STA323 Assignment3

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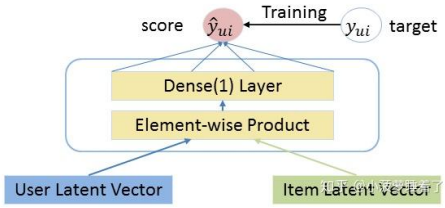
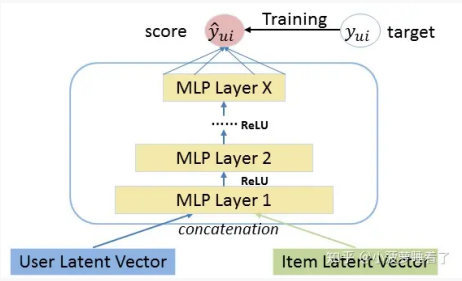
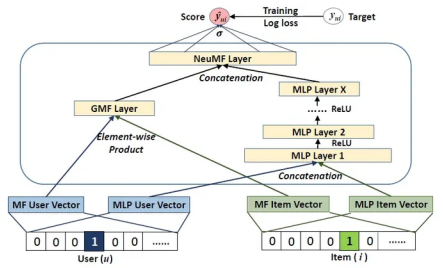
Requirements

```
root@autodl-container-90ef4388d6-b434c836:~# python --version
Python 3.10.8
root@autodl-container-90ef4388d6-b434c836:~# python -c "import torch; print(torch.__version__)"
2.1.2+cu121
```

Model description

Model	Summary
	GMF((user_embedding): Embedding(6040, 3) (item_embedding): Embedding(3706, 3) (predict_layer): Sigmoid())
	MLP((embedding_user): Embedding(6040, 4) (embedding_item): Embedding(3706, 4) (layers): ModuleList() (predict): Sequential((0): Linear(in_features=8, out_features=1, bias=True) (1): Sigmoid()))
 Figure 3: Neural matrix factorization model	NeuMF((mf_embedding_user): Embedding(6040, 3) (mf_embedding_item): Embedding(3706, 3) (mlp_embedding_user): Embedding(6040, 4) (mlp_embedding_item): Embedding(3706, 4) (mlp_layers): ModuleList() (predict): Sequential((0): Linear(in_features=11, out_features=1, bias=True) (1): Sigmoid()))

Parameters

Parameter	Set
num of negatives	4
learner	Adam
learning rate	0.001
loss function	binary cross entropy
batch size	2048

Parameter	Set
mlp layer	3
epoch	50
factor number	8

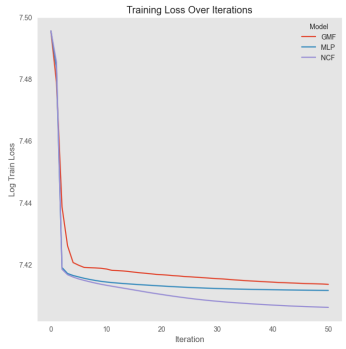
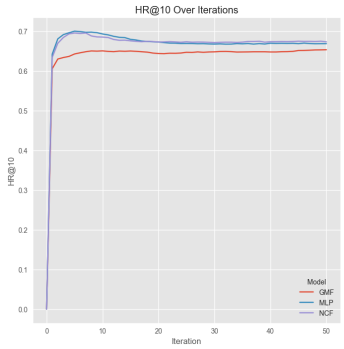
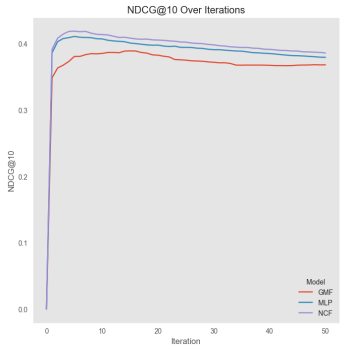
Evaluate

Name	Function
HR(Hits Ratio)	$\mathrm{HR} = \frac{1}{\mathrm{N}} \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{hits(i)}$
NDCG(Normalized Discounted Cumulative Gain)	$\mathrm{NDCG} = \frac{1}{\mathrm{N}} \sum_{\mathrm{i}=1}^{\mathrm{N}} \frac{1}{\log_2(\mathrm{p_i}+1)}$

