Cpts570-hw2

Mengxiao Zhang-11651502

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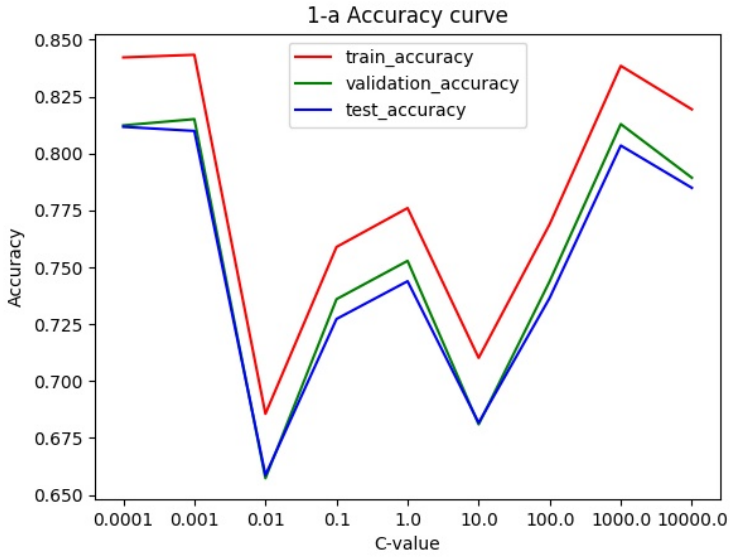
1 Programming and Empirical Analysis Part

1.1 Problem 1

1.1.1 a



Since I use LinearSVC, I cannot plot the number of support vectors. And finally I find the best C is 0.001.

1.1.2 b

When C is 0.001, the testing accuracy: 77.69%.

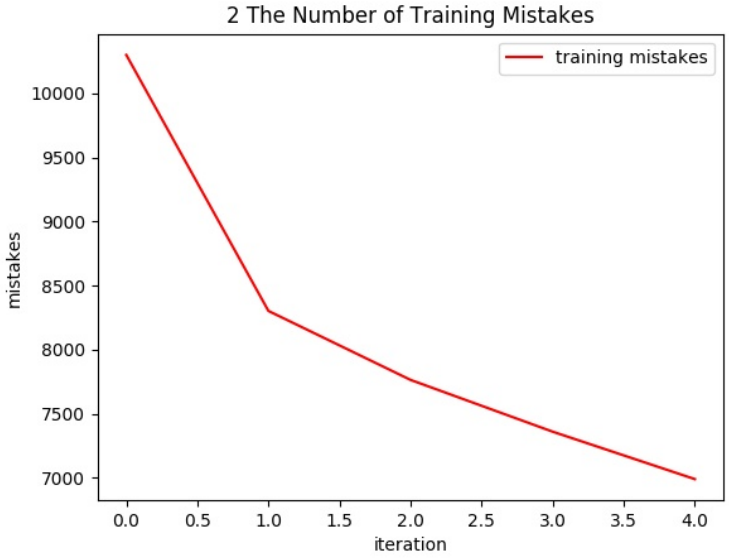
The corresponding confusion matrix:

$$\begin{bmatrix} 699 & 9 & 2 & 56 & 16 & 0 & 204 & 1 & 12 & 1 \\ 2 & 943 & 1 & 31 & 6 & 0 & 14 & 1 & 1 & 1 \\ 17 & 6 & 256 & 10 & 258 & 0 & 444 & 0 & 8 & 1 \\ 21 & 17 & 3 & 818 & 57 & 1 & 77 & 2 & 2 & 2 \\ 0 & 2 & 8 & 31 & 760 & 1 & 195 & 0 & 3 & 0 \\ 0 & 1 & 0 & 1 & 0 & 830 & 2 & 98 & 12 & 56 \\ 90 & 4 & 21 & 44 & 140 & 0 & 675 & 0 & 26 & 0 \\ 0 & 0 & 0 & 0 & 0 & 11 & 0 & 970 & 0 & 19 \\ 4 & 5 & 2 & 8 & 12 & 10 & 34 & 13 & 911 & 1 \\ 0 & 0 & 0 & 0 & 0 & 7 & 3 & 83 & 0 & 907 \end{bmatrix}$$

1.1.3 c

The degree of 2, 3, 4:
$'train\ accuracy' : array([1., 1., 1.])$,
$'validatio\ naccuracy' : array([0.88141667, 0.87016667, 0.8565])$,
$'test\ accuracy' : array([0.8755, 0.8671, 0.8477])$,
$'Number\ of\ Support\ Vectors' :$
$array([1841, 216, 2075, 1563, 2119, 959, 2810, 947, 498, 520], dtype = int32)$,
$array([1539, 169, 1720, 1301, 1815, 941, 2491, 857, 374, 463], dtype = int32)$,
$array([1362, 149, 1460, 1148, 1556, 993, 2245, 766, 321, 399], dtype = int32)]$
$The\ best\ degree : 2$
According to these data, we can know that with the kernel degree increase, the accuracy of validation and test are decrease, and the number of support vectors are also decrease. So that the degree 2 is the best one for this poly-kernel SVM

1.2 Problem 2



$train\ accuracy$: 78.7166666667%
$validation\ accuracy$: 78.9%
$test\ accuracy$: 78.8%

1.3 Problem 3

1.3.1 b

training Accuracy : 100%
validation Accuracy : 65.00%
testing Accuracy : 74.28571428571429%

1.3.2 d

training Accuracy : 86.40167%
validation Accuracy : 97.014925%
test Accuracy : 93.9338235%
From these data, we can not that with pruning the tree, the training accuracy is decrease but validation accuracy and testing accuracy are both increase. I think it is because of the overfitting, and when we do the pruning, it become more fittable.