

Practice of Recommender System

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1 Brief Introduction

In this assignment, we aim to explore and implement the methods proposed in the Neural Collaborative Filtering (NCF) paper by He et al. For the task of movie recommendation using the MovieLens dataset. The NCF framework introduces three distinct models for collaborative filtering: Generalized Matrix Factorization (GMF), Multi-Layer Perceptron (MLP), and Neural Matrix Factorization (NeuMF). These models leverage neural networks to capture complex user-item interaction patterns, improving recommendation accuracy.

2 Results & Analysis

This experiment follows the training and test setting introduced in the Subsection 4.1. of the paper, Aiming to compare the three methods using the metrics of HR@10 and NDCG@10 and Reproduce the ablation study in Table 3: comparing the results of MLP with different layers.

2.1 Task4

The following plots generated with factor num = 8, showing the comparison obviously.

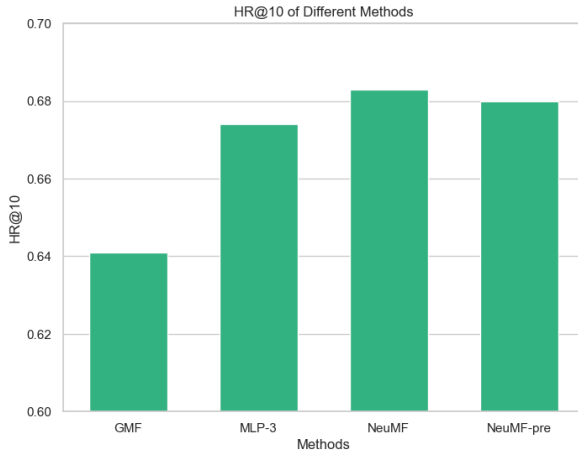


Figure 1: HR@10

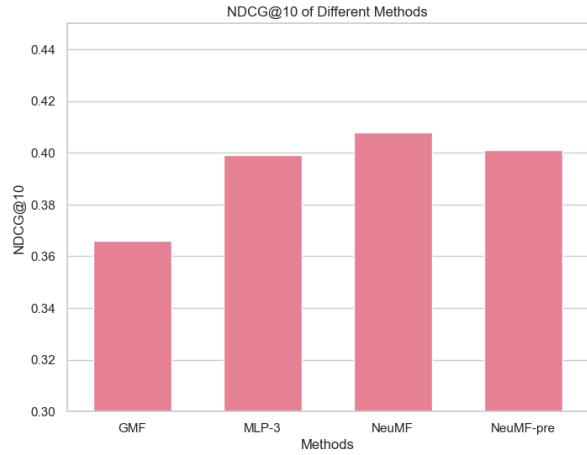


Figure 2: NDCG@10

We can find that NeuMF > NeuMF-pre > MLP-3 > GMF at factor num = 8 on both metrics, showing the corresponding result with original paper. Nevertheless, it will give different conclusion under different hyperparameters.

2.2 Task5

The following table almost reproduce the ablation experiment.

| Factors | MLP-0 | MLP-1 | MLP-2 | MLP-3 | MLP-4 |
|---------|-------|-------|-------|-------|-------|
| 8 | 0.454 | 0.611 | 0.643 | 0.674 | 0.681 |
| 16 | 0.454 | 0.647 | 0.676 | 0.679 | 0.689 |
| 32 | 0.454 | 0.673 | 0.685 | 0.696 | 0.699 |
| 64 | 0.454 | 0.688 | 0.690 | 0.701 | 0.705 |

Table 1: HR@10 of MLP with different layers

| Factors | MLP-0 | MLP-1 | MLP-2 | MLP-3 | MLP-4 |
|----------------|--------------|--------------|--------------|--------------|--------------|
| 8 | 0.253 | 0.345 | 0.374 | 0.399 | 0.410 |
| 16 | 0.253 | 0.374 | 0.405 | 0.409 | 0.414 |
| 32 | 0.253 | 0.399 | 0.411 | 0.416 | 0.421 |
| 64 | 0.253 | 0.410 | 0.416 | 0.422 | 0.430 |

Table 2: NDCG@10 of MLP with different layers

It’s obvious that more layers and more factors both make the model better. But the gains are increasingly limited.

3 Conclusion

By the expriment above, we can be more familiar with the idea of recommender system and more complex ideas about collaborative filtering.

By Task4, NeuMF has better performance than others. But will this continue as the number of factors increases? There are some future work to explore.

By Task5, it was found that MLP performance varied dramatically with the number of layers and factors, but it was challenging to be able to choose parameters that were good enough to pass without wasting computational resources.

