

# Assignment 12

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1. The result of both part are showing together

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Problem 1a
For tanh:
G(1):
[[-0.06376622 -0.06376622]
 [-0.06376622 -0.06376622]
 [-0.12753245 -0.12753245]]

G(2):
[[-0.60733448]
 [-0.46254239]
 [-0.46254239]]

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For identity:
G(1):
[[-0.07752788 -0.07752788]
 [-0.07752788 -0.07752788]
 [-0.15505575 -0.15505575]]

G(2):
[[-0.73840584]
 [-0.56236558]
 [-0.56236558]]

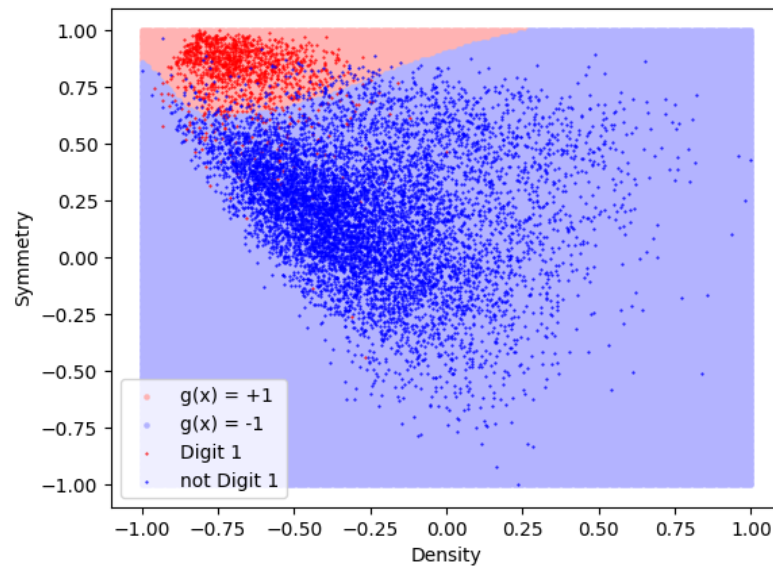
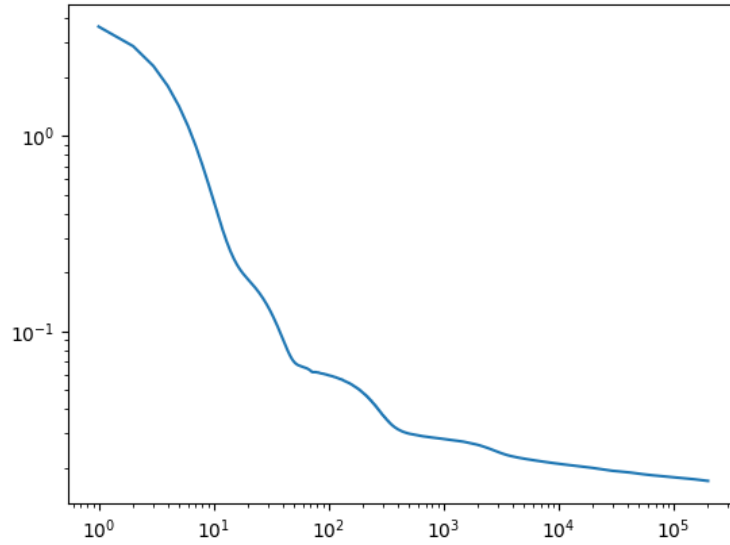
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Problem 1b: Numerical Gradient
For tanh:
G(1):
[[-0.06376622 -0.06376622]
 [-0.06376622 -0.06376622]
 [-0.12753245 -0.12753245]]

G(2):
[[-0.60733448]
 [-0.46254239]
 [-0.46254239]]

