Where to Go Next for Recommender Systems? ID- vs. Modality-based Recommender Models Revisited

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Key weaknesses of ID-based Recsys (IDRec)

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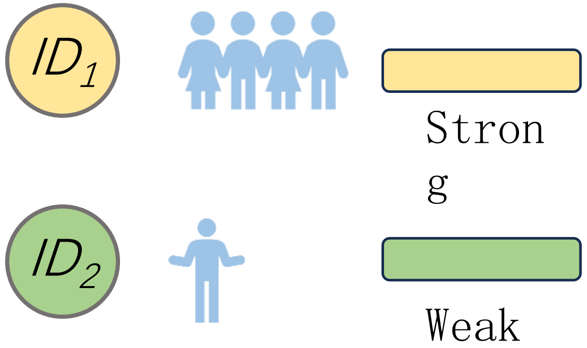

(1) Cold-start
setting

Background and Motivation

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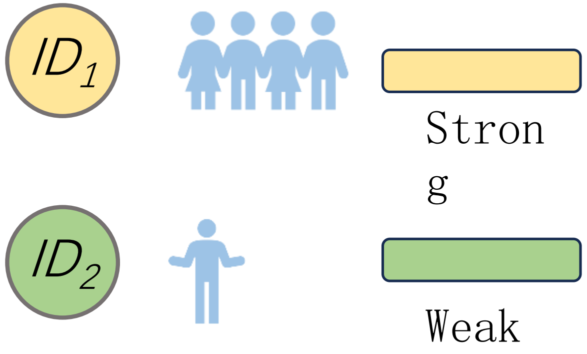

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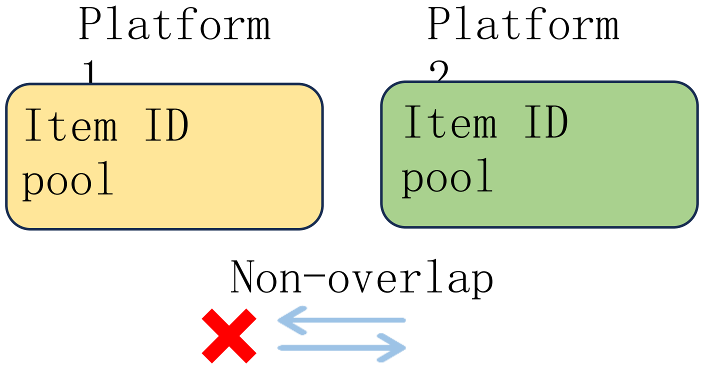

(2) Non-transferable

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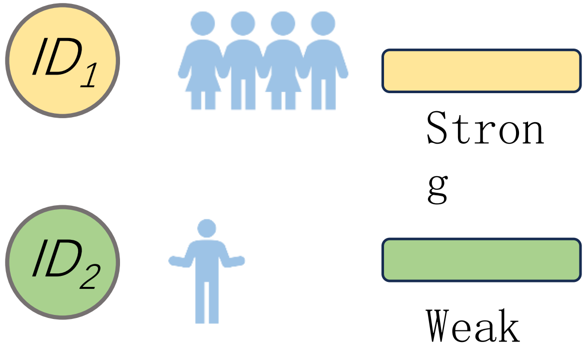

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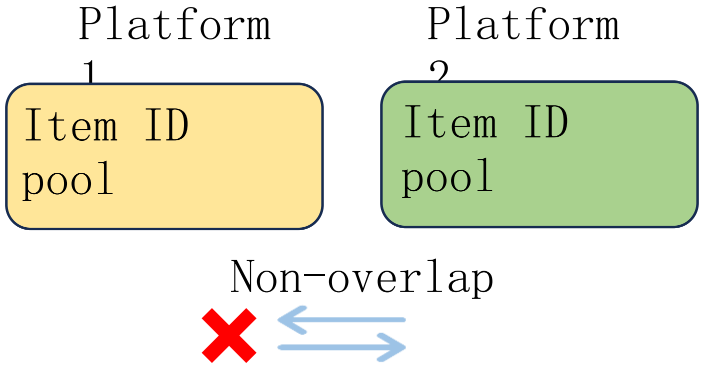

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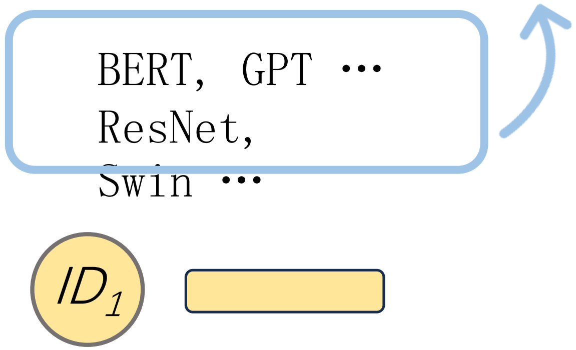

(3) Non-benefits

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Modality-based Recsys (MoRec)

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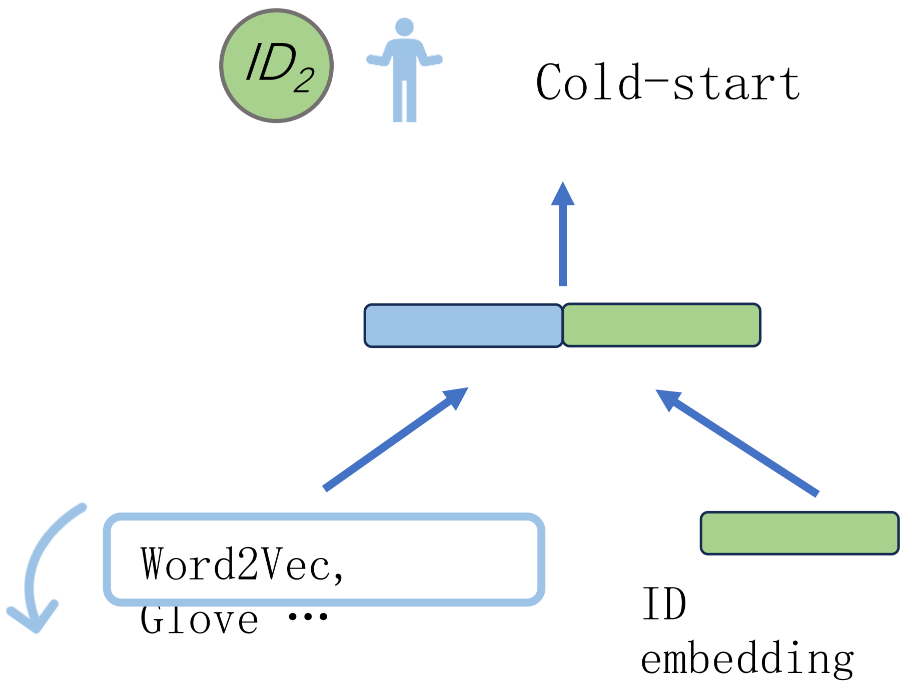
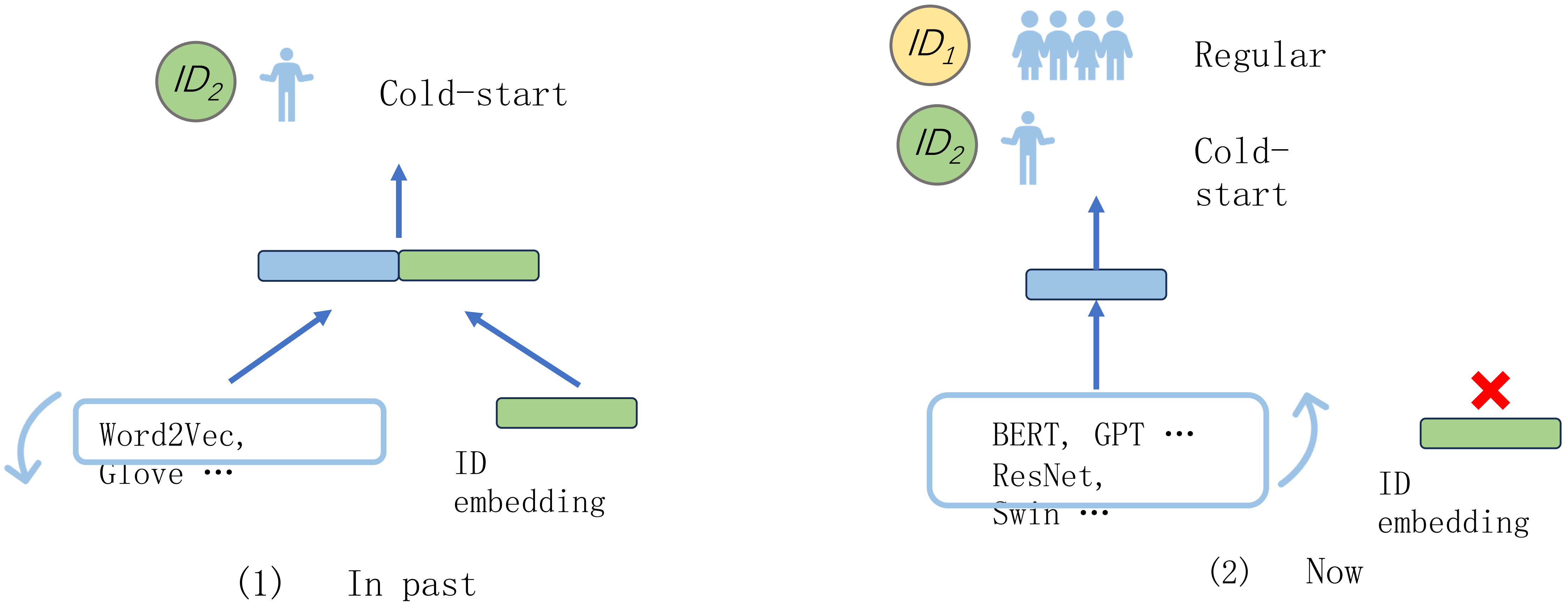


