CS5304: Assign5

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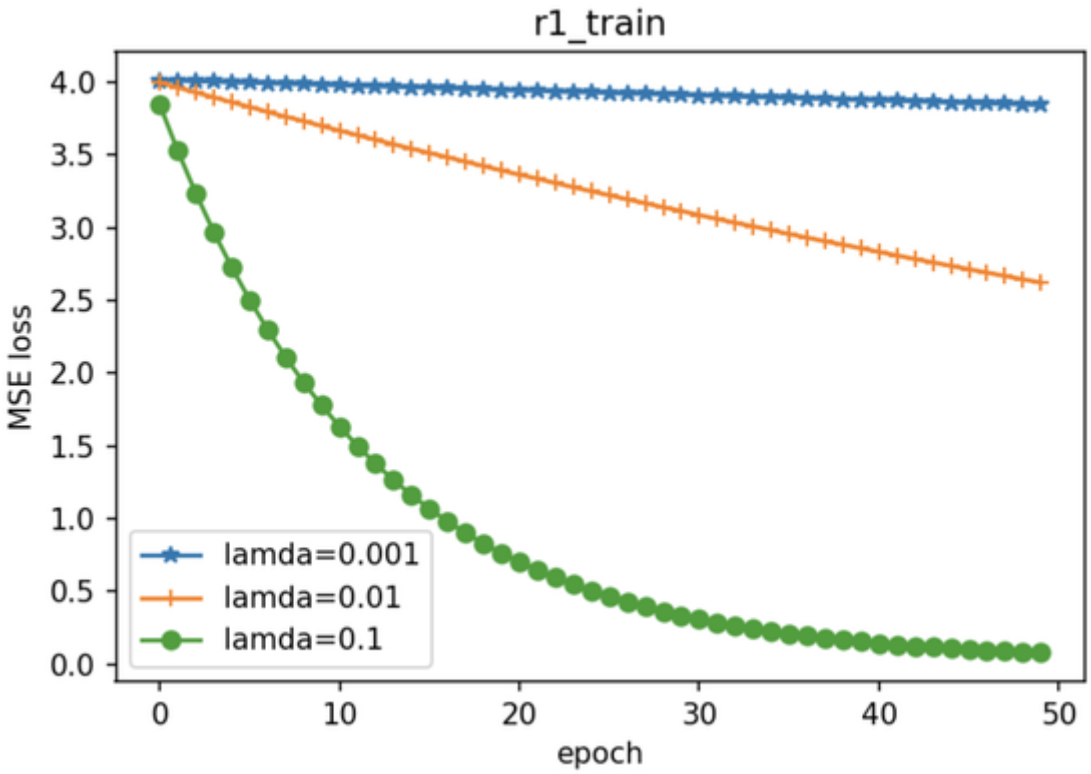
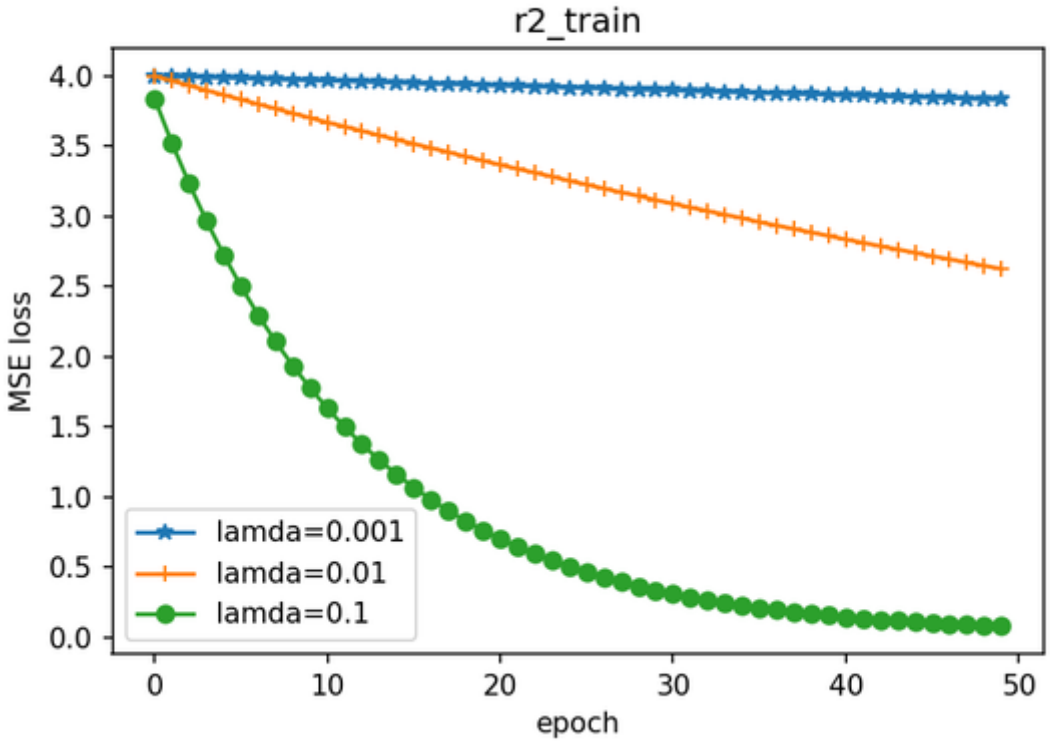
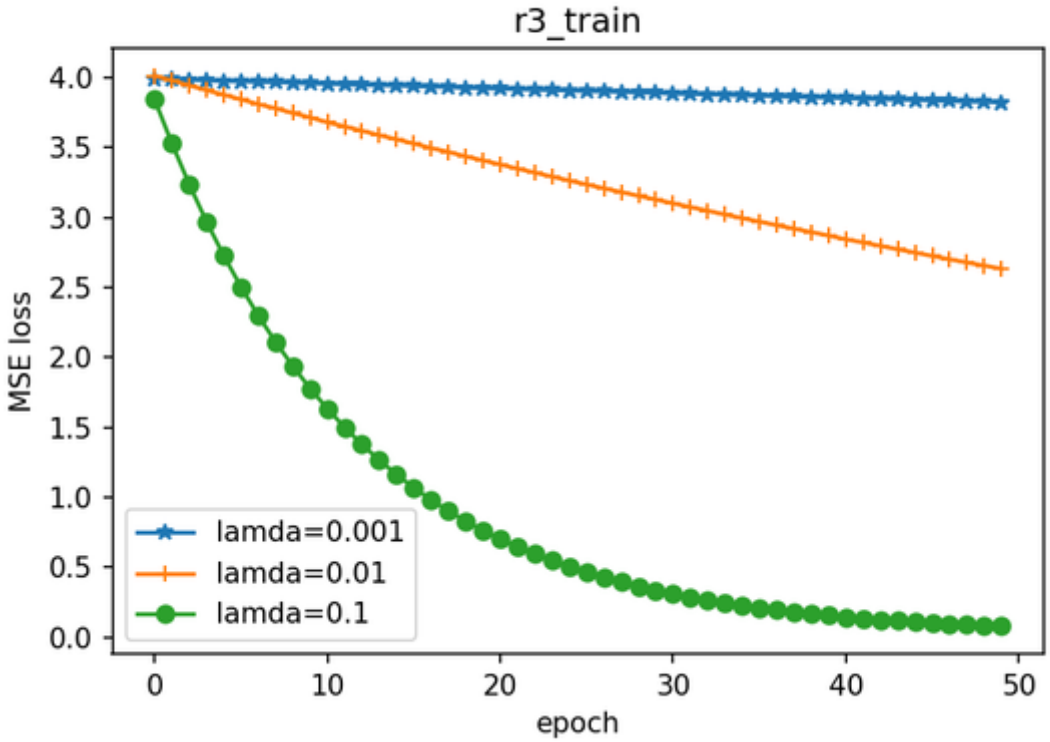
Task 1

