Make the most of ML

without growing the team

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Data Analytics and AI
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Things change.

Data rich

Interaction rich

Small data science team.


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Bringing down the silo walls

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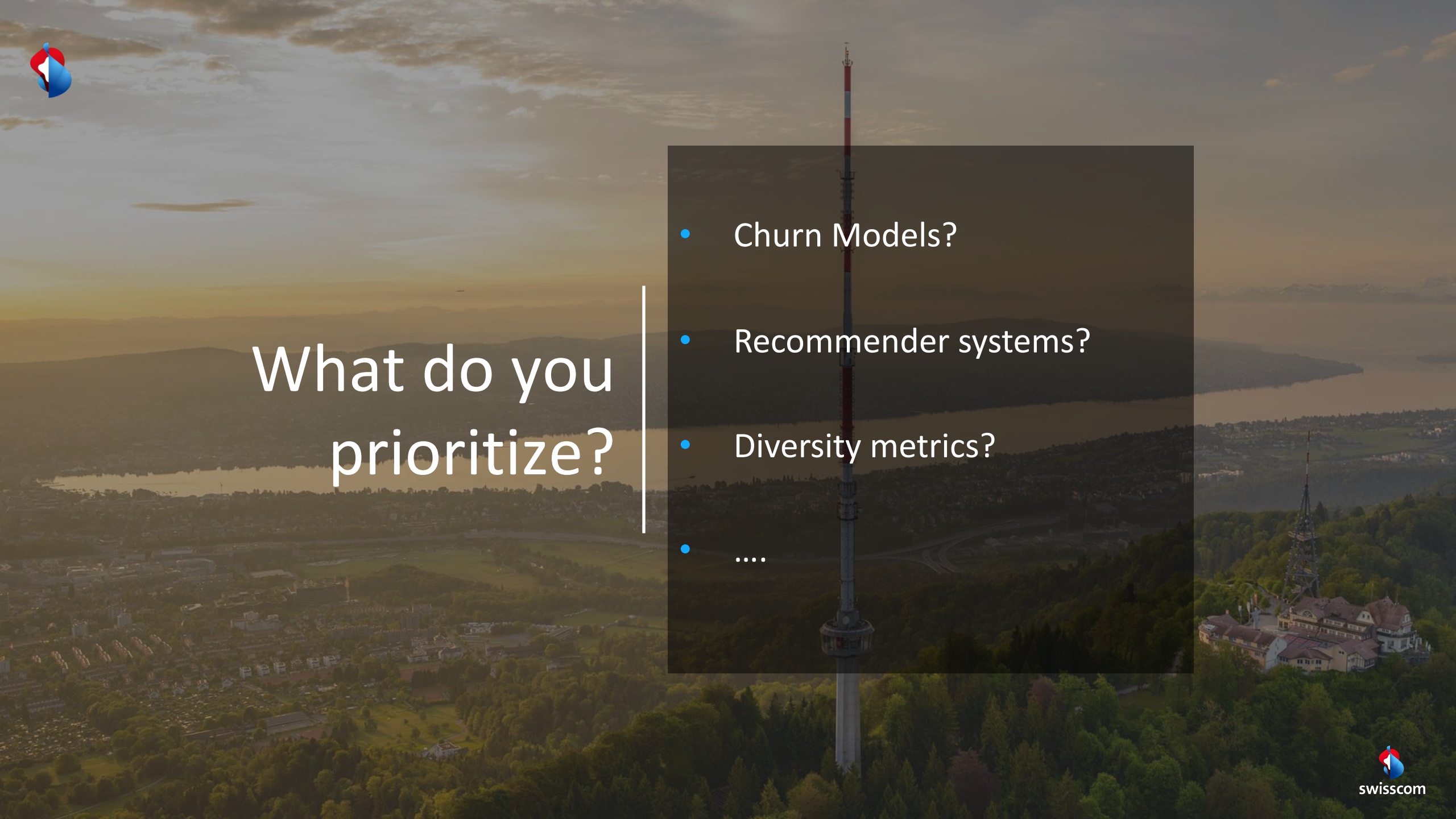
What do you prioritize?
Churn Models?
Recommender systems?
Diversity metrics?
….
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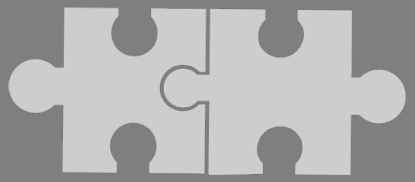
What else is this data good for?