(1) In past

Background and Motivation

Modality-based Recsys (MoRec)



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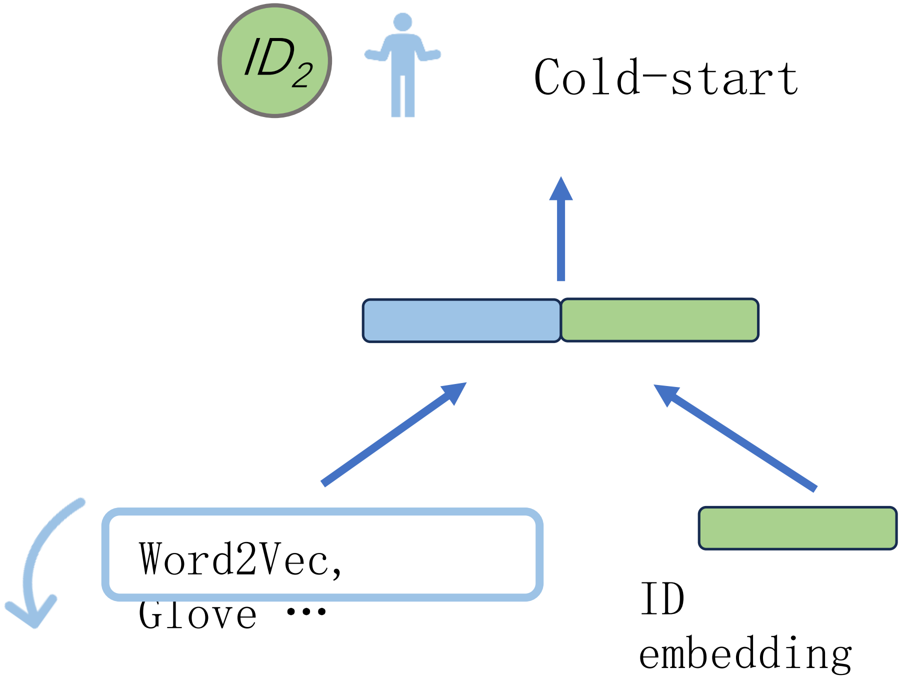

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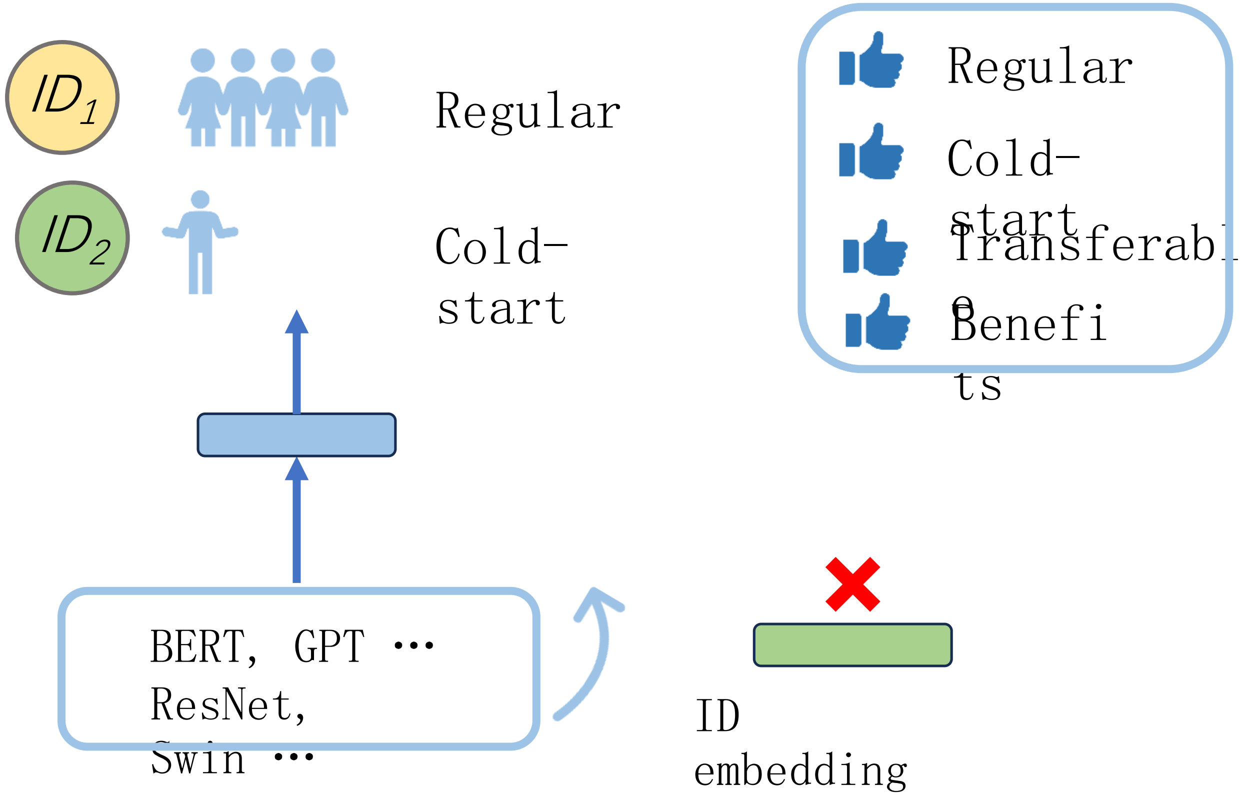
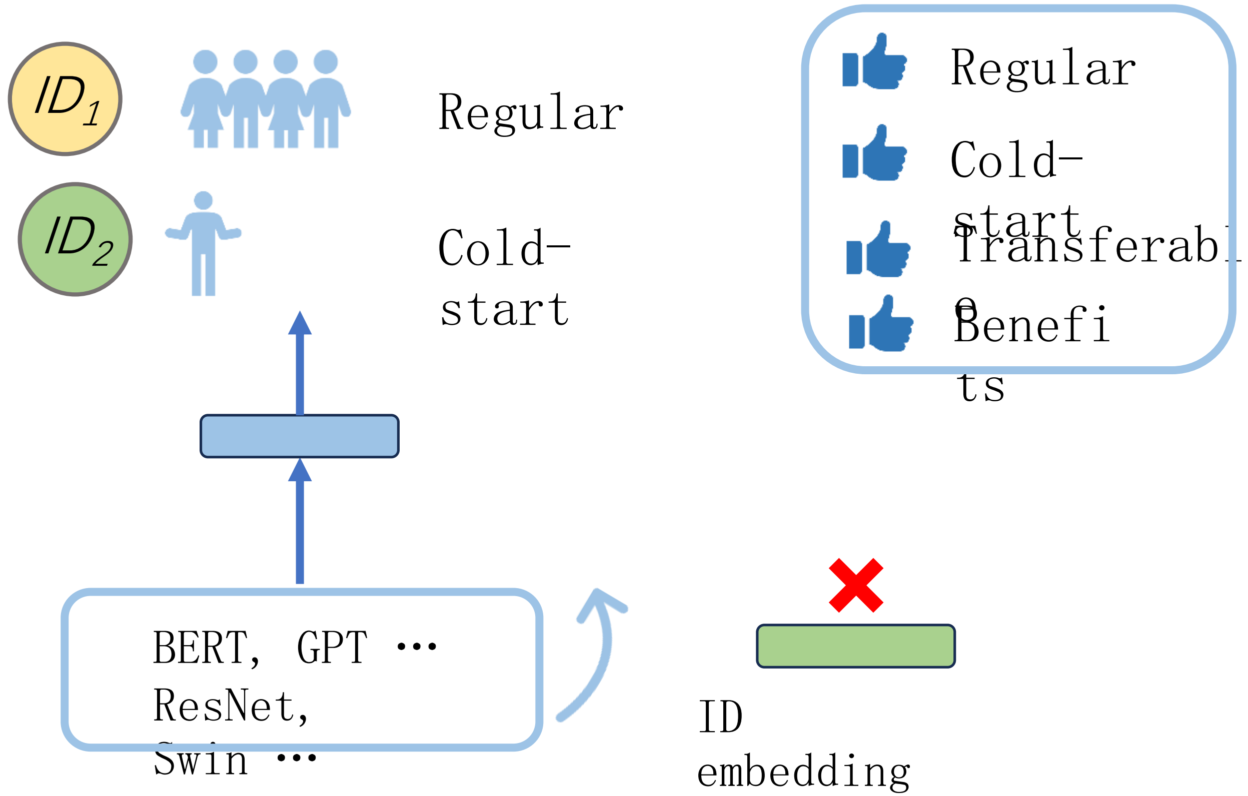