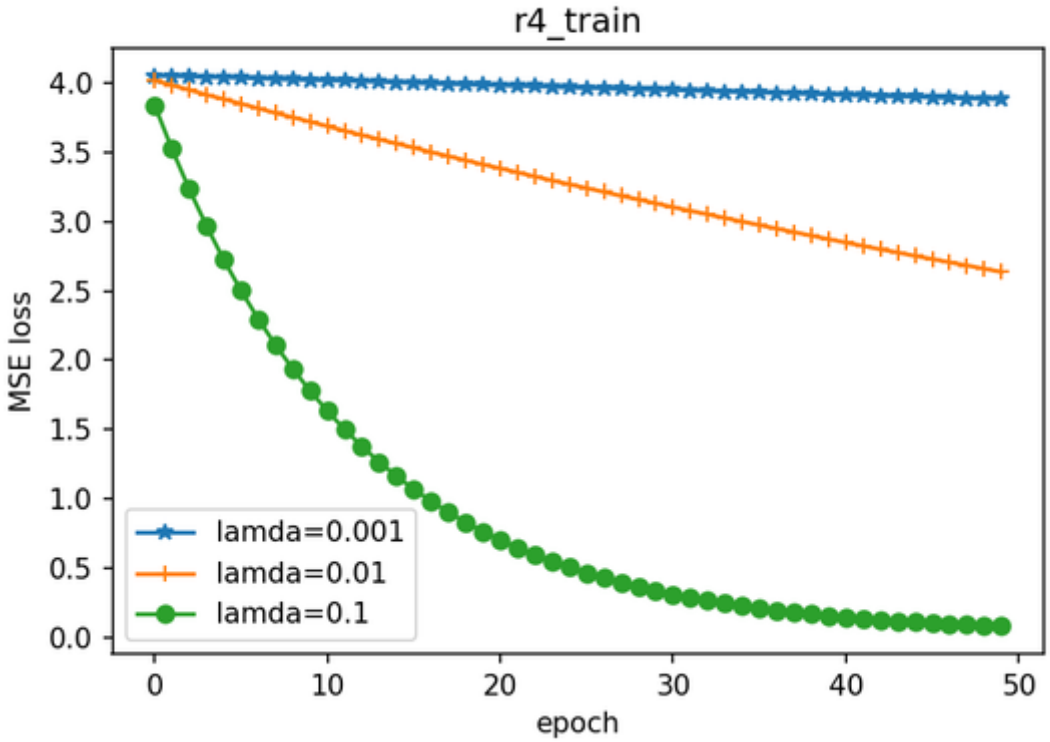
In this task, I use `r1~r5.train` to train Matrix Factorization (without bias term) models and use the corresponding test set to validate them. The number of latent features of these models is `4`.

