a)
When C = 2, Accuracy:

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9	Average
0.9873	0.9932	0.9796	0.9747	0.9814	0.9706	0.9807	0.9828	0.9517	0.9631	0.9076

When C = 2, Number of Support Vectors:

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9
464	505	1211	1422	900	1326	686	779	2093	1848

When C = 4, Accuracy:

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9	Average
0.9868	0.9922	0.9792	0.9742	0.9802	0.9749	0.9804	0.9821	0.9559	0.9631	0.9043

When C = 4, Number of Support Vectors:

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9
455	486	1201	1416	880	1292	671	770	2097	1836

When C = 8, Accuracy:

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9	Average
0.9854	0.9913	0.9787	0.9748	0.9796	0.9736	0.9792	0.9808	0.9555	0.9636	0.9013

When C = 8, Number of Support Vectors:

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9
436	455	1189	1400	869	1253	651	744	2077	1816

When C = 2, plot the 3 support vectors of the largest Lagrange multiplier

digit 0, y_i = 1

digit 0, y_i = -1

digit 1, y_i = 1

digit 1, y_i = -1

digit 2, y_i = 1

digit 2, y_i = -1

digit 3, y_i = 1

digit 3, y_i = -1

digit 4, y_i = 1

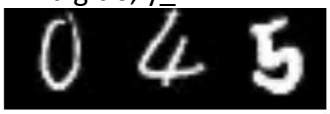
digit 4, y_i = -1

digit 5, y_i = 1

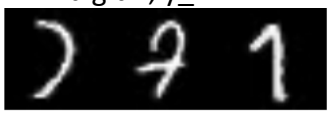
digit 5, y_i = -1

digit 6, y_i = 1

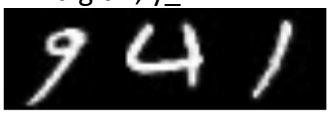
digit 6, y_i = -1



digit 7, y_i = 1



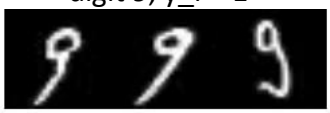
digit 7, y_i = -1



digit 8, y_i = 1

digit 8, y_i = -1

digit 9, y_i = 1



digit 9, y_i = -1

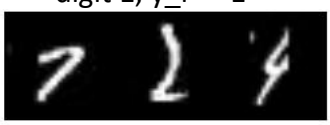
When C = 4, plot the 3 support vectors of the largest Lagrange multiplier