(2) Now

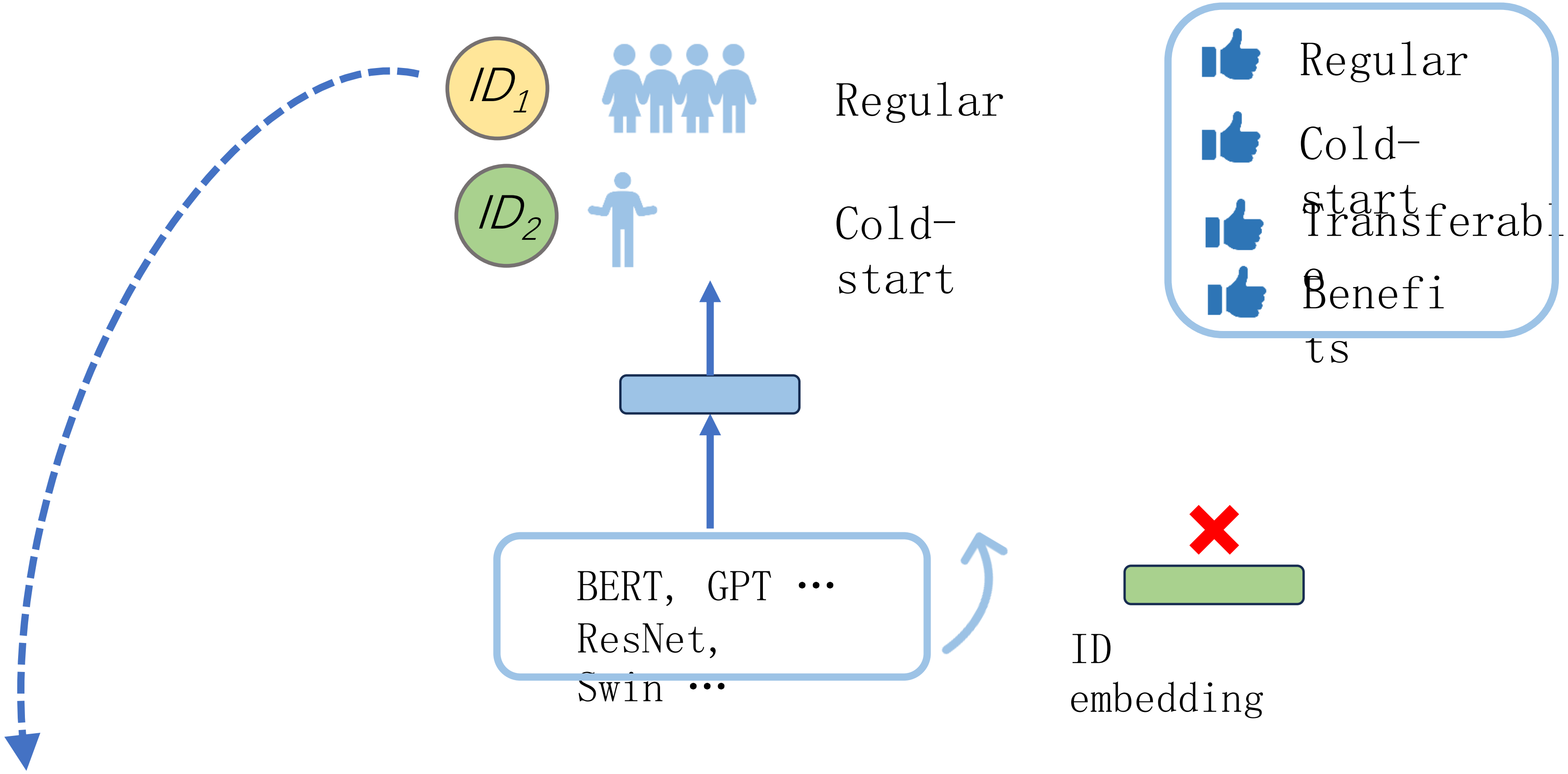
Background and Motivation

Rethink the potential of MoRec



Background and Motivation

Rethink the potential of MoRec (1/4)



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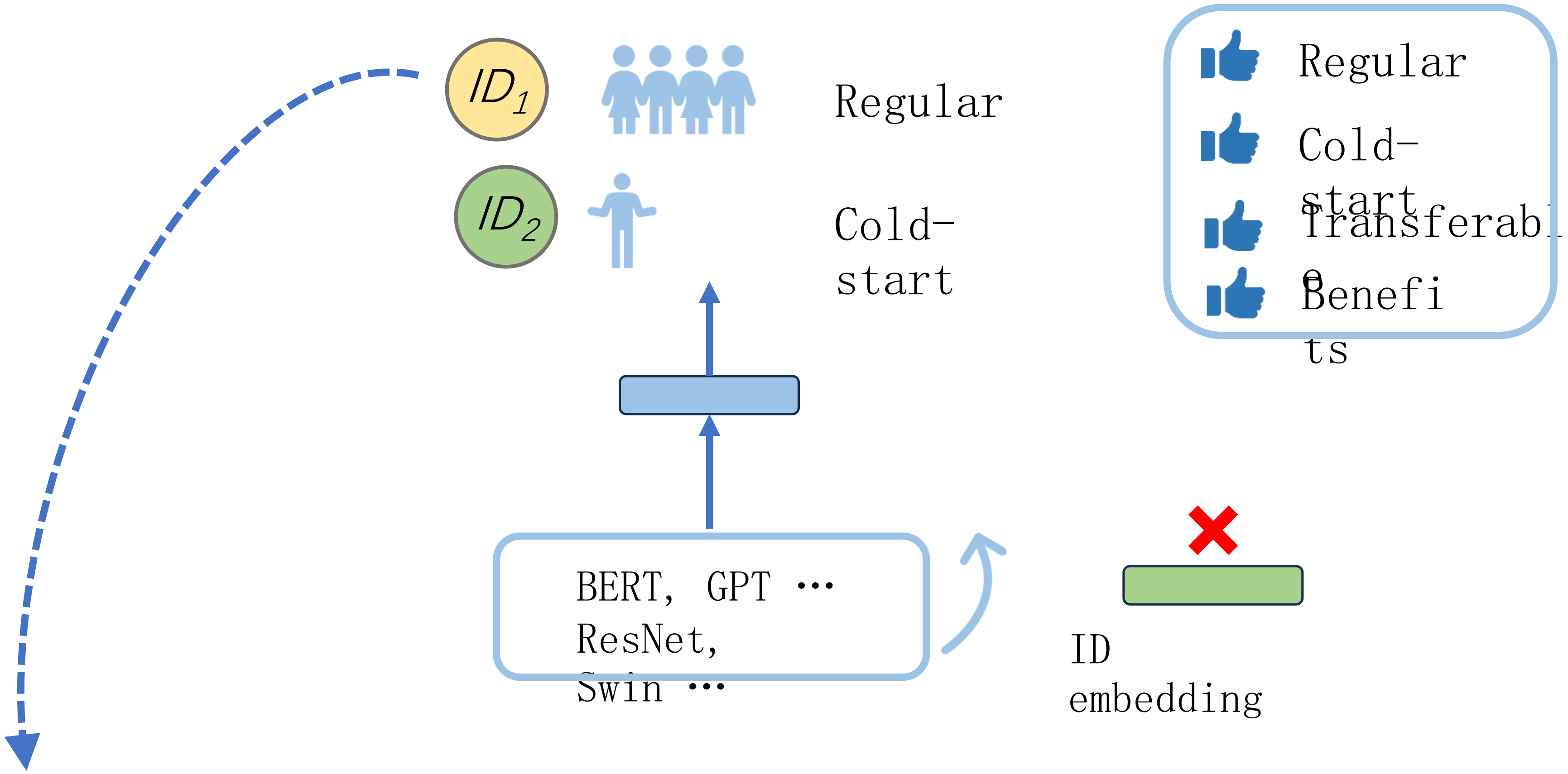
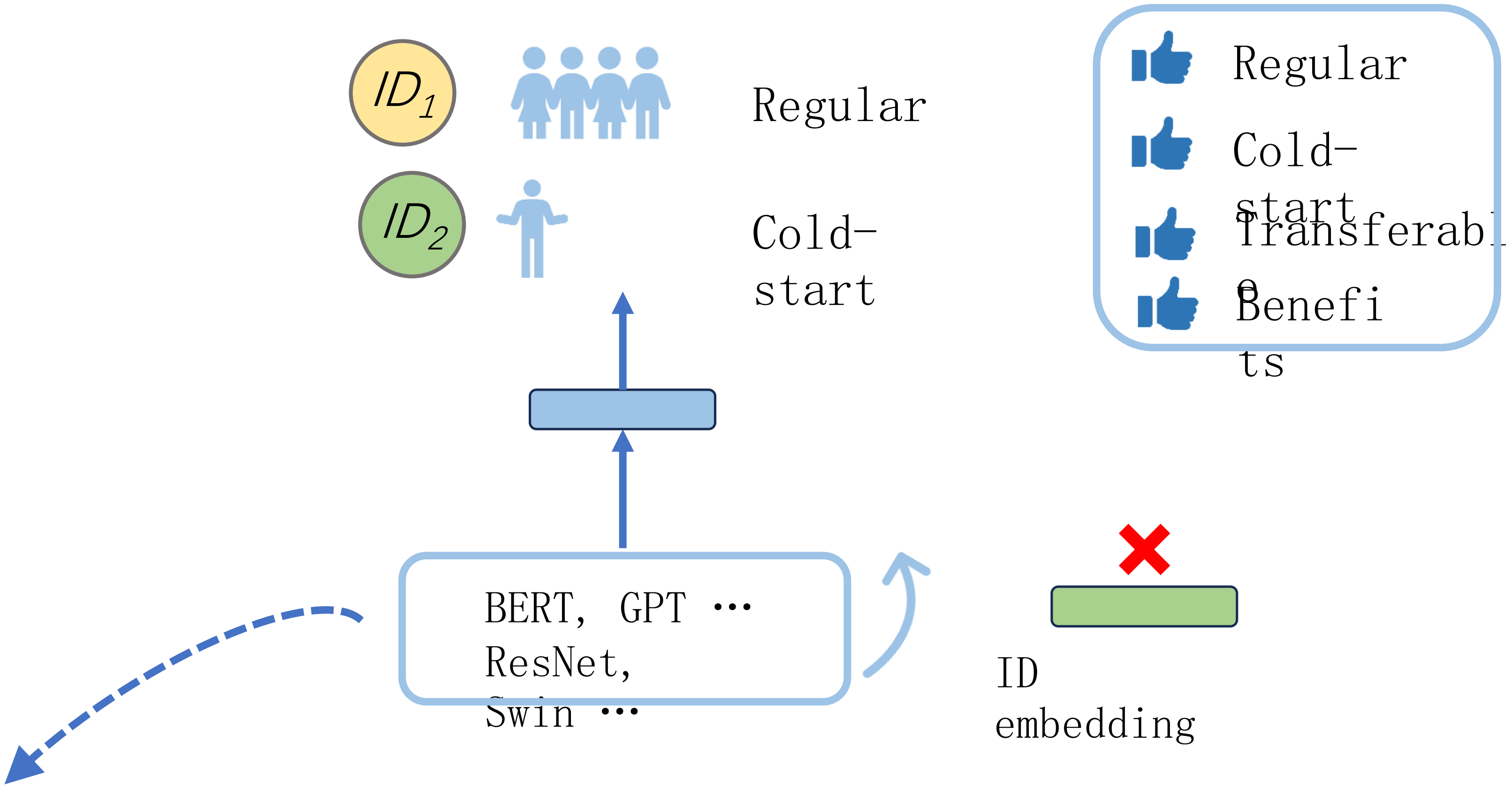