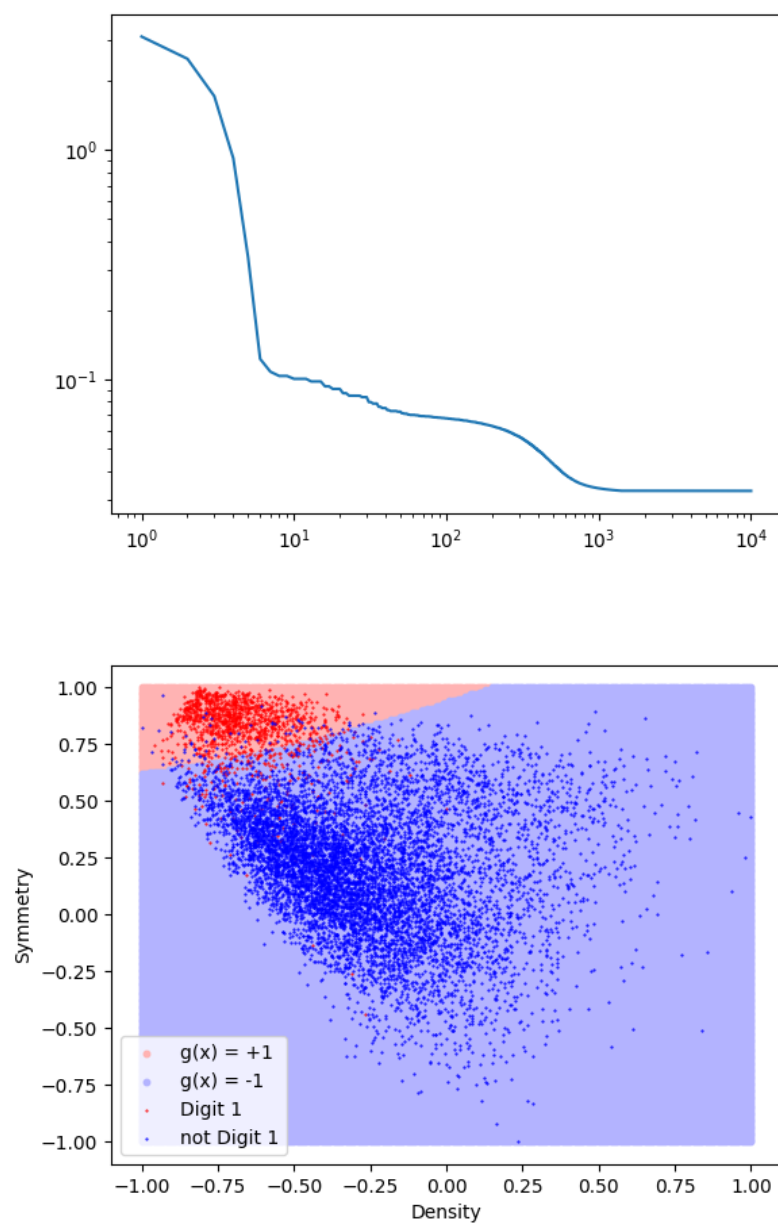
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For identify:
G(1):
[[-0.07752788 -0.07752788]
 [-0.07752788 -0.07752788]
 [-0.15505576 -0.15505576]]

