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IE598 MLF F18

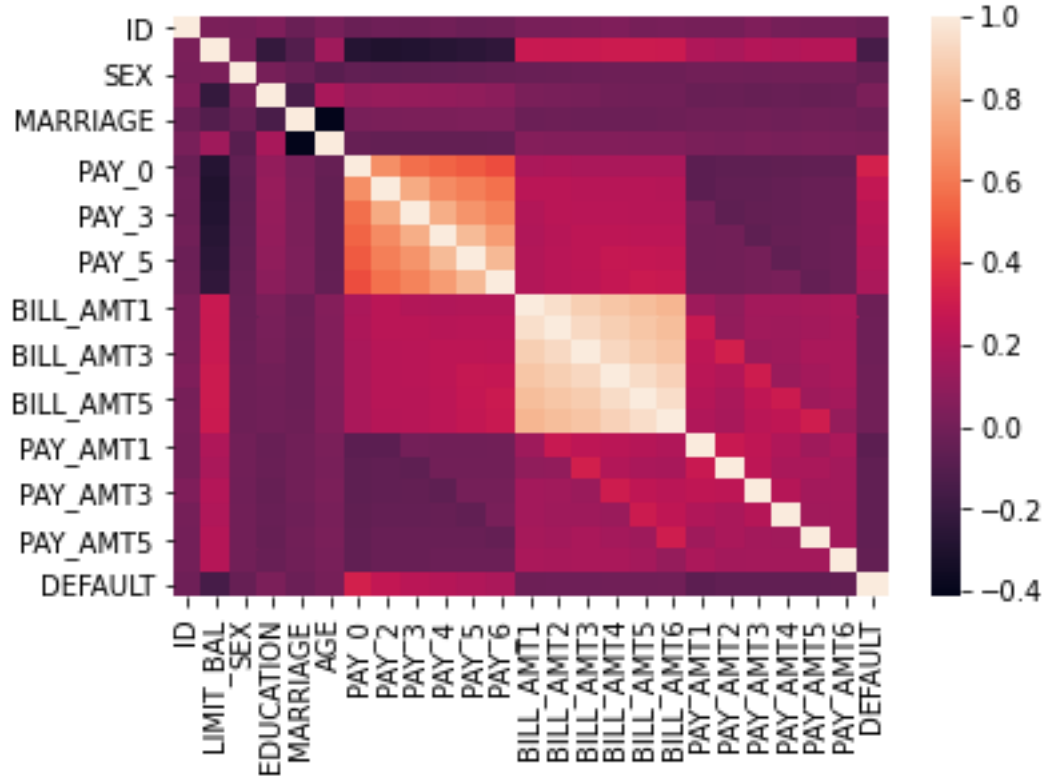
Module 7 Homework (Random Forest)

Using the ccdefault dataset, and 10 fold cross validation described in Raschka;

Part 1: Random forest estimators

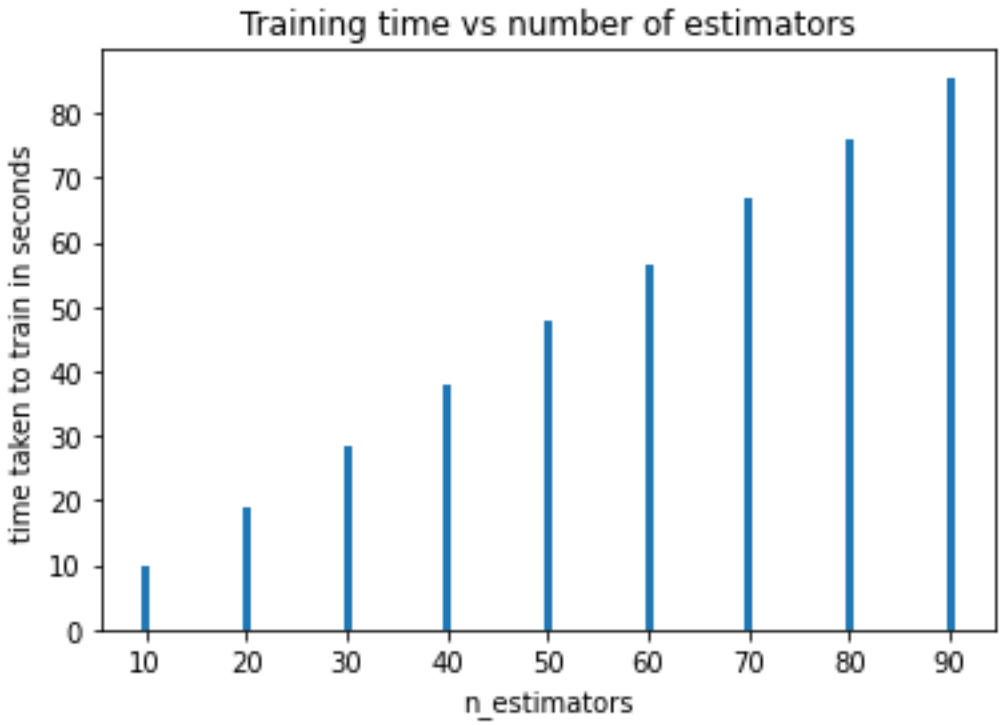
Fit a random forest model, try several different values for N_estimators, report in-sample accuracies.