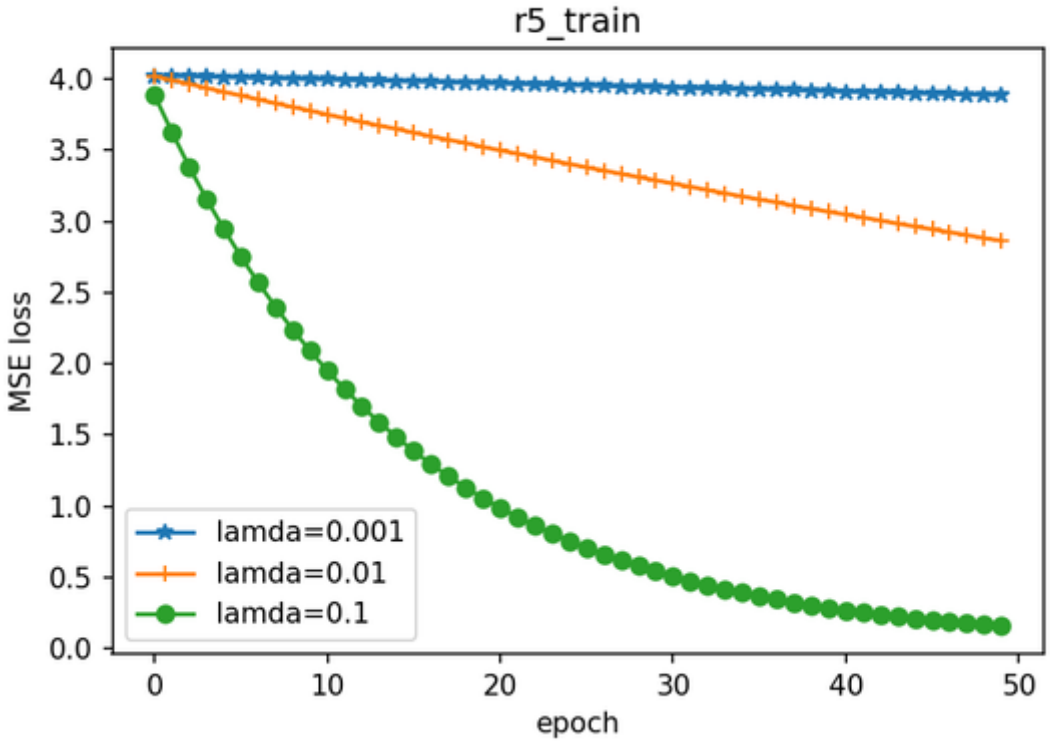
The following chart shows how the MSE losses change over the epochs in the training process with `r1~r5.train`.