How can I integrate constraints and objectives?

How can I use all the relevant knowledge?



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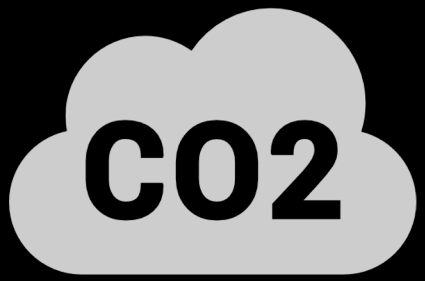
Data Reusability



From anonymized network data to smart cities and CO2 tracking

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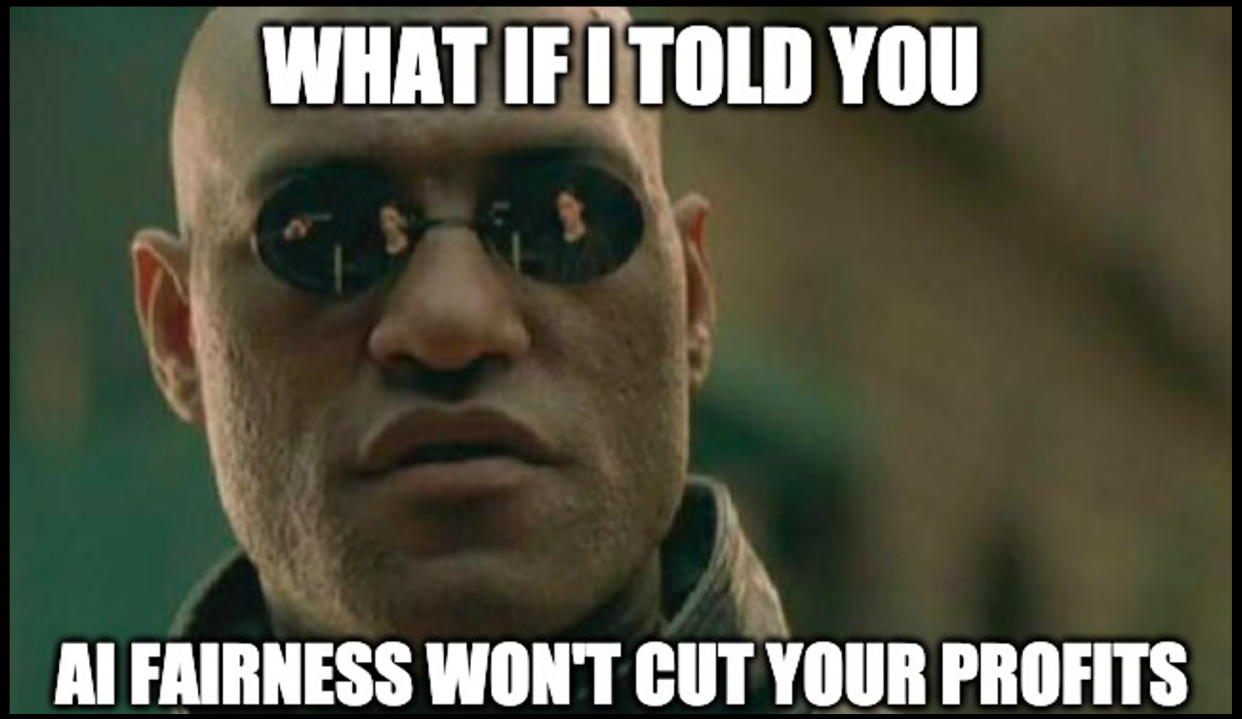
A multitude of objectives



