Report:

Assumptions (which are not necessarily true):

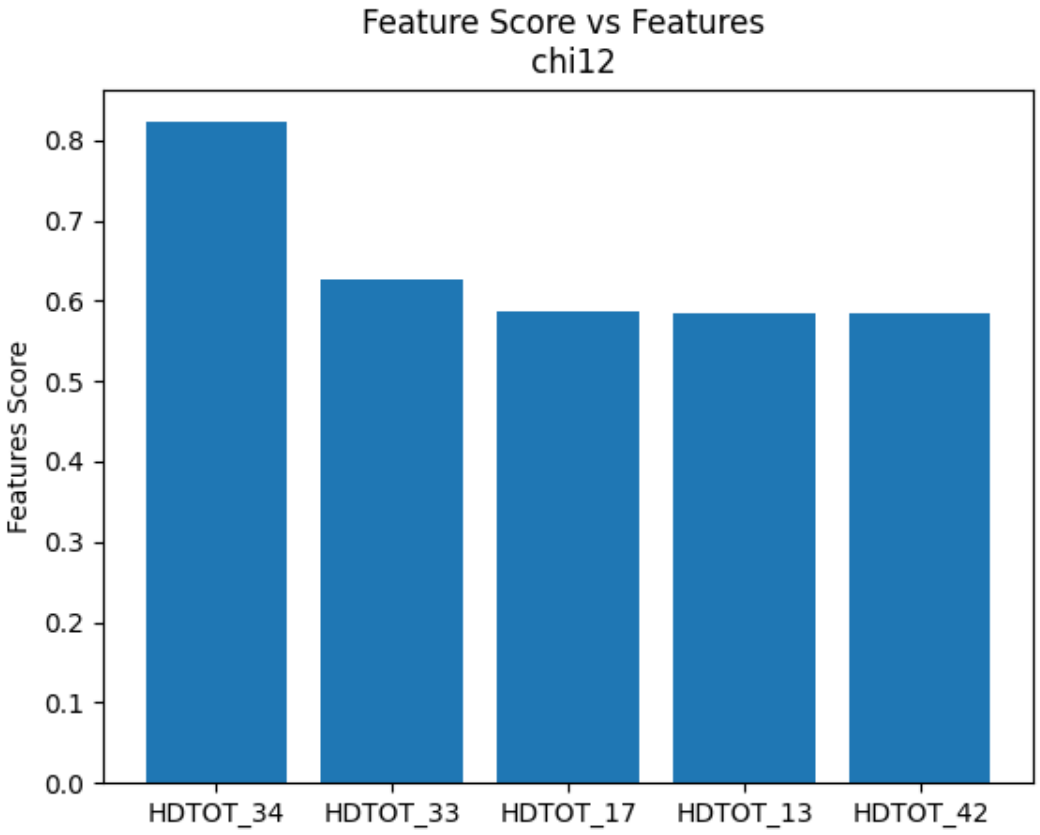
- Medicine features are independent - there is no effect of one medicine on the other or a combined effect of both.
- There is no correlation between medicine features and demographics. No impact of location on the medicine given.
- This analysis is concentrated on clinical improvement vs not. Code and suggestion for a slope of week vs depression improvement based model explained in the end.

Data preprocessing:

Delete all unmatched IDs, 34 were found in table 2 and 1 found in table 3. Delete the row with -2 value in features matrix, only 1 row with such value.
Return the row with -2 in features matrix to delete afterwards from y_teacher.
Binomial labeling based on a given threshold per subject.