r2_train
MSE loss
epoch
lamda=0.001
lamda=0.01
lamda=0.1
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
10
20
30
40
50


r3_train
MSE loss
epoch
lamda=0.001
lamda=0.01
lamda=0.1
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
10
20
30
40
50





One can see that when regularization parameters λ increases, the MSE loss decreases more rapidly over the epochs.

The following table shows the MSE losses of the models over their corresponding test set.

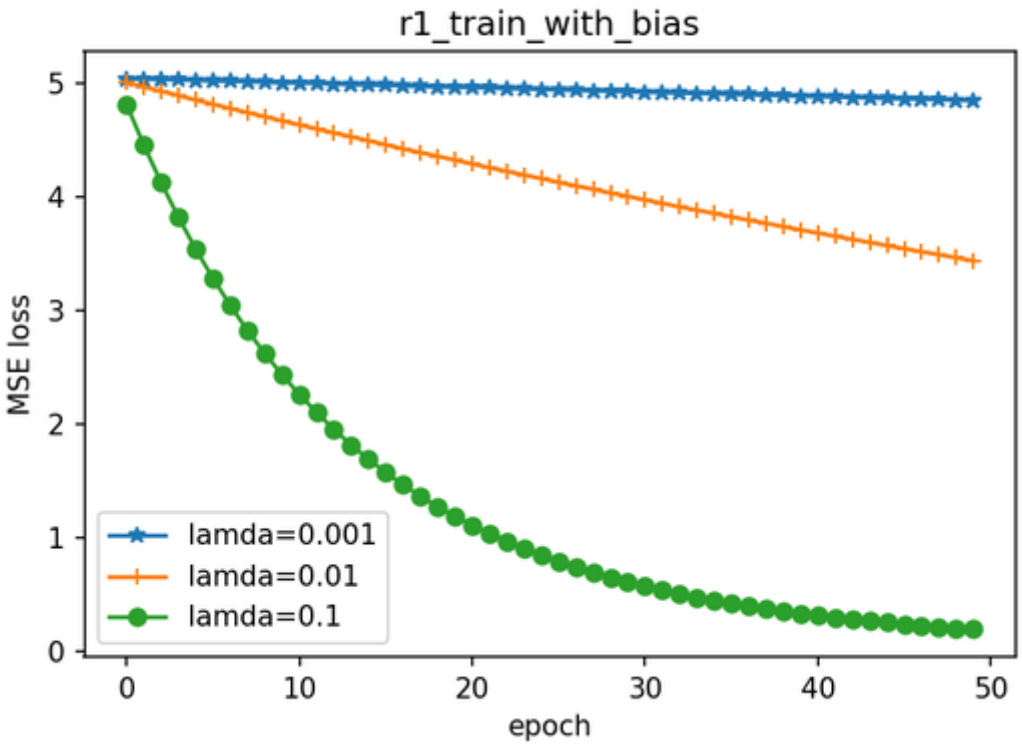
	r1.train	r2.train	r3.train	r4.train	r5.train	Standard Error
λ=0.001	3.832	3.803	3.800	3.857	3.123	0.1403
λ=0.01	2.623	2.611	2.608	2.611	2.257	0.07129
λ=0.1	0.08087	0.06737	0.06279	0.06046	0.1038	0.008008