Accuracy

Novelty

Revenue

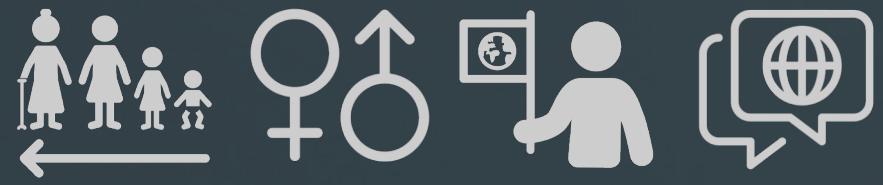
Diversity

Fairness

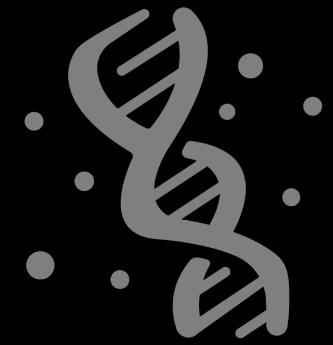
From wish to action

- Strategic goals

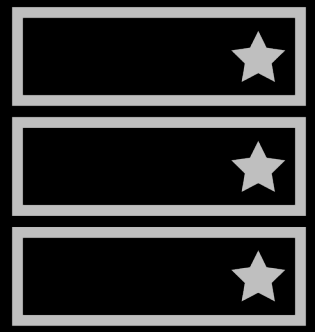
- Short term action



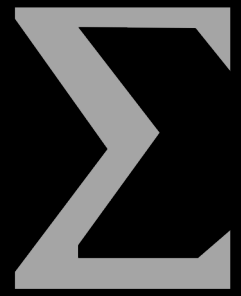
Multi-objective recommender systems



Evolutionary Algorithms



Re-ranking



Weighted Sum

$$\alpha_i \nabla_i$$

Multi-gradient descent

Multi-objective optimization problem

$$\min_{w \in R^D} \boldsymbol{L}(\boldsymbol{w}) = \min_{w \in R^D} \begin{vmatrix} L_1(w) \\ L_2(w) \\ \vdots \\ L_n(w) \end{vmatrix}_{n \times 1}$$

Common descent vector

$$\boldsymbol{\nabla_w L}(\boldsymbol{w}) = \sum_{i=1}^{N} \alpha_i \nabla_w L_i(w)$$

$\alpha_1, \ldots, \alpha_n \geq 0$ and $\sum_{i=1}^{n} \alpha_i = 1$.

Stochastic multi-subgradient descent

- **QCOP**

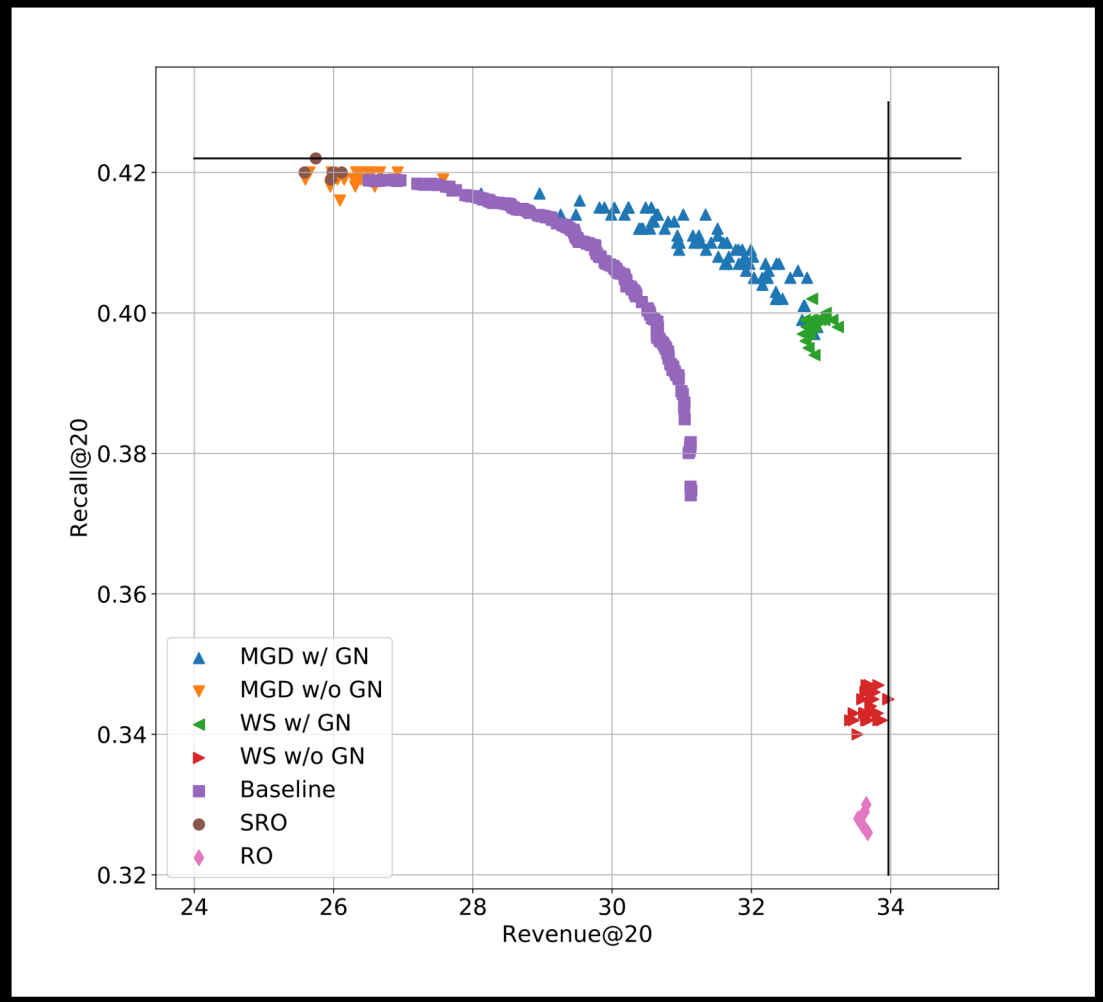
$$\boldsymbol{\nabla_w L(w)} = \min_{\alpha_1,\dots,\alpha_n} \left\{ \left\| \sum_{i=1}^{N} \alpha_i \nabla_w L_i(w) \right\|^2 \;\middle|\; \sum_{i=1}^{N} \alpha_i = 1, \alpha_1, \dots, \alpha_n \geq 0 \right\}$$