Experiments

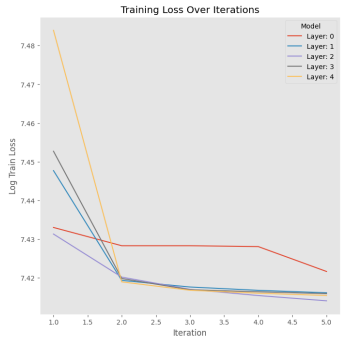
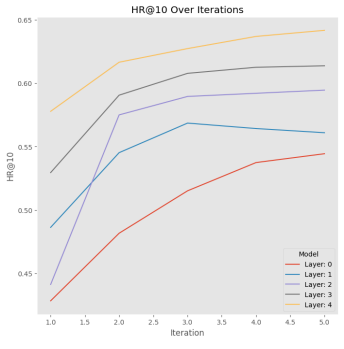
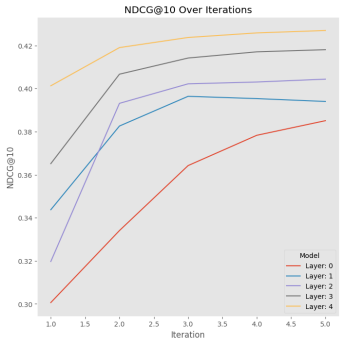
I will point out different parameters comparing with the list above.

Model Compare

Training Loss	HR@10	NDCG@10
		

Ablation study for the MLP layer

For this part, I use **epoch** of 5, **mlp layer** from 0 to 4.

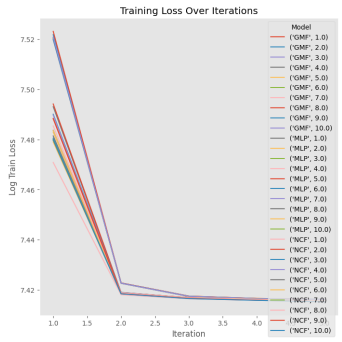
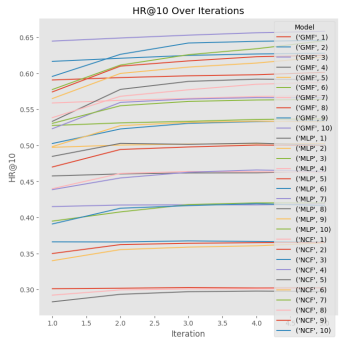
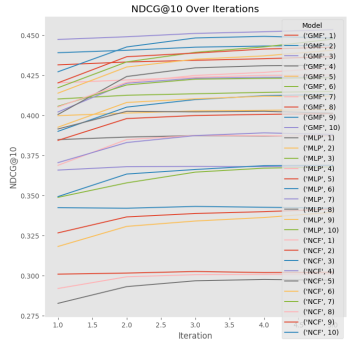
Training Loss	HR@10	NDCG@10
		

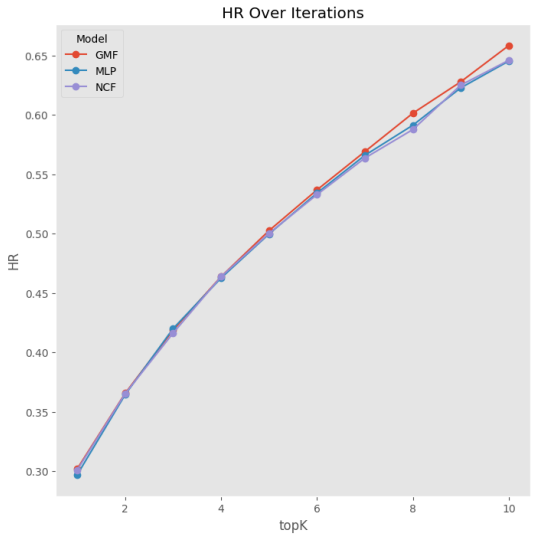
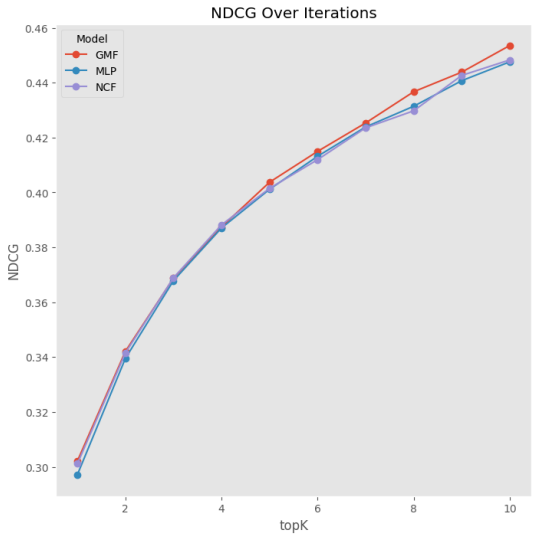
Evaluate	MLP-0	MLP-1	MLP-2	MLP-3	MLP-4
HR@10	0.544	0.561	0.595	0.614	**0.642**