digit 0, y_i = 1

digit 0, y_i = -1

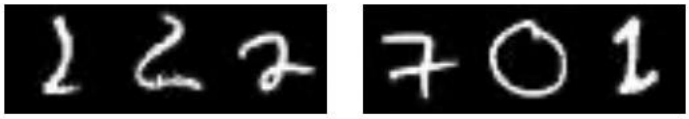
digit 1, y_i = 1

digit 1, y_i = -1



digit 2, y_i = 1

digit 2, y_i = -1

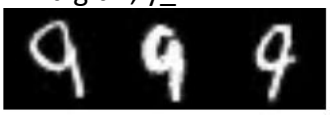


digit 3, y_i = 1

digit 3, y_i = -1

digit 4, y_i = 1

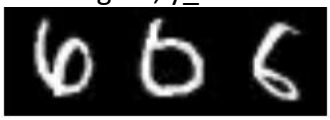
digit 4, y_i = -1



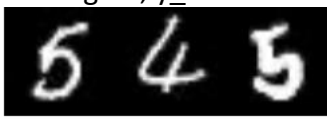
digit 5, y_i = 1

digit 5, y_i = -1

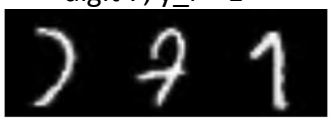
digit 6, y_i = 1



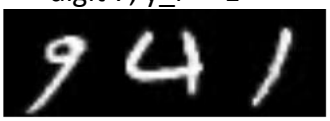
digit 6, y_i = -1



digit 7, y_i = 1



digit 7, y_i = -1

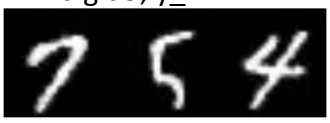


digit 8, y_i = 1

digit 8, y_i = -1

digit 9, y_i = 1

digit 9, y_i = -1



When C = 8, plot the 3 support vectors of the largest Lagrange multiplier

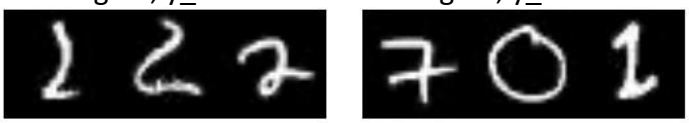
digit 0, y_i = 1

digit 0, y_i = -1

digit 1, y_i = 1

digit 1, y_i = -1

digit 2, y_i = 1 digit 2, y_i = -1



digit 3, y_i = 1 digit 3, y_i = -1

digit 4, y_i = 1 digit 4, y_i = -1

digit 5, y_i = 1 digit 5, y_i = -1

digit 6, y_i = 1 digit 6, y_i = -1

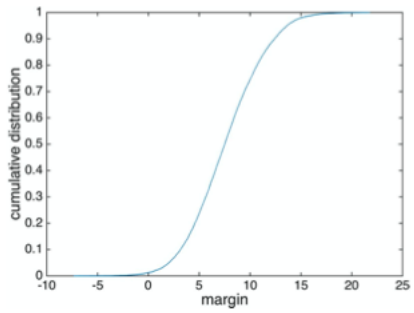
digit 7, y_i = 1 digit 7, y_i = -1

digit 8, y_i = 1 digit 8, y_i = -1

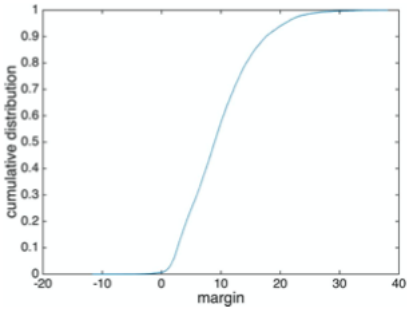
digit 9, y_i = 1 digit 9, y_i = -1

Comments: C doesn't make a lot of differences. Digit 8 and Digit 9 are the hardest to identify. They obtain the less accuracy and require the most support vectors.

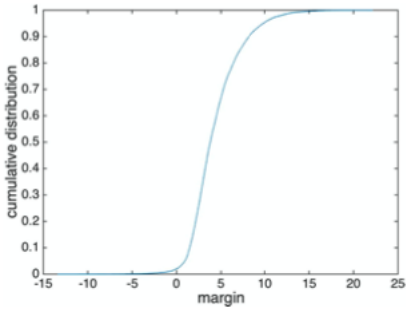
b)
When C =2, the cdf plots for digits 0-9:



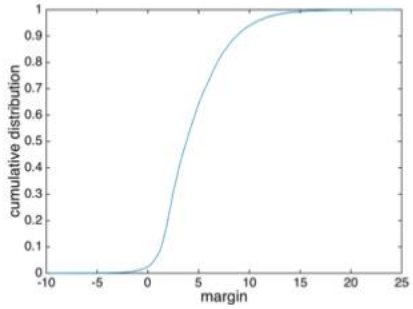
Digit0



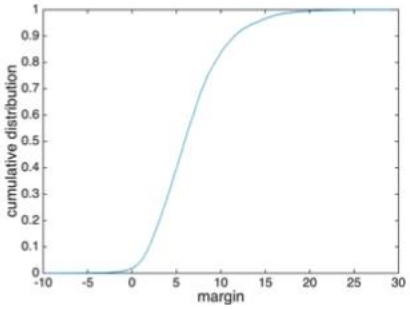
Digit1



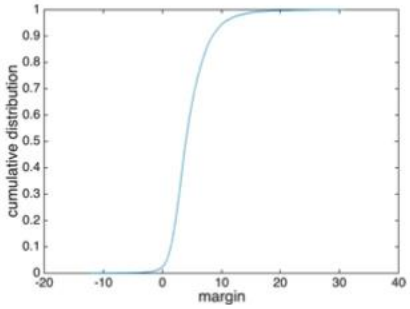
Digit2



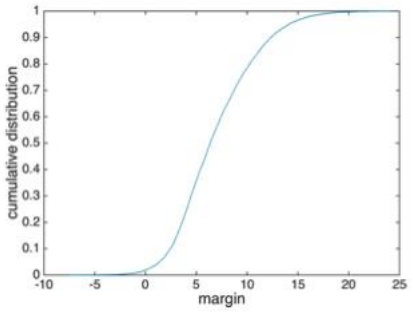
Digit3



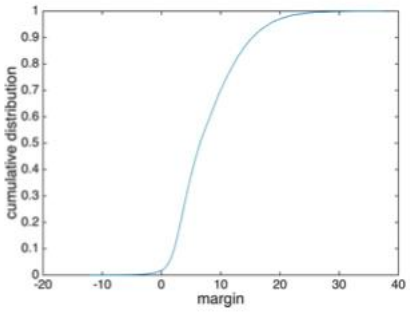
Digit4



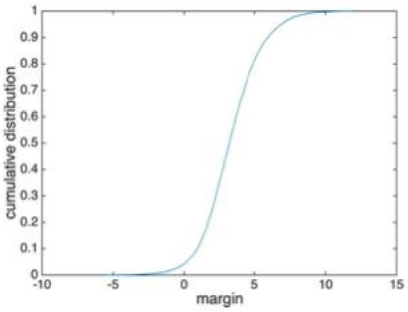
Digit5



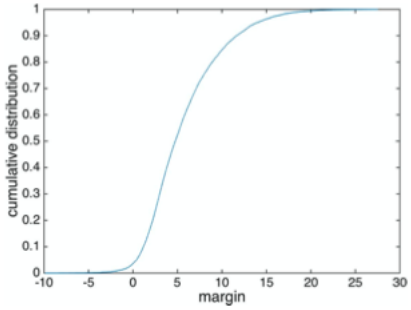
Digit6



Digit7

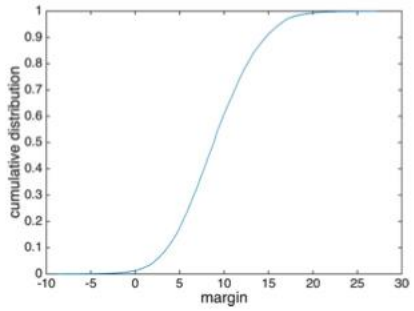


Digit8

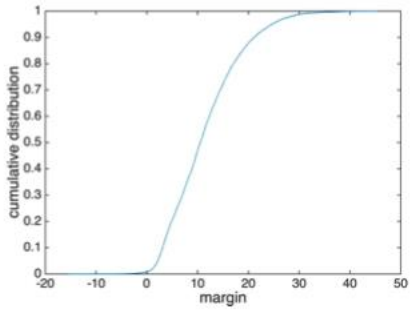


Digit9

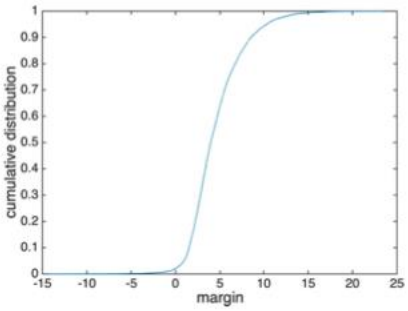
When C =4, the cdf plots for digits 0-9:



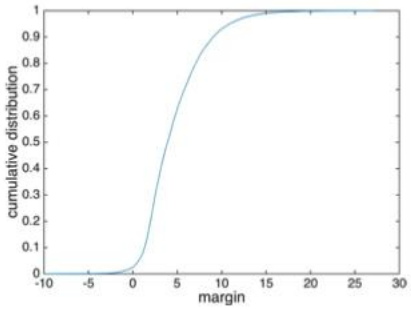
Digit0



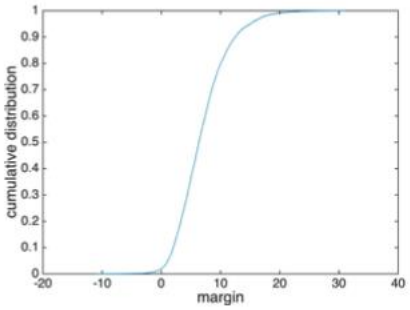
Digit1



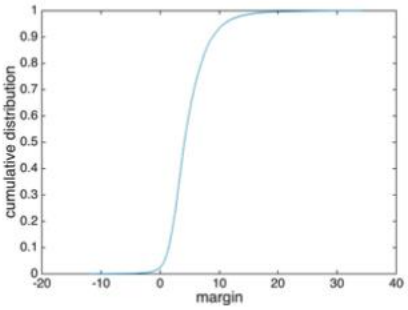
Digit2



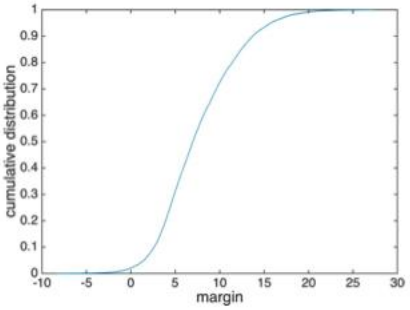
Digit3



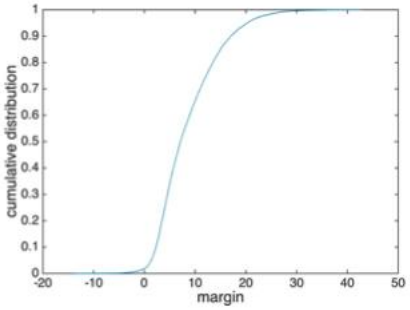
Digit4



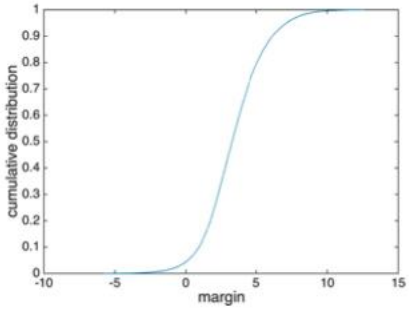
Digit5



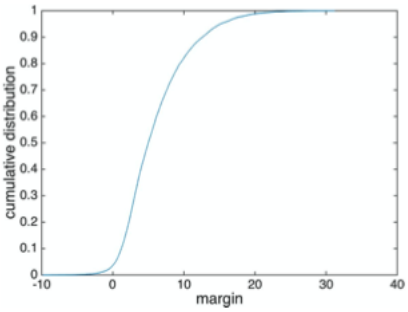
Digit6



Digit7

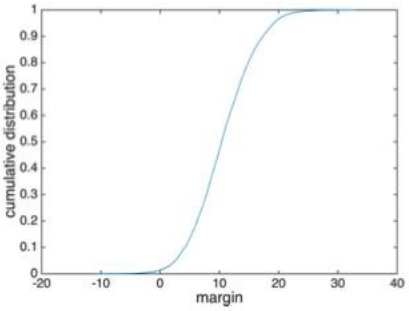


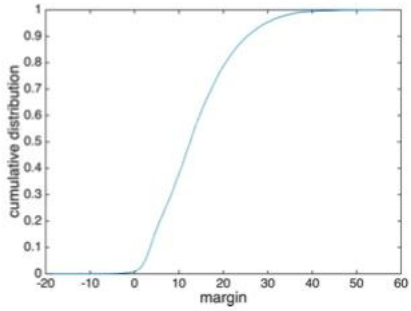
Digit8

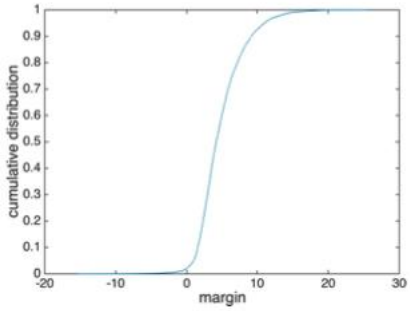


Digit9

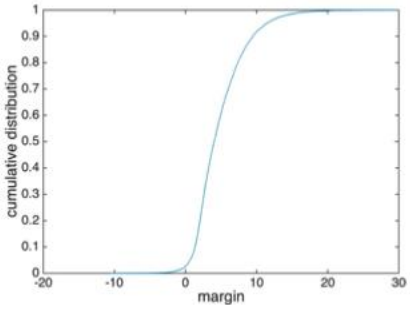
When C =8, the cdf plots for digits 0-9:



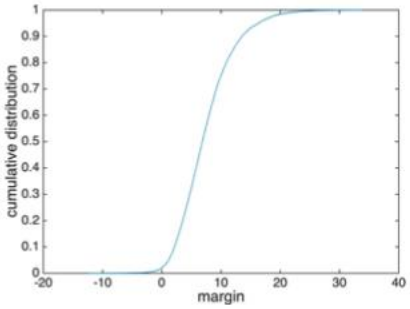




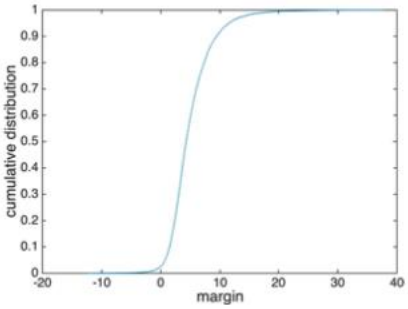
Digit0