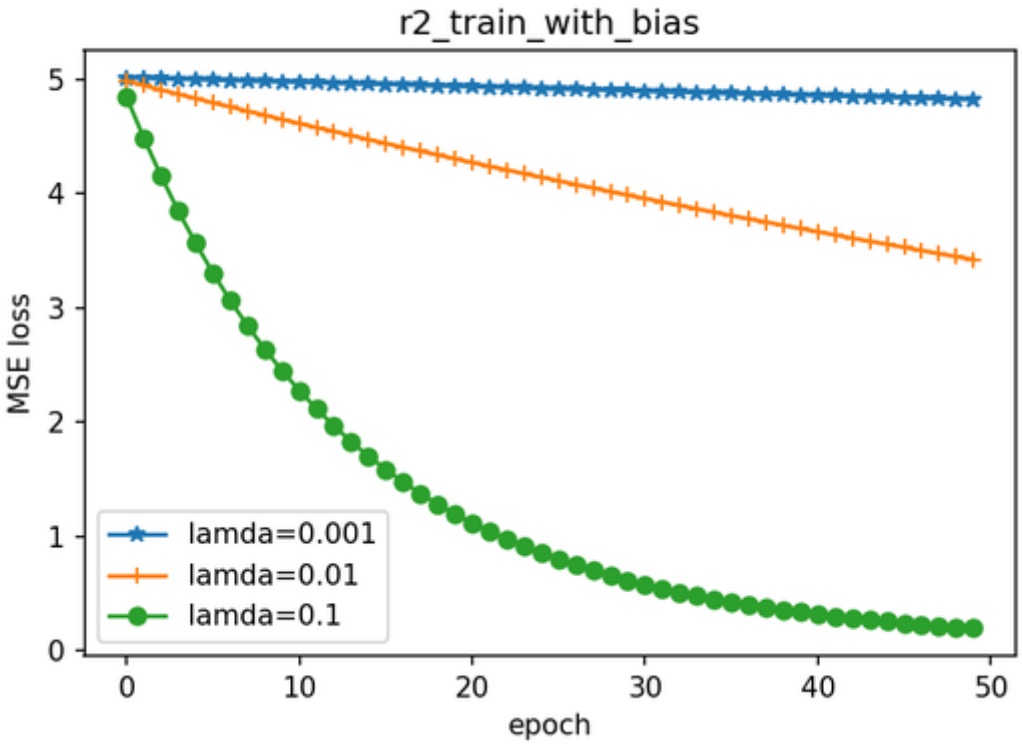
From the statistical data above, we can see that `λ=0.1` is the best regularization parameter to use for the Matrix Factorization model (without bias term).