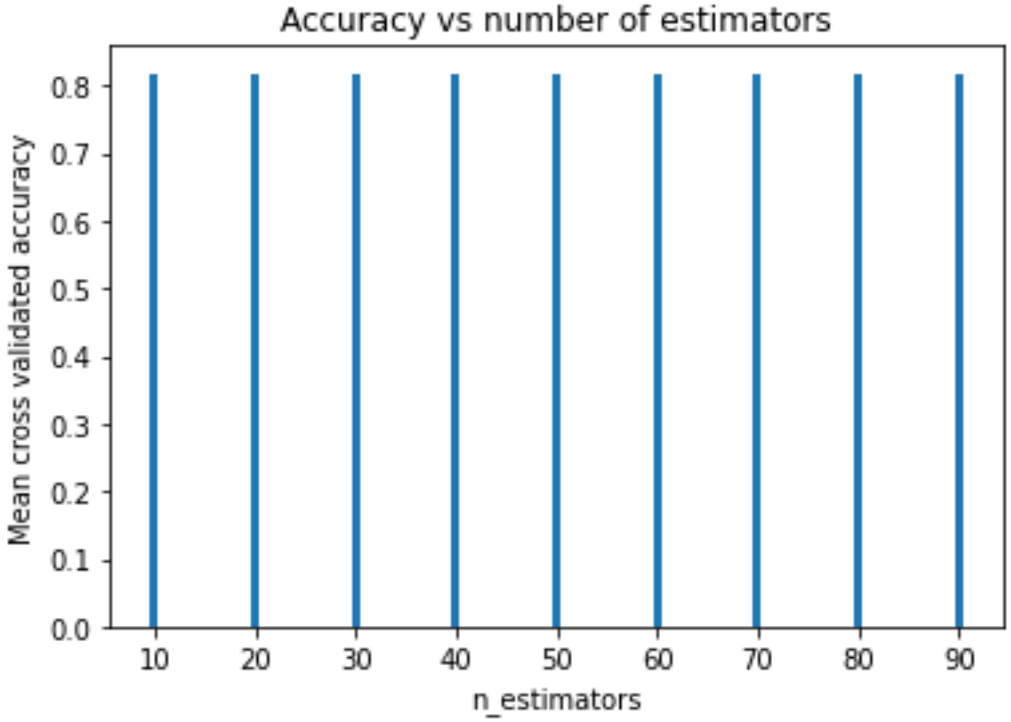
Correlation heatmap:



Although, there are a few features that are highly correlated, PCA is not used because we want to better understand the feature importances.

Trying out different N_estimators





Although, not visible clearly in the plot, the accuracies slightly increase with number of estimators. For this problem, we are using max_depth=None i.e. we are forcing the individual trees to overfit and using

ensembling via RF classifier to eliminate the overfitting. Therefore, we see a slight increase of accuracy while increasing the n_estimators. The increase can be observed in the print outputs below.