G(2):
[[-0.73840584]
 [-0.56236558]
 [-0.56236558]]
```

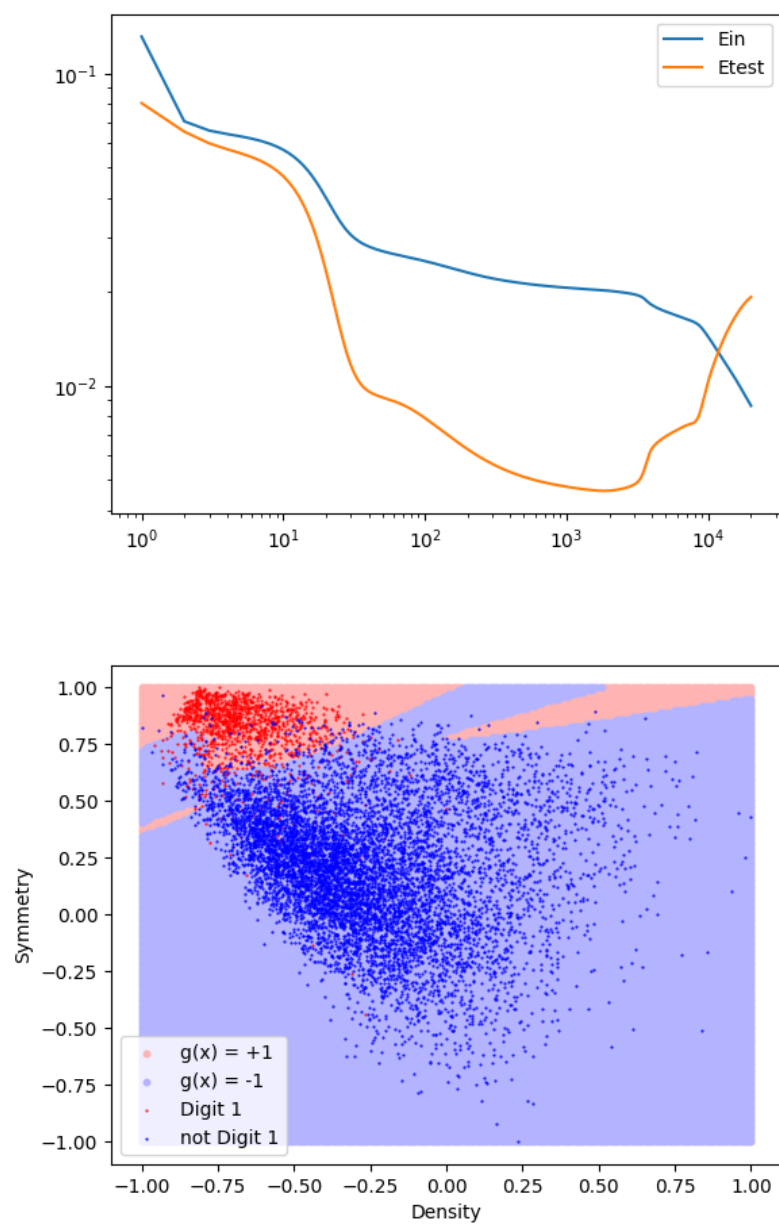
2. (a) The program is running for about 10 hours and it is still running till 11:30pm, I changed to use  $2 \times 10^5$  instead.



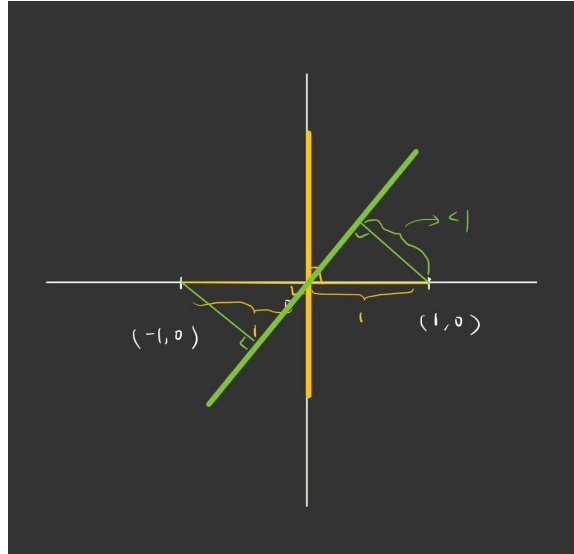
(b) Running for 2000 iterations



(c) Running for 20000 iterations

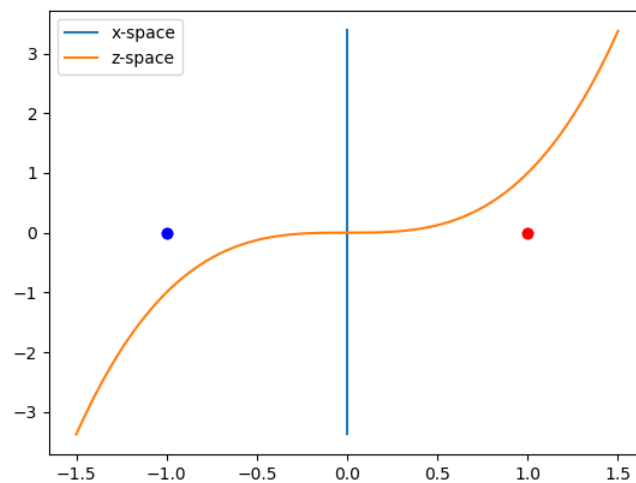


3. (a) The optimal hyperplane should at least cross the midpoint of two data point to make sure the distance from