3. Margin Boundary

Margin Boundary

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The **decision boundary** is the set of points x which satisfy

$$\theta \cdot x + \theta_0 = 0.$$

The **Margin Boundary** is the set of points x which satisfy

$$\theta \cdot x + \theta_0 = \pm 1.$$

So, the distance from the decision boundary to the margin boundary is $\frac{1}{|| \theta ||}$.

Margin Boundary 1

1/1 point (graded)

As explained in the lecture video, margin boundary is the set of points (x, y) at which the distance from the decision boundary to (x, y) is $\frac{1}{||\theta||}$. Now, what is the value of $y^{(i)}\left(\theta \cdot x^{(i)} + \theta_0\right)$ for a correctly classified point $\left(x^{(i)}, y^{(i)}\right)$ on the margin boundary?

1

✔ **Answer:** 1

Solution:

From the previous problem, we know that the distance from a line $L : \theta x + \theta_0 = 0$ to $P = (x_0)$ is given by $\frac{||\theta x_0 + \theta_0||}{||\theta||}$. Because we know that the distance from the decision boundary to (x, y) is $\frac{1}{||\theta||}$,

$$|| \theta x_0 + \theta_0 || = 1$$

. Thus,

$$|| \theta x_0 + \theta_0 || = y^{(i)}\left(\theta \cdot x^{(i)} + \theta_0\right) = 1$$

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Answers are displayed within the problem

Margin Boundary 2

1/1 point (graded)

What happens to the margin boundaries as we increase $|| \theta ||$?

- (●) The margin boundaries move closer to the decision boundary
- ( ) The margin boundaries move further away from the decision boundary
- ( ) The margin boundaries converge to a certain location no matter what

✔

Solution:

As we increase $|| \theta ||$, $\frac{1}{||\theta||}$ decreases. For now, acknowledge that $\frac{1}{||\theta||}$ is the distance from the decision boundary to the margin boundary (which we will closely examine in the next set of problems.) Thus, the distance from the point $\left(x^{(i)}, y^{(i)}\right)$ that satisfy

$$y^{(i)}\left(\theta \cdot x^{(i)} + \theta_0\right) = 1$$

to the decision boundary will decrease. Thus the margin moves closer to the decision boundary.

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