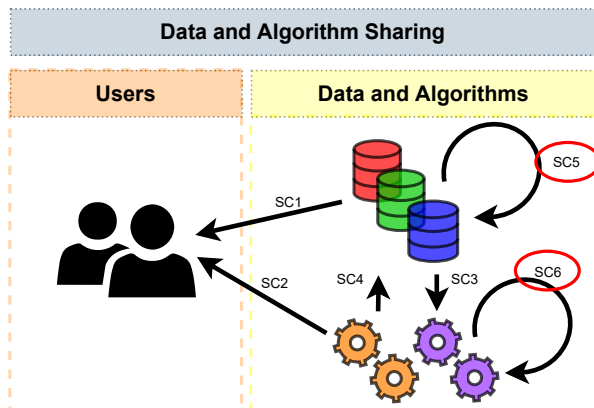
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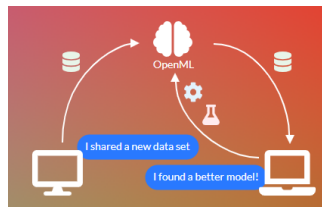
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# OpenML Dataset

- Retrieved from dataset and algorithm sharing platform OpenML<sup>1</sup>
- Interactions: User  $u$  applied algorithm  $a$  to dataset  $d$
- Many (new) datasets and algorithms without interactions
- We want to predict interactions!



Users	512	} 10,945 Interactions
Algorithms	1,307	
Datasets	573	
Algorithms <sub>w/o Int.</sub>	11,037	
Datasets <sub>w/o Int.</sub>	2,104	

<sup>1</sup> <https://www.openml.org/>

## Recommendation Algorithms

- *Most Popular (MP)*: Recommends the most popular items
- *Collaborative Filtering (CF)*: Recommends preferred items of similar target entities, i.e., those who get the recommendation
- *Content-based Filtering (CB)*: Recommends items similar to the ones the target entity prefers



# Evaluation Procedure

## Recommendation Algorithms

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- *Content-based Filtering (CB)*: Recommends items similar to the ones the target entity prefers

## Evaluation Criteria

- Accuracy: How satisfied the target is with the recommendations
- Popularity Bias (Exploration Potential): How well the available items can be explored through recommendations

# Results: Recommendation Accuracy

- CF generates the most accurate recommendations
- MP and CB perform poorly

Recommendation Scenario	Method	P@1	R@10	nDCG@10	Cov@10	RecPop@10
SC1 (Datasets to Users)	MP	0.00	0.22	0.08	0.01	593.79
	CF	<b>0.26</b>	<b>0.34</b>	<b>0.30</b>	0.06	181.50
	CB	0.05	0.05	0.04	<b>0.12</b>	<b>10.25</b>
SC2 (Algorithms to Users)	MP	0.03	0.11	0.07	0.00	265.75
	CF	<b>0.12</b>	<b>0.26</b>	<b>0.18</b>	0.02	90.51
	CB	0.02	0.06	0.03	<b>0.03</b>	<b>9.25</b>
SC3 (Datasets to Algorithms)	MP	0.00	0.12	0.04	0.01	555.20
	CF	<b>0.33</b>	<b>0.39</b>	<b>0.35</b>	0.06	143.36
	CB	0.00	0.13	0.09	<b>0.14</b>	<b>7.07</b>
SC4 (Algorithms to Datasets)	MP	0.01	0.29	0.18	0.00	270.62
	CF	<b>0.52</b>	<b>0.56</b>	<b>0.51</b>	0.01	97.56
	CB	0.01	0.03	0.02	<b>0.03</b>	<b>12.75</b>
SC5 (Datasets to Datasets)	MP	0.00	0.02	0.01	0.00	650.23
	CF	<b>0.17</b>	<b>0.44</b>	<b>0.28</b>	0.09	55.74
	CB	0.05	0.12	0.08	<b>0.28</b>	<b>14.88</b>
SC6 (Algorithms to Algorithms)	MP	0.01	0.02	0.01	0.00	278.32
	CF	<b>0.07</b>	<b>0.24</b>	<b>0.14</b>	0.02	55.01
	CB	0.04	0.12	0.07	<b>0.04</b>	<b>7.87</b>

# Results: Recommendation Accuracy

- Highest accuracy for SC4: Many more algorithms (i.e., 1307) than datasets (i.e., 573)  $\Rightarrow$  accurate recommendations
- Lowest accuracy for SC6: Sparse/Large interaction space  $\Rightarrow$  poor recommendations

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# Results: Recommendation Accuracy

- SC2 and SC4 have same item catalog and same no. of targets ( $\approx 500$  users,  $\approx 600$  datasets), but accuracy for SC2 is smaller than for SC4
- Reason: Users have larger profiles than datasets  $\rightarrow$  more difficult to generate accurate recommendations

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# Results: Popularity Bias (Exploration Potential)

- CB recommends most and least popular items
- Harder to explore larger item catalogs (i.e., algorithms)
- Many items remain unexplored

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# Summary

## Our findings

- Six recommendation scenarios between users, datasets, and algorithms
- CF produces accurate recommendations, CB covers most items
- Not all datasets and algorithms can be explored!
- Recommendation scenarios are different recommendation problems!

## Future Work

- Monetization and financial constraints
- Privacy-related, legal, or economical concerns

# Thank you!

**OpenML Dataset**

[zenodo.org/record/6517031](https://zenodo.org/record/6517031)

**Contacts**

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