the data to the plane are equal. Then from the following graph, it is easy to say that the plane should be perpendicular.



- (b)  $z_1 = [1^3 - 0, 1 * 0] = [1, 0]$ , and  $z_1 = [(-1)^3 - 0, -1 * 0] = [-1, 0]$  The hyperplane in Z should be  $z_1 = 0$  which is the same to the X-space.

- (c) Plotting:

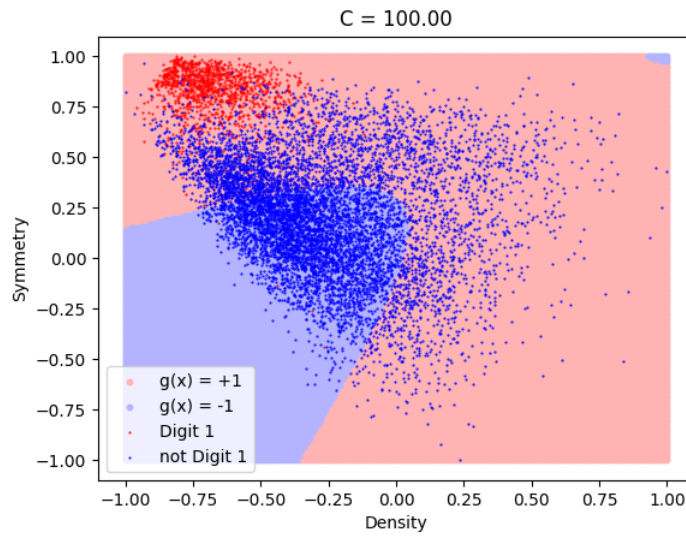
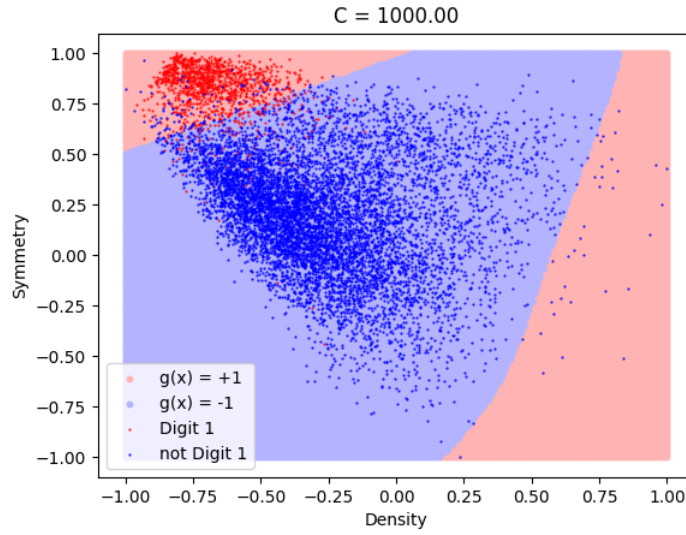


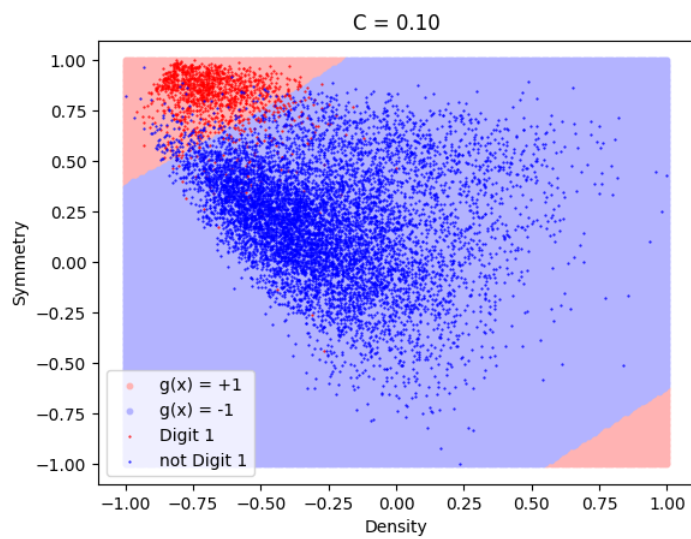
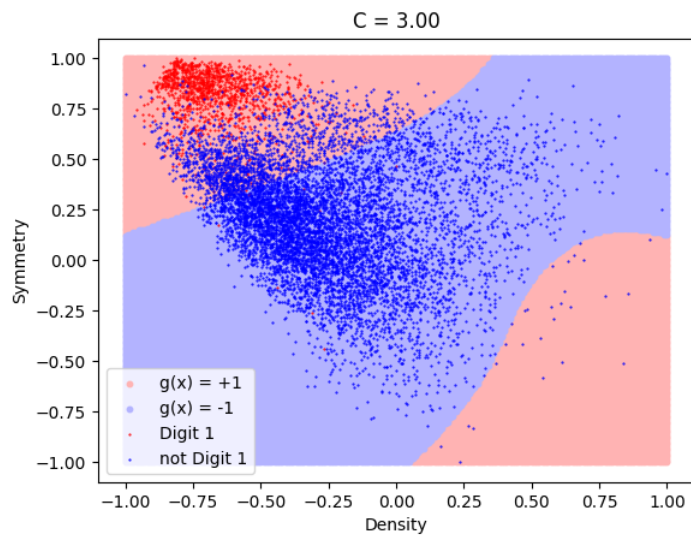
(d)