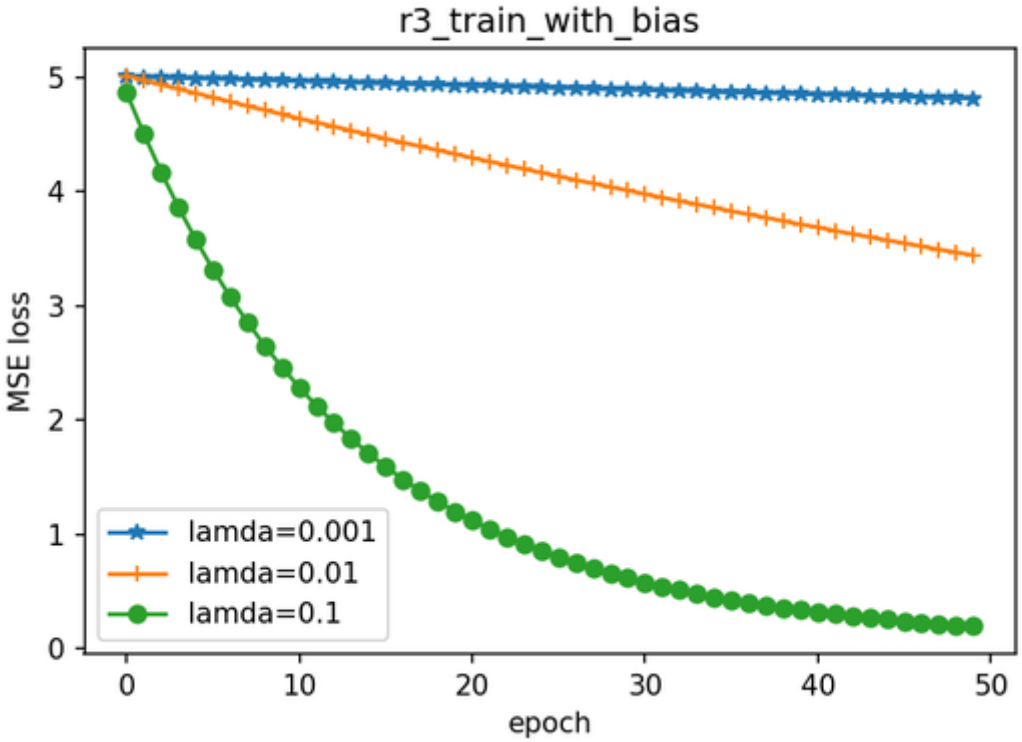
Task 2

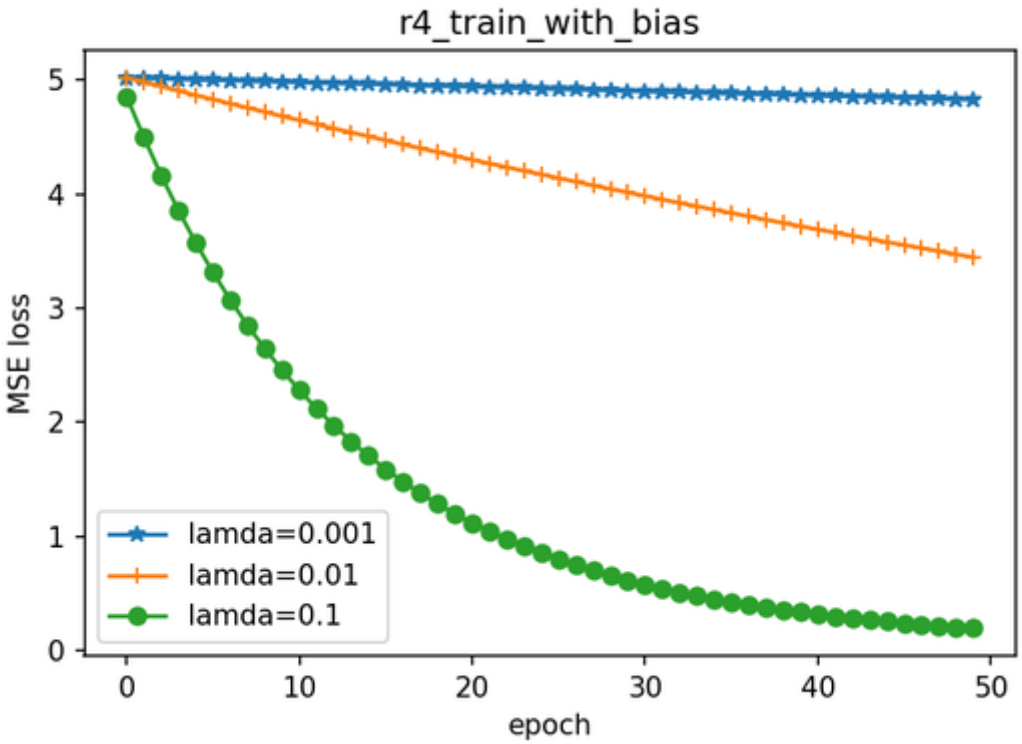
For this task, I train the Matrix Factorization (with bias term) models only for movie bias but not for user bias. The number of latent features of these models is `4` .