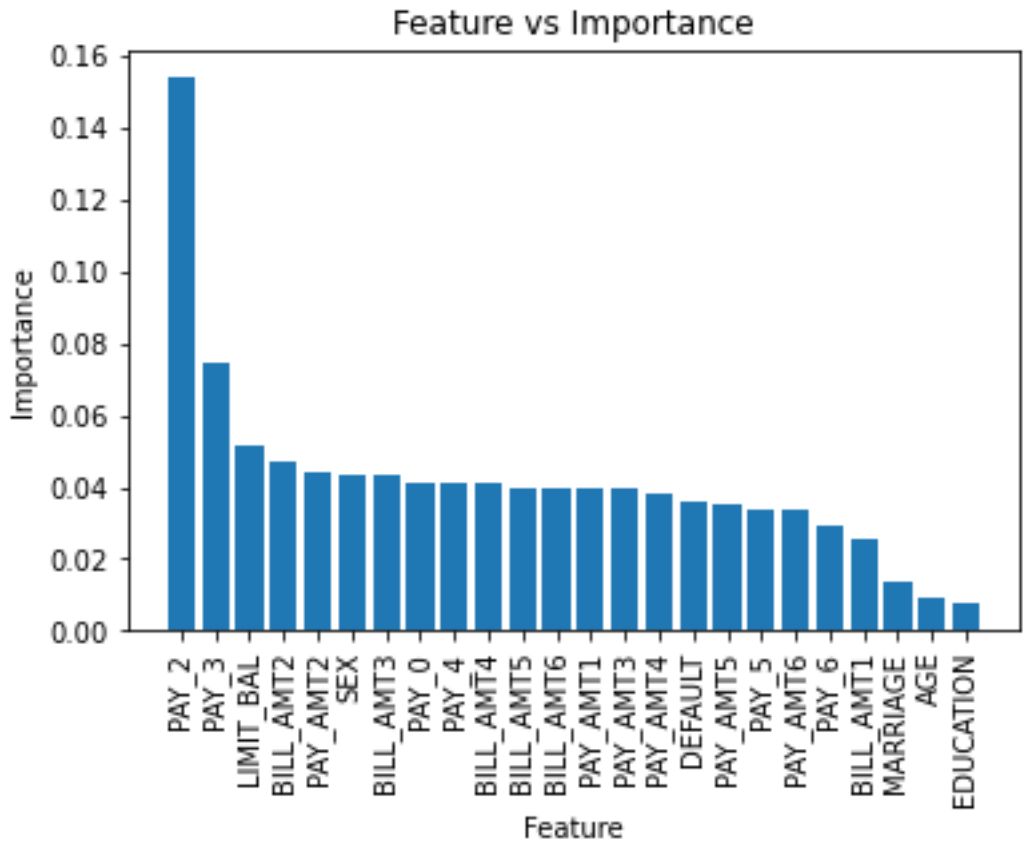
mean accuracy with stratified k fold for n_estimators= 10 is: 0.8063333333333332
mean accuracy with stratified k fold for n_estimators= 20 is: 0.8094259259259259
mean accuracy with stratified k fold for n_estimators= 30 is: 0.8113333333333334
mean accuracy with stratified k fold for n_estimators= 40 is: 0.8123888888888888
mean accuracy with stratified k fold for n_estimators= 50 is: 0.8131111111111111
mean accuracy with stratified k fold for n_estimators= 60 is: 0.813716049382716
mean accuracy with stratified k fold for n_estimators= 70 is: 0.8143015873015873
mean accuracy with stratified k fold for n_estimators= 80 is: 0.8146759259259259
mean accuracy with stratified k fold for n_estimators= 90 is: 0.8149465020576132

We can also see that the increase in accuracy is minimal while using high n_estimators. Therefore, to reduce the time taken to fit the RF, n_estimators=50 is used for the fitting the full training set. The out of sample accuracy observed for the final model is 0.815.

Part 2: Random forest feature importance

Display the individual feature importance of your best model in Part 1 above using the code presented in Chapter 4 on page 136. {importances=forest.feature_importances_ }

Below is the plot for the feature importances of the final RF model (with n_estimators=50)



As expected, the most important features tend to be the previous months' payment histories, followed by limit balance and billing amounts.

Part 3: Conclusions

Write a short paragraph summarizing your findings. Answer the following questions:

a) What is the relationship between n_estimators, in-sample CV accuracy and computation time?
The in sample CV accuracies as well as the computational time increase with increase in number of estimators. However this increase in accuracy tends to saturate at some point and hence the extra effort is not worth the increase in accuracy at high number of estimators.

b) What is the optimal number of estimators for your forest?

The optimal number of estimators seems to be 50. The computational time is very high beyond 50 estimators.

c) Which features contribute the most importance in your model according to scikit-learn function?

Previous payments seem to be the most important features.

d) What is feature importance and how is it calculated? (If you are not sure, refer to the Scikit-Learn.org documentation.)

Feature importance is the amount of influence each feature has on the target. In RF Classifier, this is computed as the averaged impurity decrease of all the decision trees in the forest w.r.t that feature.

Part 4: Appendix

Link to github repo:
https://github.com/chinthojuprajwal/IE517/blob/main/IE517_FY21_HW7/IE517_FY21_HW7_prajwal.ipynb