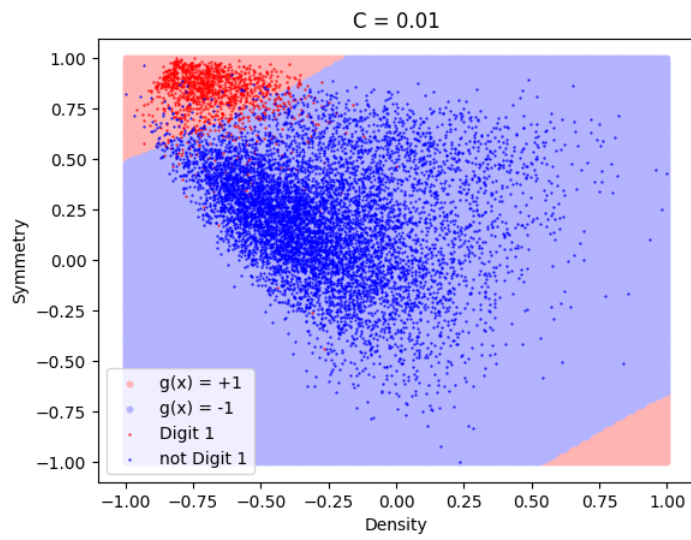
$$\begin{aligned}
K(x, y) &= z(x) * z(y) \\
&= [x_1^3 - x_2, x_1 * x_2] \cdot [y_1^3 - y_2, y_1 * y_2] \\
&= x_1^3 y_1^3 - x_1^3 y_2 - x_2 y_1^3 + x_2 y_2 + x_1 x_2 y_1 y_2
\end{aligned}$$

(e) From the given two point we have  $Q = [[1, 1], [1, 1]]$  and  $A = [[1, -1], [-1, 1], [1, 0], [0, 1]]$ , and then from  $b = y_1 - w^T x$ , I get  $[b, w_1, w_2] = [0, 1, 0]$ .

4. (a) Plot with different C







(b) The larger the  $C$  the more possible to be overfit.

(c)

5.