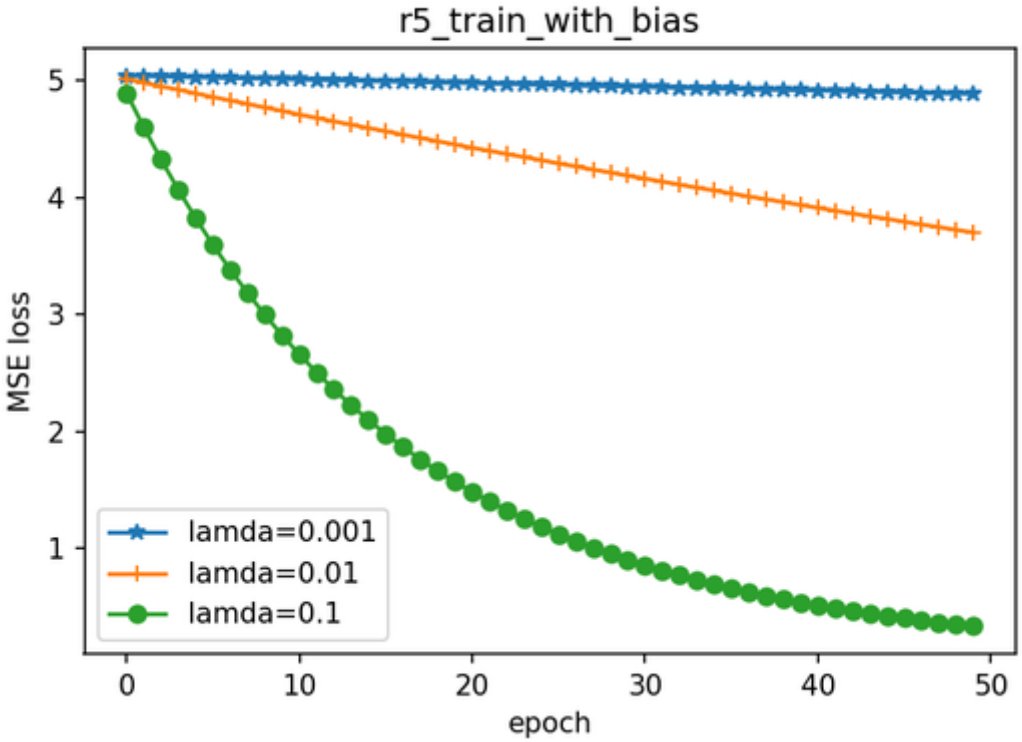
The following chart shows how the MSE losses change over the epochs in the training process with `r1~r5.train` .




r2_train_with_bias
MSE loss
epoch
lamda=0.001
lamda=0.01
lamda=0.1
0
1
2
3
4
5
0
10
20
30
40
50


r3_train_with_bias
MSE loss
epoch
lamda=0.001
lamda=0.01
lamda=0.1
0
1
2
3
4
5
0
10
20
30
40
50





One can see that for the Matrix Factorization model with bias term, when regularization parameters λ increases, the MSE loss also decreases more rapidly over the epochs.

The following table shows the MSE losses of the models over their corresponding test set.

	r1.train	r2.train	r3.train	r4.train	r5.train	Standard Error
λ=0.001	4.820	4.813	4.804	4.820	4.117	0.1394
λ=0.01	3.420	3.407	3.414	3.424	3.343	0.01492
λ=0.1	0.1945	0.1827	0.1786	0.1761	0.2914	0.02191

From the statistical data above, we can see that `λ=0.1` is the also best regularization parameter to use for the Matrix Factorization model (with bias term).