Q(i): Equipped with strong modality encoders, can MoRec be comparable to or even surpass IDRec in no-cold setting?

Rethink the potential of MoRec (2/4)



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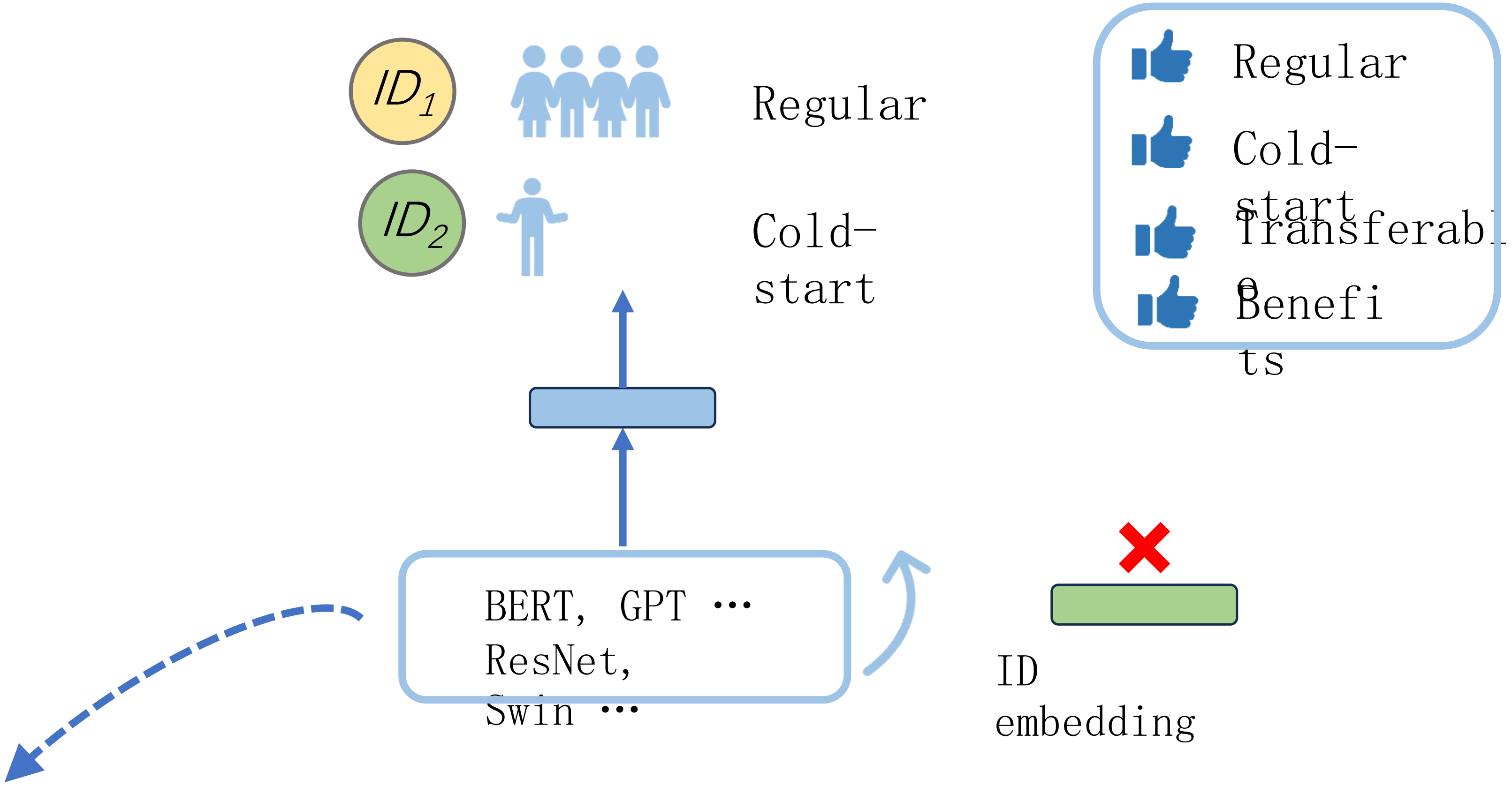
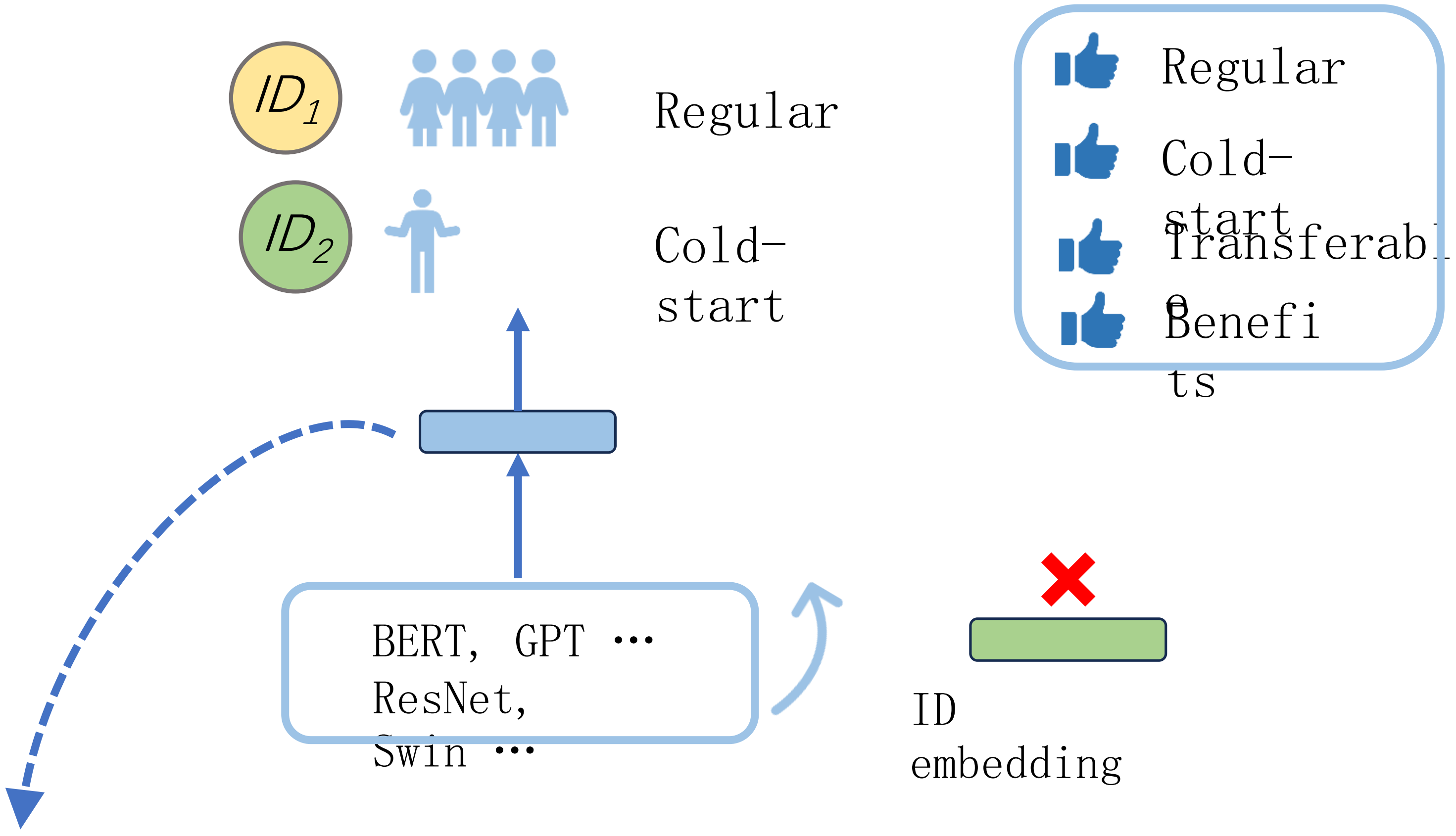