Training results:

Most significant features found:



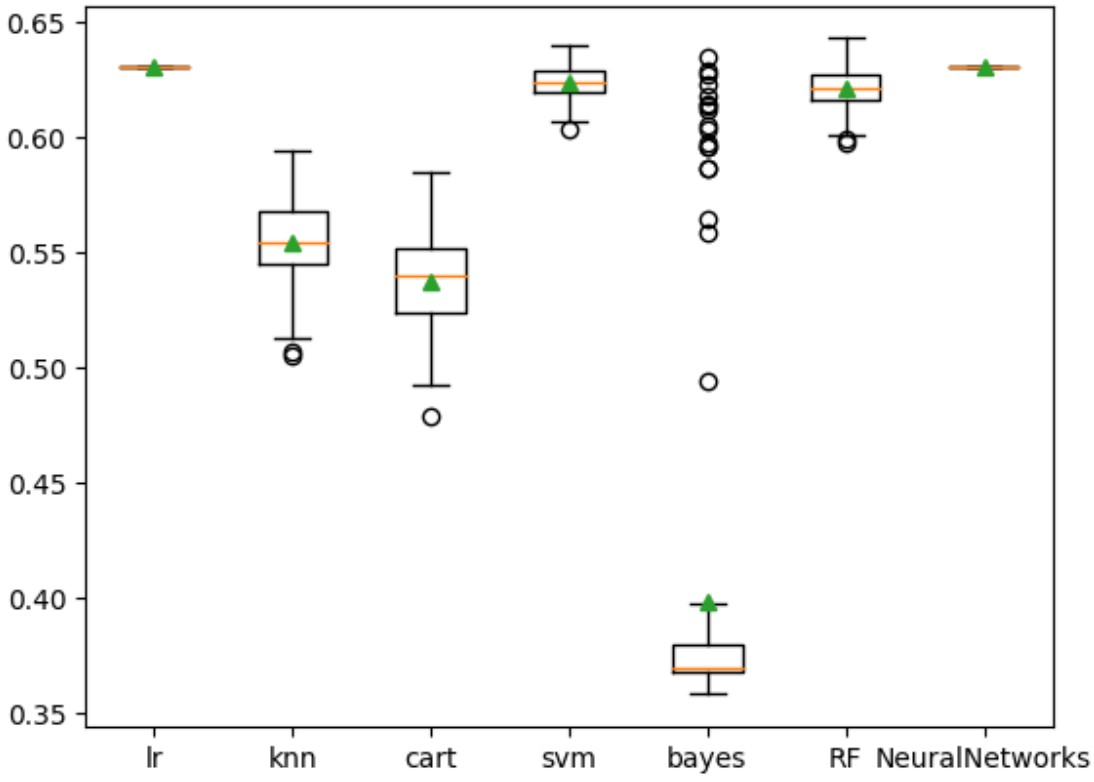
They were found using the chi^2 algorithm for probability distribution, a significant difference between features based on the binomial classifier.

Modeling:

In order to cross reference the demographic data, I took the data of the patients who got significant improvement and checked whether they have a significant difference in demographic information compared to the whole group.

Unfortunately significant of <0.05 was not found for the demographic value.

In order to find the best model, a cross model ensemble was done. The best models achieved 63.1% accuracy.



Low accuracy can be explained by lack of data and insufficient variation of data. As well as by asserting binomial labeling of whether the patient passed threshold in any given week. A harder classification threshold such as a specific week cap would increase performances.

Runtime:
41.68(s)

Explanation:

We can see that both logistic regression and neural networks achieved the same results. We can infer that NN neurons have learned the same model as LR. That means that the weights of the NN composes a LR curve to classify the data. We can also assess that this model is highly optimized compared to other models since both models reached the same accuracy compared to other models who have reached lower accuracy.

From that we can assume that bigger databases with deeper layers of NN would be able to reach better accuracy results by learning more sub-features, differences, correlations and patterns.

Additional Tools to add:

- Implement week based non-binomial labeling mechanism based on slope of week vs depression improvement. Set 2 different models - one for patients who did not pass the threshold. And one for patients who had and it is possible to track their week vs depression slope. (code is commented - line 53)
- Add more data to improve model accuracy
- Implement intra-patient analysis: training data is the patient situation in first n-1 weeks and labeling data is the patient situation in the last n week.
- Implement DL model such as DropoutNet[1]. There is potential in using more complex supervised models with DL to get better model accuracy. For that more data is required than given in the exercise.

[1] http://www.cs.toronto.edu/~mvolkovs/nips2017_deepcf.pdf