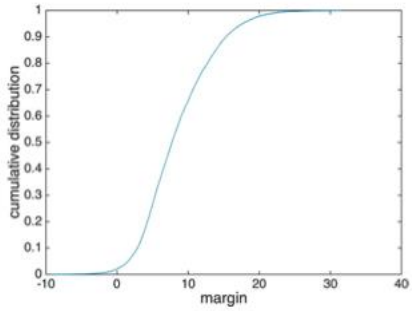
Digit1



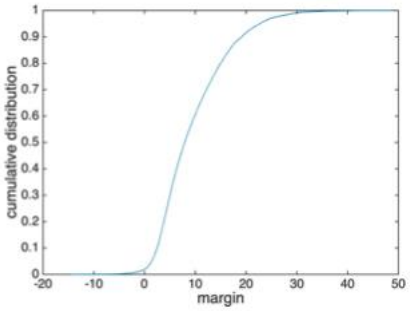
Digit2



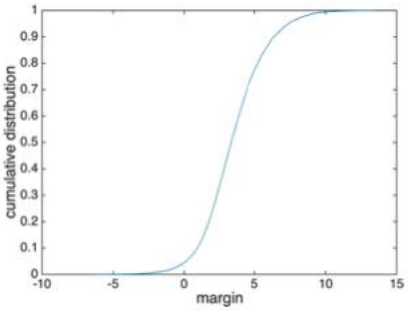
Digit3



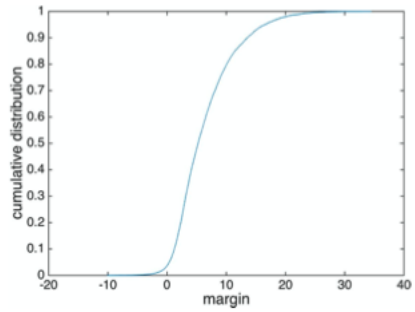
Digit4



Digit5



Digit6



Digit7

Digit8

Digit9

c) When C = 2, γ = 0.0625, the test accuracy is better than those for linear svm

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9	Average
0.9953	0.9976	0.9888	0.9885	0.9915	0.9874	0.9930	0.9907	0.9837	0.9883	0.9742

When C = 2, γ = 0.0625, Number of Support Vectors are much higher than those for linear svm

Digit0	Digit1	Digit2	Digit3	Digit4	Digit5	Digit6	Digit7	Digit8	Digit9
5861	2416	6892	7131	6302	6683	5648	5742	7672	6492