Q(ii): Can the recent technical advances developed in NLP and CV fields
translate into improvement in MoRec?

Background and Motivation

Rethink the potential of MoRec (3/4)



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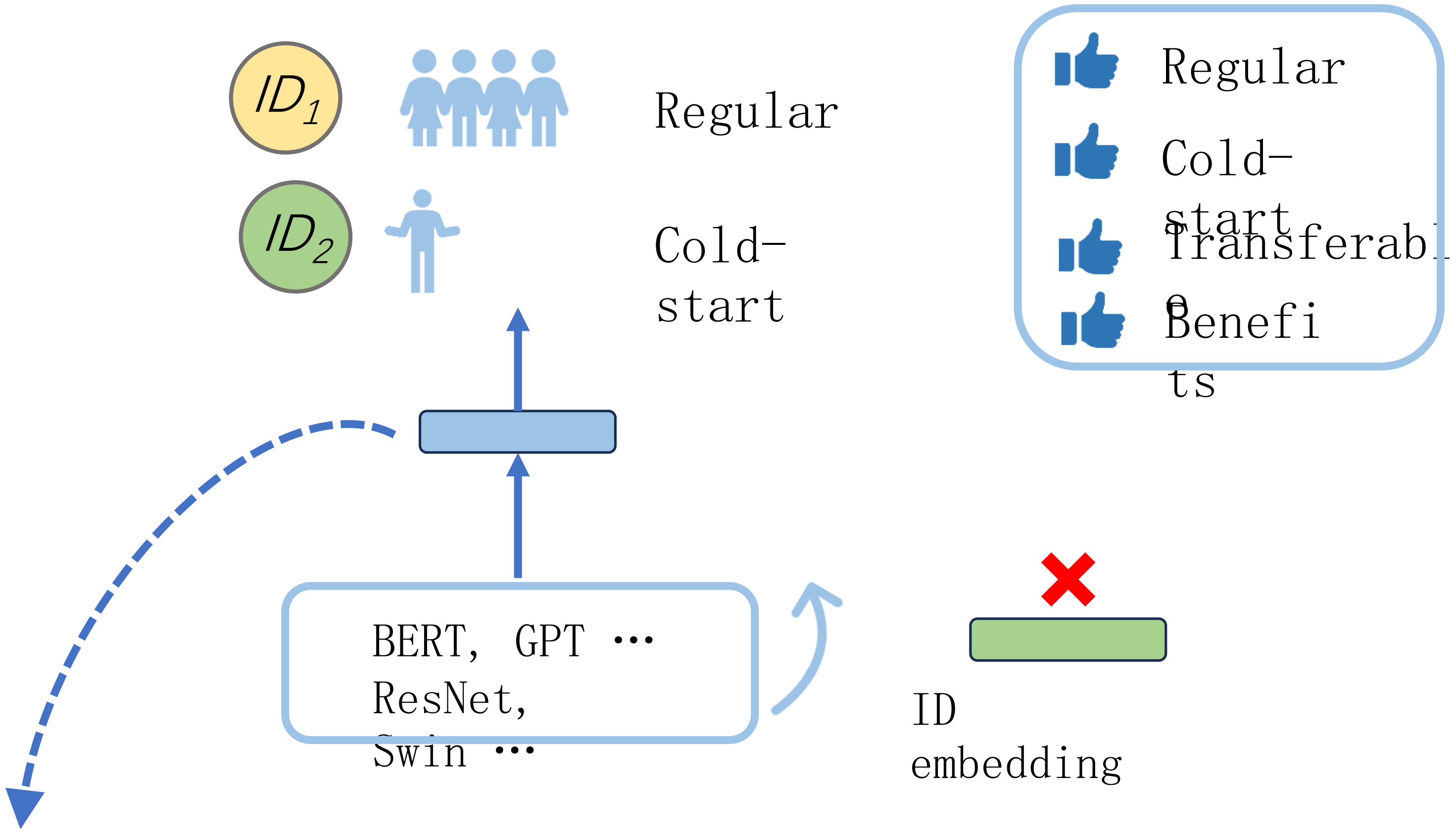

Q(iii): How can we effectively use the item modality representations derived from a pre-training NLP or CV encoder?

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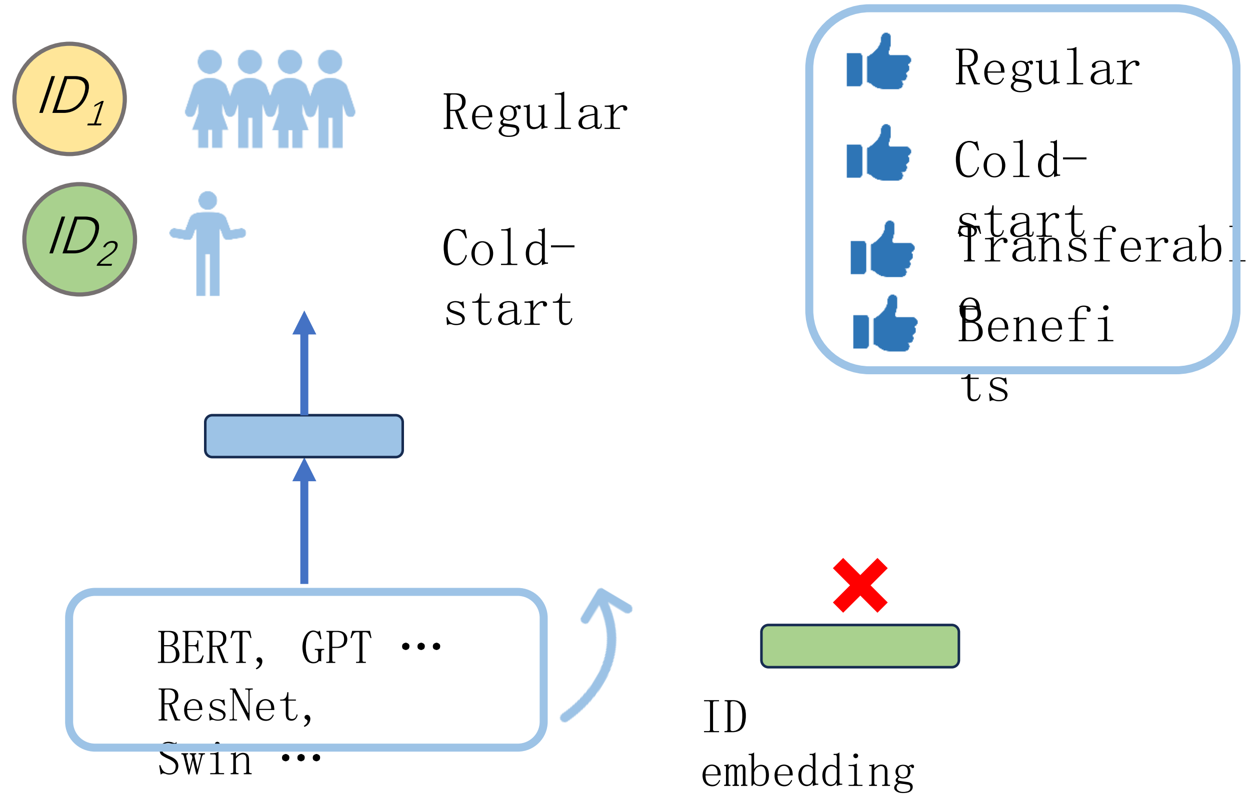

