Name: Abdullahi Bala Mohammed

Student ID: 2018673

Course: Recommender Systems

Task: Homework 2

Summary

In this assignment, we performed a grid search over three hyperparameters of a Matrix Factorization recommender model: embedding size, learning rate and regularization strength. The model was trained and evaluated on the MovieLens 100K dataset using RMSE and MAE as error metrics.

Across all configurations, the results showed that learning rate has the strongest influence on performance. A higher learning rate (0.1) consistently produced lower errors, while lower learning rates (0.001 and 0.01) struggled to converge within the training epochs. Smaller embedding sizes (8 dimensions) performed better than larger ones, likely due to the relatively small dataset size. Regularization did not significantly improve performance, and in many cases slightly degraded accuracy.

The best-performing configuration was:

- **Embedding size:** 8
- **Learning rate:** 0.1
- **Regularization:** 0.0
- **RMSE:** 1.1844
- **MAE:** 0.9356

This model achieved the lowest test error and represents the optimal balance of complexity and convergence speed for this dataset.

Experiment Result Table

Table 1 - Results for Embedding size = 8

Learning Rate	**Regularization**	**RMSE**	**MAE**
0.001	0.0	4.7016	3.8839
0.001	0.001	4.7600	3.9546
0.001	0.01	4.6910	3.8937
0.01	0.0	3.9231	3.2633

Learning Rate	Regularization	RMSE	MAE
0.01	0.001	3.8561	3.2369
0.01	0.01	4.0241	3.4380
0.1	**0.0**	**1.1844**	**0.9356**
0.1	0.001	1.2223	0.9952
0.1	0.01	2.3540	2.1033

Table 2 - Results for Embedding size = 16

Learning Rate	Regularization	RMSE	MAE
0.001	0.0	5.5511	4.5135
0.001	0.001	5.4581	4.4390
0.001	0.01	5.5172	4.4875
0.01	0.0	4.3478	3.5354
0.01	0.001	4.2916	3.5212
0.01	0.01	4.3609	3.6485
0.1	0.0	1.3138	1.0014
0.1	0.001	1.2305	0.9990
0.1	0.01	2.3469	2.0952

Table 3 - Results for Embedding size = 16

Learning Rate	Regularization	RMSE	MAE
0.001	0.0	6.7160	5.3749
0.001	0.001	6.7225	5.3834
0.001	0.01	6.7328	5.3999
0.01	0.0	5.3471	4.2924

Learning Rate	Regularization	RMSE	MAE
0.01	0.001	5.0646	4.0745
0.01	0.01	5.0427	4.1000
0.1	0.0	1.6798	1.2140
0.1	0.001	1.1922	0.9548
0.1	0.01	2.3957	2.1420