Evaluate	MLP-0	MLP-1	MLP-2	MLP-3	MLP-4
NDCG@10	0.385	0.394	0.404	0.418	**0.427**

Ablation study for different topK

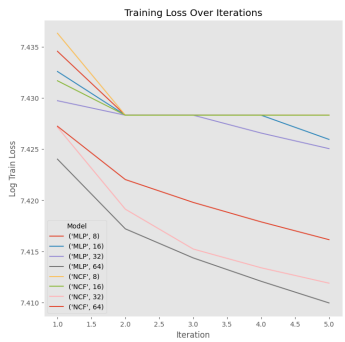
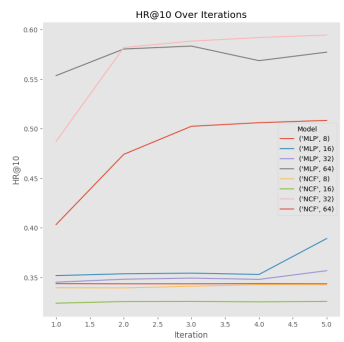
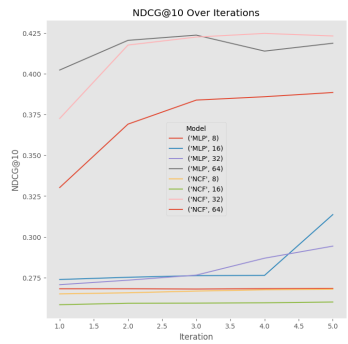
For this part, I use **epoch** of 5, **topK** from 1 to 10.

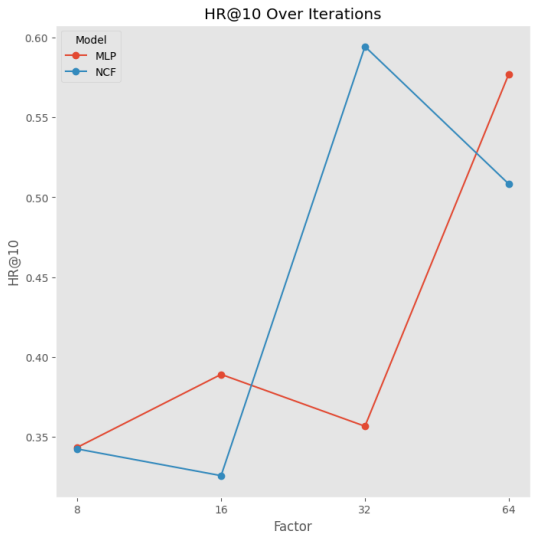
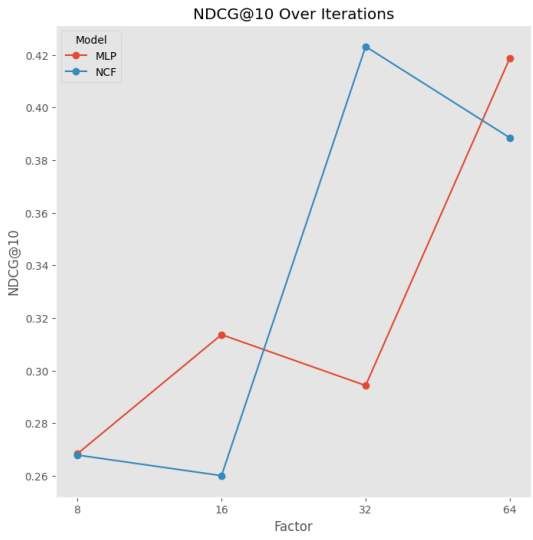
Training Loss	HR@10	NDCG@10
		

HR	NDCG
	

Ablation study for different factor

For this part, I use **epoch** of 5, **factor number** of 8, 16, 32, 64.

Training Loss	HR@10	NDCG@10
		

HR@10	NDCG@10
	

HR@10 Over Iterations
Model
MLP
NCF
HR@10
0.60
0.55
0.50
0.45
0.40
0.35
8
16
32
64
Factor

NDCG@10 Over Iterations
Model
MLP
NCF
NDCG@10
0.42
0.40
0.38
0.36
0.34
0.32
0.30
0.28
0.26
8
16
32
64
Factor