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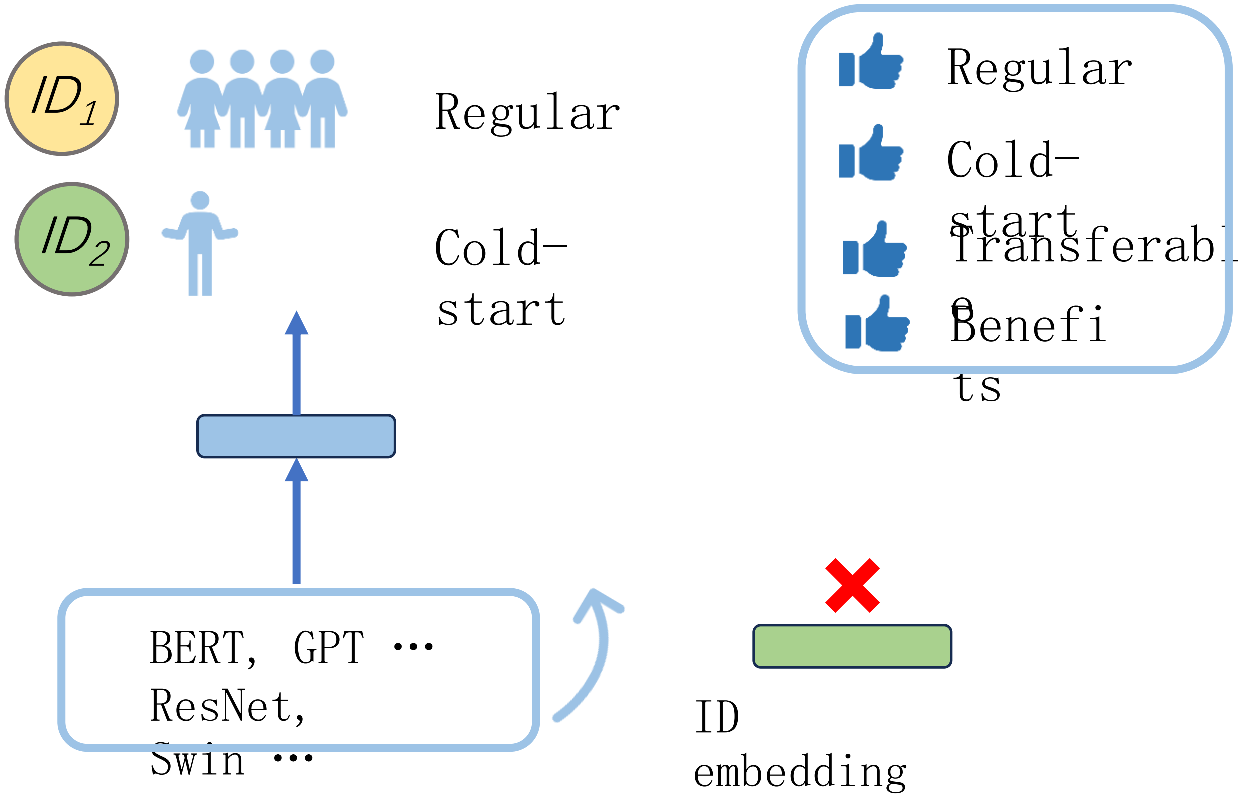

Q(iv): Several key challenges that remain unexplored for MoRec training.

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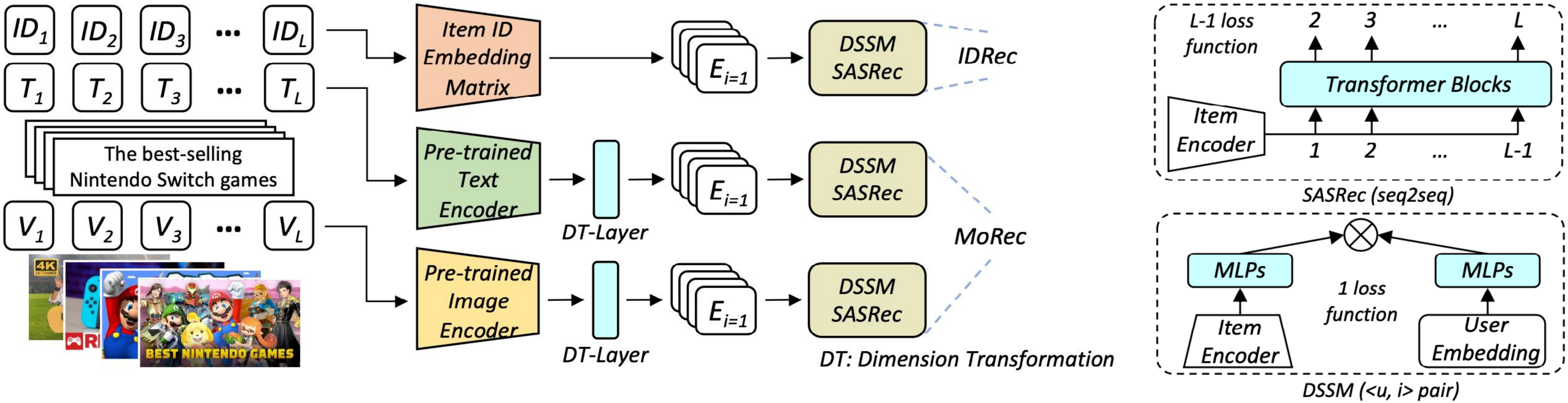

Illustration of IDRec vs MoRec.

Datasets and Loss Function

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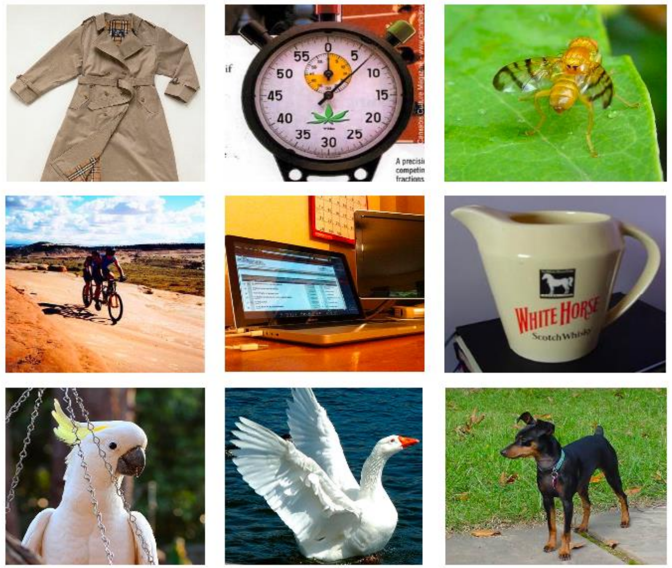
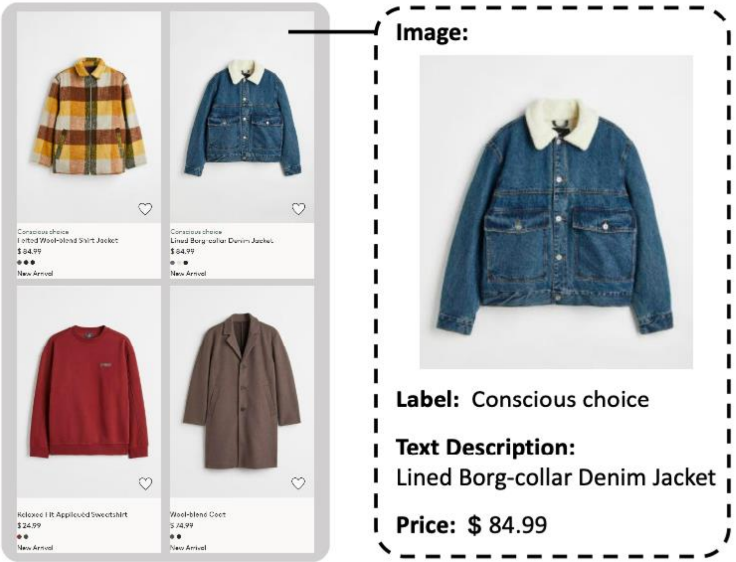


(a) Item cases on ImageNet1K.



(b) Item cases on HM.

(c) Item cases on Bili.

Item cases on datasets.