- The trick: Gradient normalization

$$\nabla_w \widehat{L_i}(w) = \frac{\nabla_w L_i(w)}{L_i(w_{init})}$$

$$\widehat{L_i}(w) \in [0, 1]$$

Correlated Objectives in Recommenders



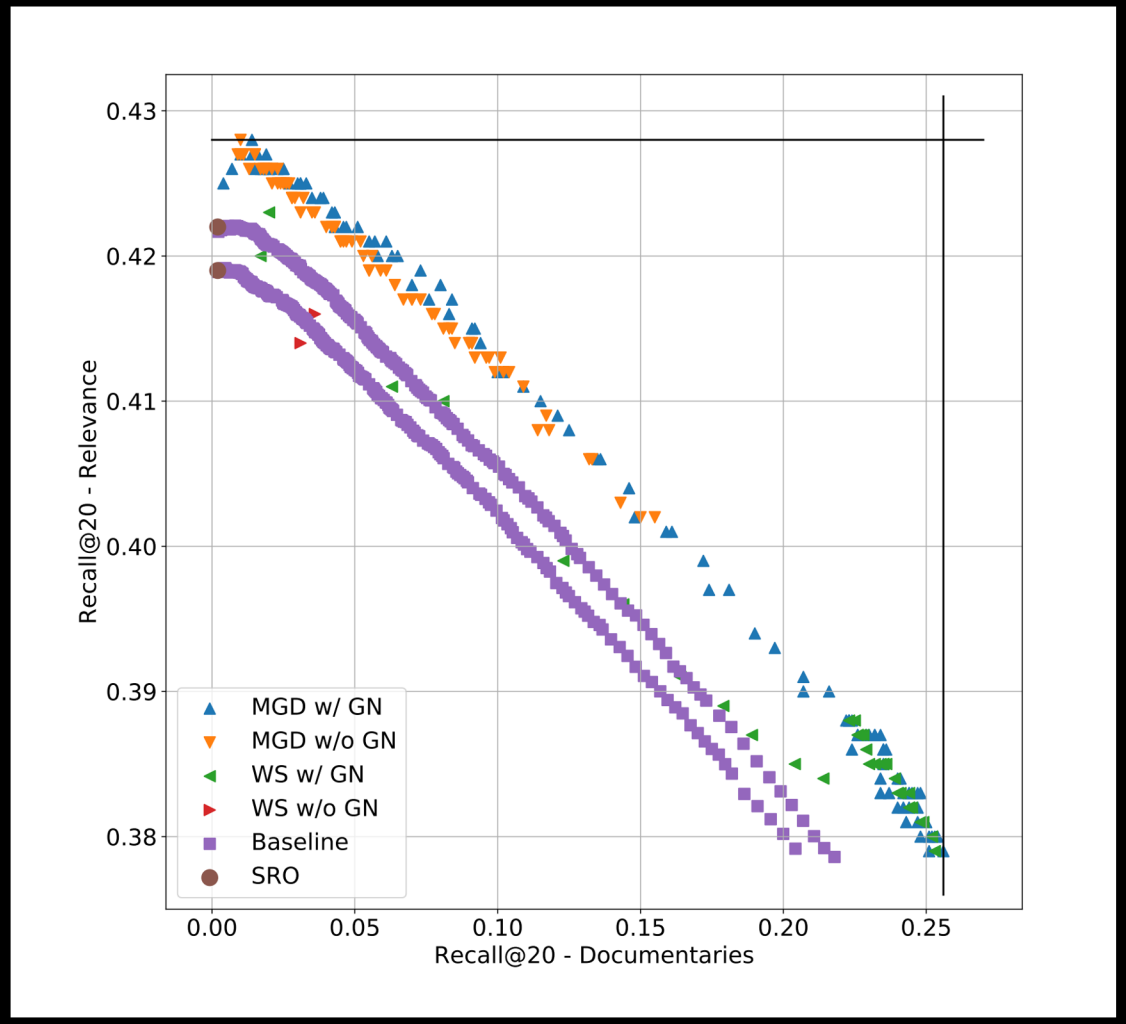
Single Objectives
Revenue
Semantic Relevance

