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CSC 577

Assignment 3 Part 2

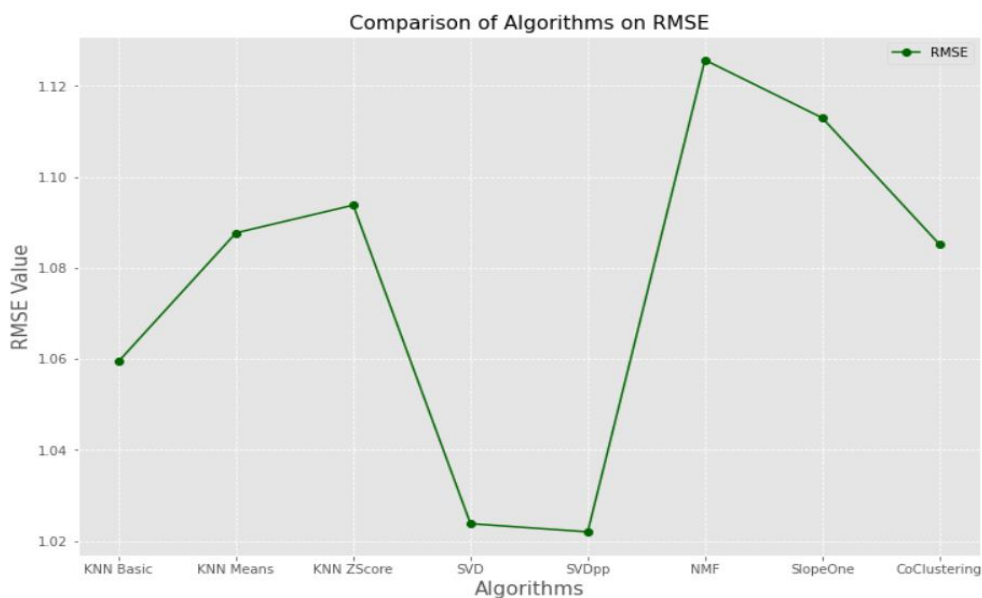
Report

For assignment 3 part 2 several algorithms are compared in order to achieve best performance on the root-mean-squared-error (RMSE) metric. I started to evaluate the models with setting rating scales in range 1 to 5 with surprise library. I ran cross validation in both one neighborhood and two model-based algorithms and calculate RMSE values. k-NN based algorithms with 5-fold cross validation were compiled in no time. Matrix factorization based and two model-based algorithms were also compiled in shorter time. Default parameters show different results and SVD based models performed the lowest scores (Table 1).

(Table 1: Different RMSE values)

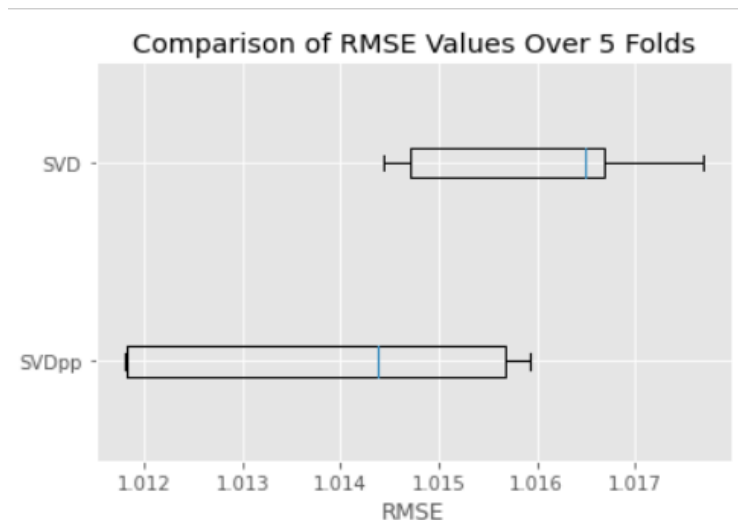
Algorithm	RMSE
KNN Basic	1.0594863316905083
KNN Means	1.0877090381395582
KNN ZScore	1.09376931697151
SVD	1.0237503598315298
SVDpp	1.021972213736008
NMF	1.1257179379599687
SlopeOne	1.1130160230691817
CoClustering	1.0851946670008341

Since it is more understandable from visual graphs, I used basic line plots to see the trend between models and compare them. Therefore, as shown in plot below, the RMSE values on NMF are located far from our winner model, SVDpp.



Next, I chose top two algorithms to perform Grid Search CV. Initially, I passed 20, 25, and 30 number of epochs, list of learning rates and regularization numbers, and it took about 2 hours to fit the model and get results. However, to improve model accuracy with RMSE values I repeated but this time with same parameters but larger list of numbers, and SVDpp took about 7 and SVD took 8 hours to get results. There is obvious trade-off between thoroughness and computational time, one might achieve better results, but parameters with grid search could take hours for larger datasets. After tuning parameters, RMSE values decreased slightly, and below table shows RMSE values and the best parameters for each model. Since we limited our parameters to save time, parameters chosen for two model-based algorithms are somehow similar.

Model	RMSE	Best parameters
SVDpp	1.014211067642224	{'n_epochs': 25, 'lr_all': 0.006, 'reg_all': 0.1}
SVD	1.014742426188841	{'n_epochs': 35, 'lr_all': 0.006, 'reg_all': 0.4}



After creating final model, I performed cross validation and compare the results with boxplot. Overall, the median value of RMSE for SVDpp is lower than regular SVD model. To summarize our work, matrix factorization-based algorithms perform better results in finding lower values for root-mean-squared error values. Although achieving low errors in our dataset, grid search cv should not be considered. We might use other algorithms to tune parameters and get better performance. I believe we could get even lower results if time permits, including number of factors, adding more epochs into our list.