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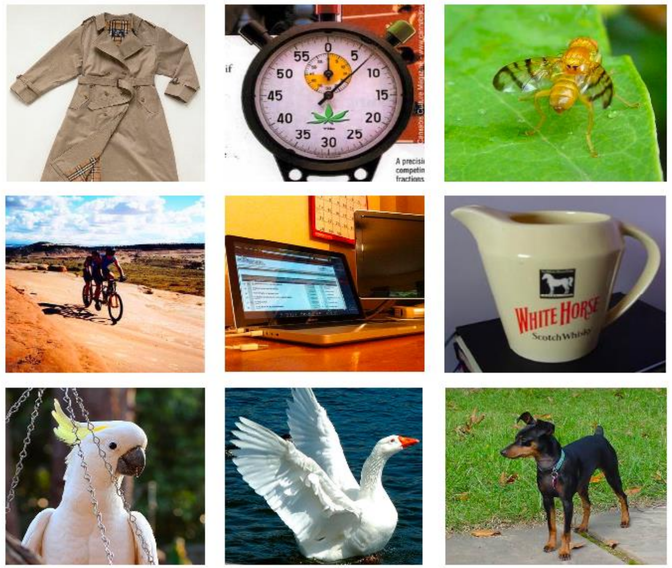

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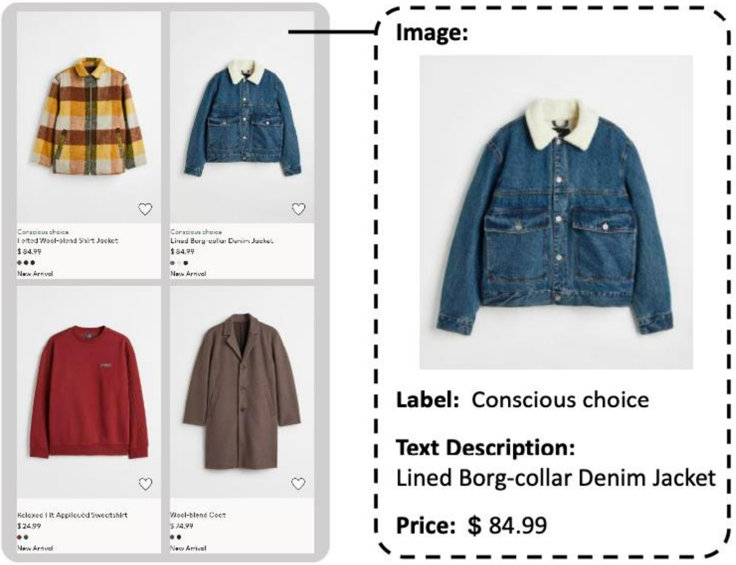

(b) Item cases on HM.

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Item cases on datasets.

Binary cross entropy loss

$$\begin{cases} min - \sum_{u \in \mathcal{U}} \sum_{i \in [2,\ldots,L]} \{\log(\sigma(\hat{y}_{ui})) + \log(1 - \sigma(\hat{y}_{uj}))\} & \text{SASRec} \\ min - \sum_{<u,i,j> \in \mathcal{R}} \{\log(\sigma(\hat{y}_{ui})) + \log(1 - \sigma(\hat{y}_{uj}))\} & \text{DSSM} \end{cases}$$

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Q(i):

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Dataset	Metrics	DSSM			SASRec				Improv.
		IDRec	$\text{BERT}_{\text{base}}$	$\text{RoBERTa}_{\text{base}}$	IDRec	$\text{BERT}_{\text{small}}$	$\text{BERT}_{\text{base}}$	$\text{RoBERTa}_{\text{base}}$	
MIND	HR@10	**3.58**	2.68	3.07	17.71	18.50	18.23	**18.68**	+5.48%
	NDCG@10	**1.69**	1.21	1.35	9.52	9.94	9.73	**10.02**	+5.25%
		IDRec	ResNet50	Swin-T	IDRec	ResNet50	Swin-T	Swin-B	
HM	HR@10	**4.93**	1.49	1.87	6.84	6.67	6.97	**7.24**	+5.85%
	NDCG@10	**2.93**	0.75	0.94	**4.01**	3.56	3.80	3.98	-0.75%
Bili	HR@10	**1.14**	0.38	0.57	3.03	2.93	3.18	**3.28**	+8.25%
	NDCG@10	**0.56**	0.18	0.27	1.63	1.45	1.59	**1.66**	+1.84%

MoRec vs IDRec (Regular Setting)

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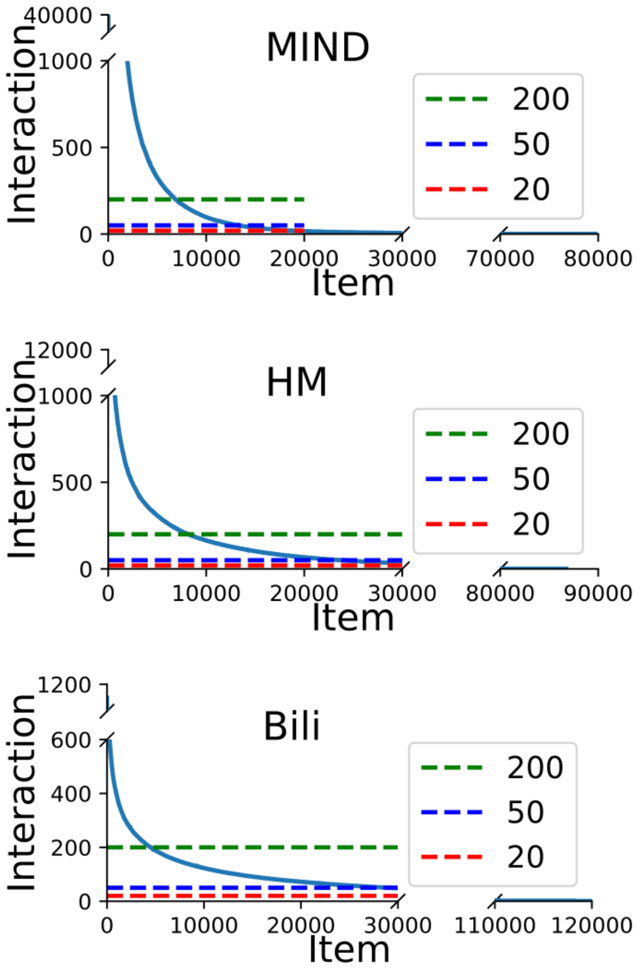

Dataset	MIND		HM		Bili	
	IDRec	$\text{BERT}_{\text{base}}$	IDRec	Swin-T	IDRec	Swin-T
Warm-20	20.12	**20.19**	7.89	**8.05**	3.48	**3.57**
Warm-50	20.65	**20.89**	**8.88**	8.83	**4.04**	4.02
Warm-200	**22.00**	21.73	**11.15**	11.10	**10.04**	9.98

MoRec vs IDRec (Warm Item Settings)

Q(ii):

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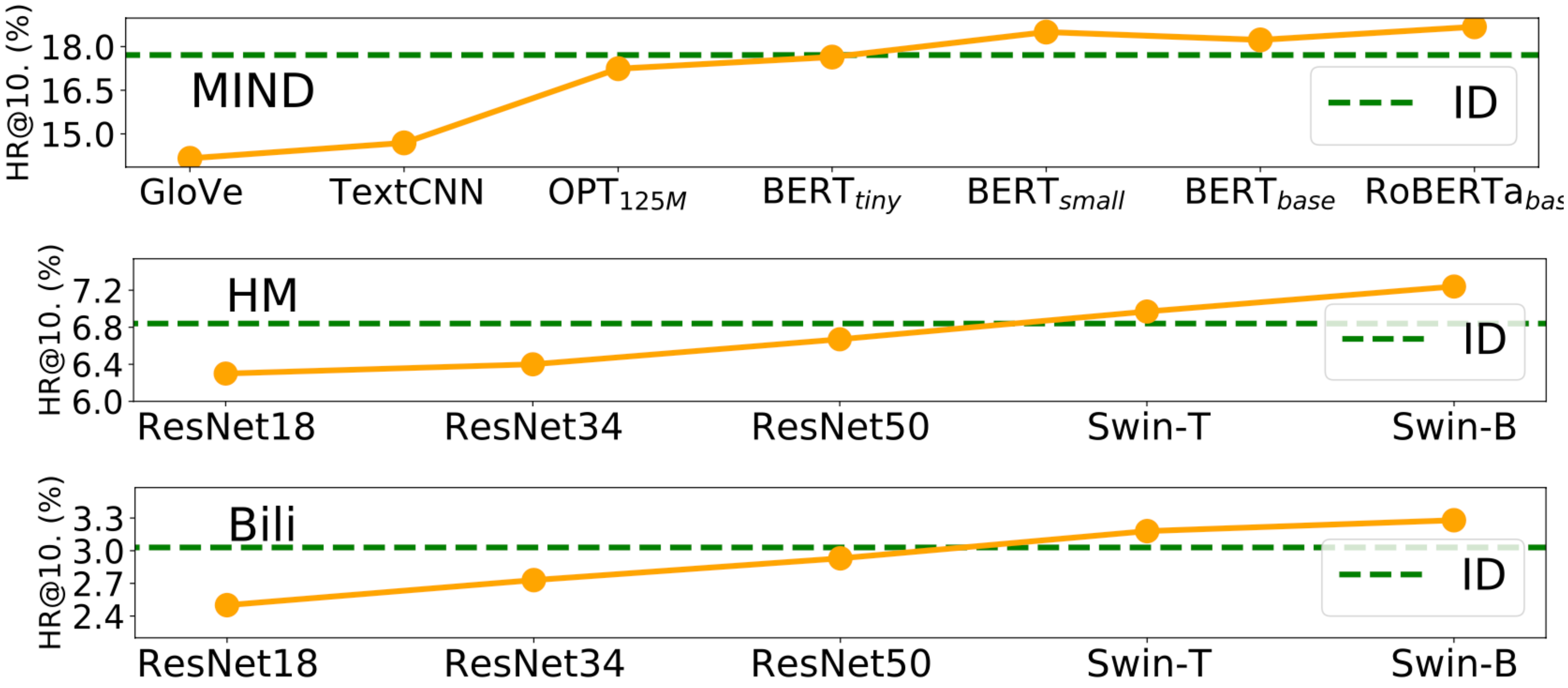

