

Unit 1 Linear Classifiers and

Course > Generalizations (2 weeks)

3. Margin Boundary

Lecture 3 Hinge loss, Margin

> boundaries and Regularization

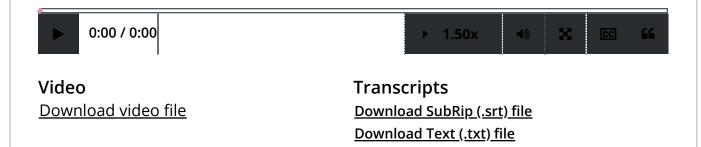
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# 3. Margin Boundary Margin Boundary





The  $\operatorname{\mathbf{decision}}$   $\operatorname{\mathbf{boundary}}$  is the set of points x which satisfy

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

The  ${f Margin\ Boundary}$  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  $\frac{1}{\mid\mid\theta\mid\mid}$ .

# 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  $y^{(i)}$   $(\theta \cdot x^{(i)} + \theta_0)$  for a correctly classified point  $(x^{(i)}, y^{(i)})$  on the margin boundary?

#### **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  $\frac{1}{||\theta||}$ ,

$$|| | heta x_0 + heta_0 || = 1$$

. Thus,

$$\mid\mid heta x_0 + heta_0 \mid\mid = y^{(i)} \left( heta \cdot x^{(i)} + heta_0 
ight) = 1$$

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You have used 1 of 2 attempts

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  $(x^{(i)},y^{(i)})$  that satisfy

$$y^{(i)}\left( heta\cdot x^{(i)}+ heta_0
ight)=1$$

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

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• Answers are displayed within the problem

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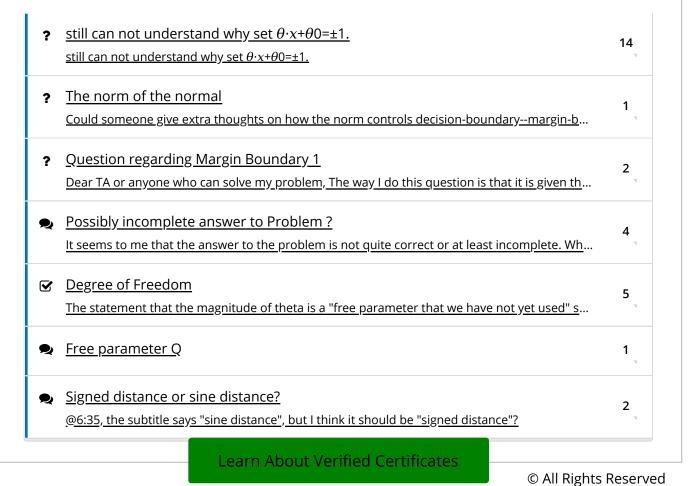
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