Reranking

Weighted Sum
w/o grad norm
with grad norm

SMSGDA
w/o grad norm
with grad norm

Uncorrelated Objectives in Recommenders



Single Objectives
Revenue
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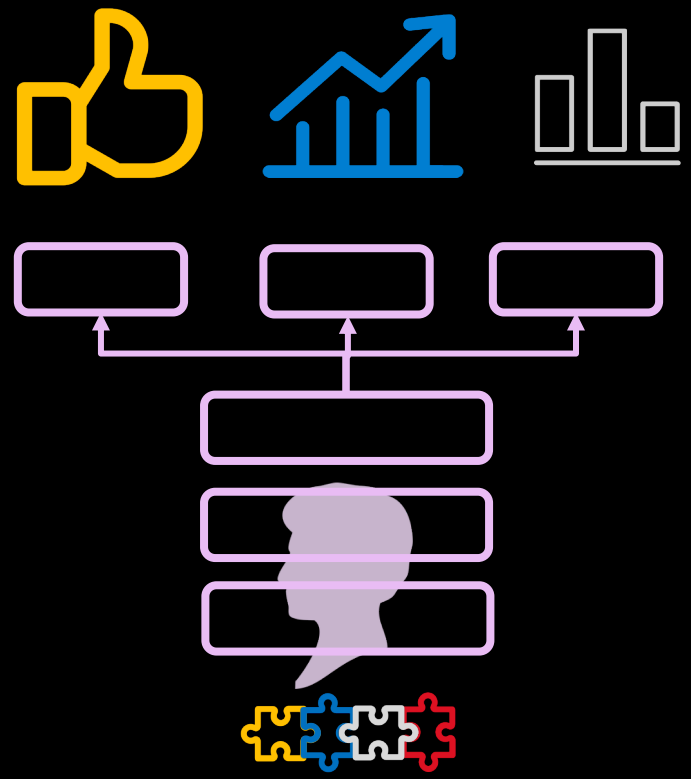
with grad norm

SMSGDA
w/o grad norm
with grad norm

Multi-Gradient Descent for Multi-Objective Recommender Systems. Milojkovik et al. WICRS@AAAI 2020

Knowledge Efficiency



Evaluating the Search Phase of Neural Architecture Search. Yu, Sciuto et al. ICLR 2020

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