Accuracy with different pre-trained ME in MoRec

Q(iii):

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Dataset	IDRec	ME	TS	TS-DNN					E2E
				2	6	8	10	12	
MIND	17.71	$BERT_{base}$	13.93	15.20	16.26	<u>16.66</u>	16.32	16.14	**18.23**
HM	6.84	ResNet50	4.03	4.64	<u>5.40</u>	5.39	<u>5.40</u>	5.02	6.67
		Swin-T	3.45	4.46	5.28	<u>5.55</u>	5.40	5.38	**6.97**
Bili	3.03	ResNet50	0.72	1.23	<u>1.62</u>	1.47	1.28	1.24	2.93
		Swin-T	0.79	1.40	1.81	<u>2.10</u>	1.95	1.64	**3.18**

E2E vs TS with additional MLP layers

Q(iv):

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Dataset	Method	#Param.	FLOPs	Time/E	MU	GPU
MIND	IDRec	47M	0.12G	2.7m	3G	V100-32G(1)
	$\text{BERT}_{\text{tiny}}$	11M	0.63G	10m	4G	V100-32G(1)
	$\text{BERT}_{\text{small}}$	35M	16G	42m	13G	V100-32G(1)
	$\text{BERT}_{\text{base}}$	116M	107G	102m	52G	V100-32G**(2)**
HM	IDRec	114M	1G	4.3m	5G	V100-32G(1)
	ResNet18	18M	40G	95m	23G	V100-32G(1)
	ResNet34	29M	81G	136m	30G	V100-32G(1)
	ResNet50	31M	91G	83m	80G	V100-32G**(4)**
	Swin-T	34M	96G	107m	157G	A100-40G**(4)**
	Swin-B	94M	333G	102m	308G	A100-40G**(8)**

The training cost of IDRec and End2end MoRec

Q(iv):

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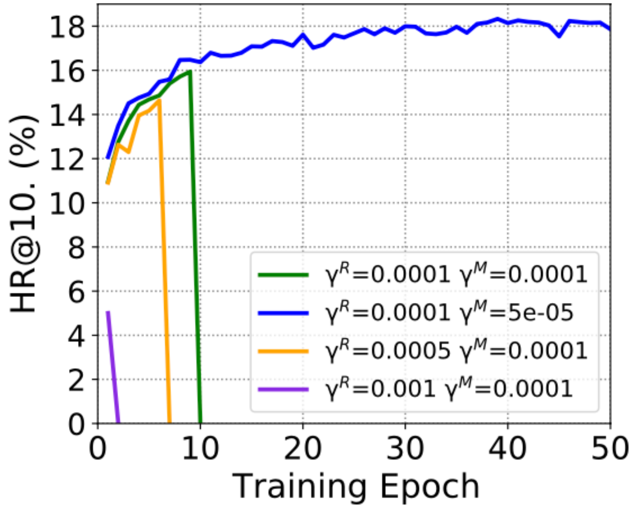
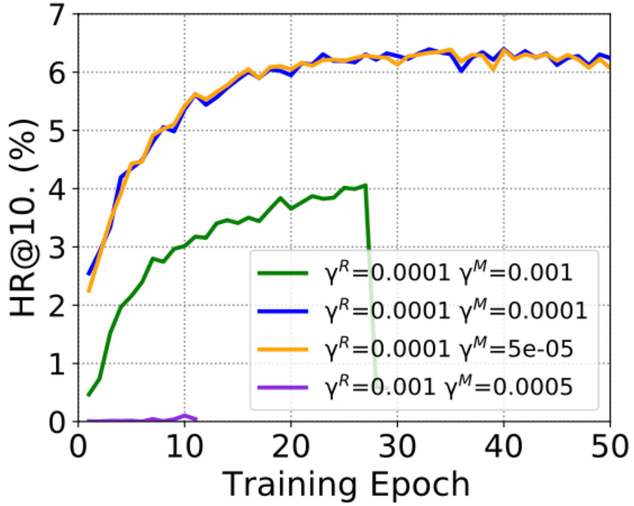
Dataset	ME	TS			E2E		
		w/o	w/	Improv.	w/o	w/	Improv.
MIND	$\text{BERT}_{\text{base}}$	13.93	**14.68**	+5.38%	18.23	**18.63**	+2.19%
HM	MAE_{base}	2.50	**2.79**	+11.60%	7.03	**7.07**	+0.57%
Bili	MAE_{base}	0.57	0.57	0.00%	**3.18**	3.17	-0.31%

Performing a second round of pre-training for ME



(a) MoRec with $\text{BERT}_{\text{base}}$ on MIND.



(b) MoRec with Swin-T on HM.

Q(iv):

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Dataset	ME	IDRec	TS	ID+TS w/o ADD	ID+TS w/o CON	ID+TS w/ ADD	ID+TS w/ CON	Improv.	TS-DNN	ID+TS-DNN w/o ADD	ID+TS-DNN w/o CON	ID+TS-DNN w/ ADD	ID+TS-DNN w/ CON	Improv.	E2E	ID+E2E w/o ADD	ID+E2E w/o CON	Improv.
MIND	$\text{BERT}_{\text{base}}$	17.71	13.93	16.10	17.20	17.66	17.57	-0.28%	16.66	14.93	16.58	17.29	17.55	-0.90%	**18.23**	16.25	17.12	-6.09%
HM	Swin-T	6.84	3.45	5.75	4.89	5.37	5.40	-15.94%	5.55	5.27	4.00	4.77	5.11	-22.95%	**6.97**	5.40	4.95	-22.53%
Bili	Swin-T	3.03	0.79	3.01	2.61	3.02	2.86	-0.33%	2.10	2.86	2.35	2.50	2.72	-5.61%	**3.18**	2.94	2.55	-7.55%

co-training ID and modality.

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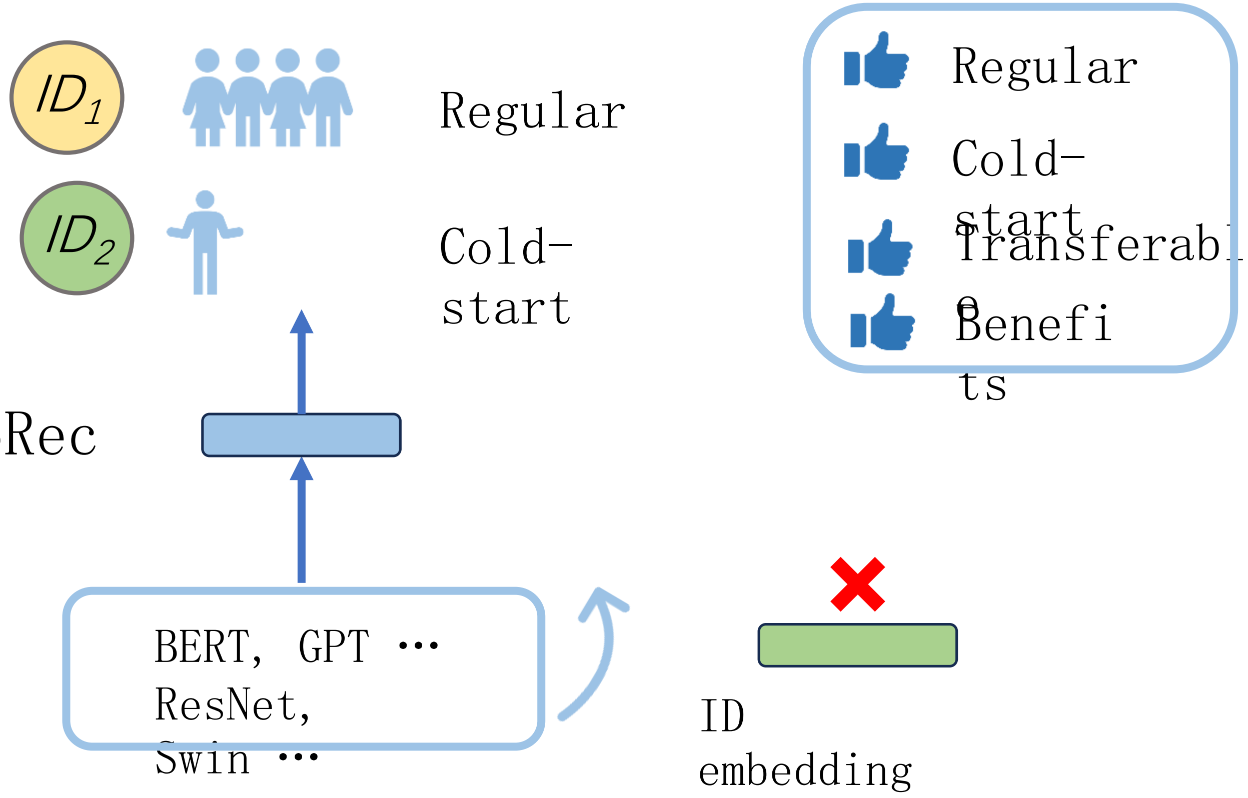

2. Multimodal MoRec

1. Text, vision, voice and video

3. Improved networks;
4. Scale up training data
5. Large Language Models: ChatGPT, GPT4

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Q&A

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