4 Appendix: Metrics v.s. Iterations Plots of Task4 and Task5

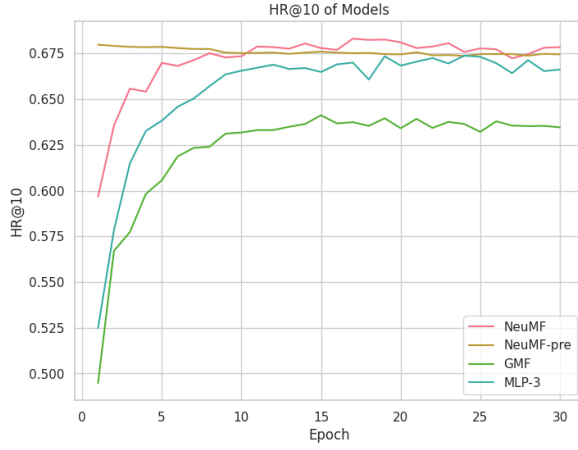


Figure 3: HR@10 of models

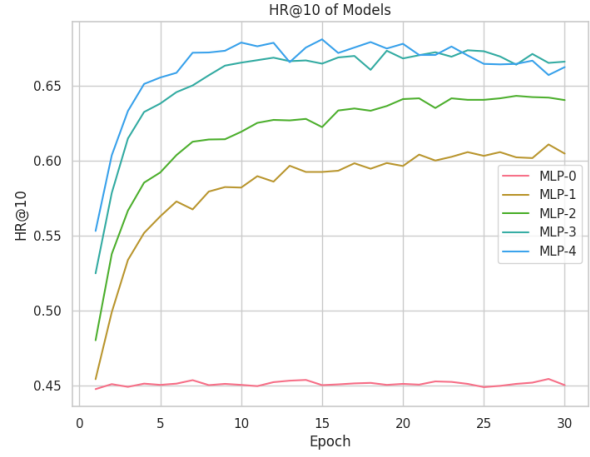


Figure 4: HR@10 of MLP with different layers

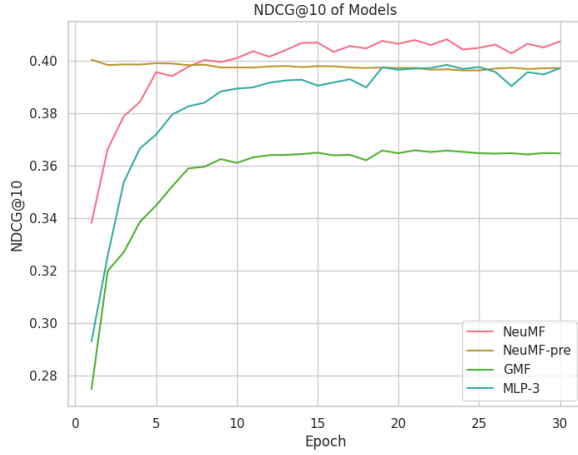


Figure 5: NDCG@10 of models

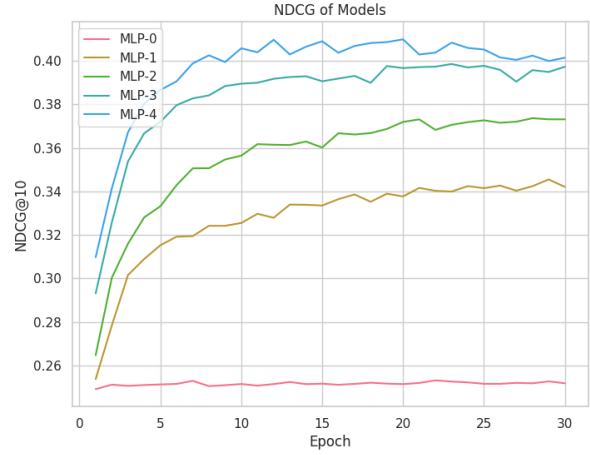


Figure 6: NDCG@10 of MLP with different layers

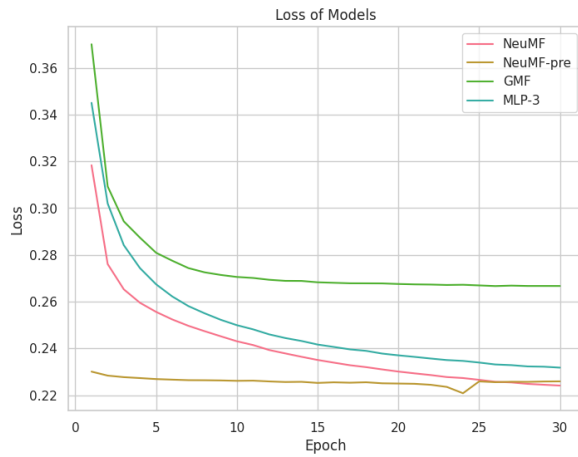


Figure 7: Loss of models

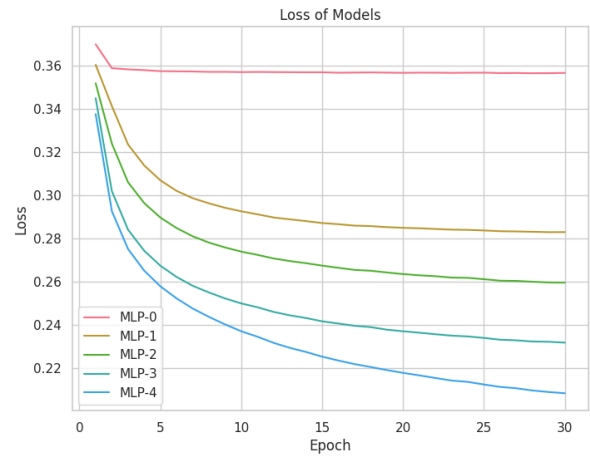


Figure 8: Loss of MLP with different layers