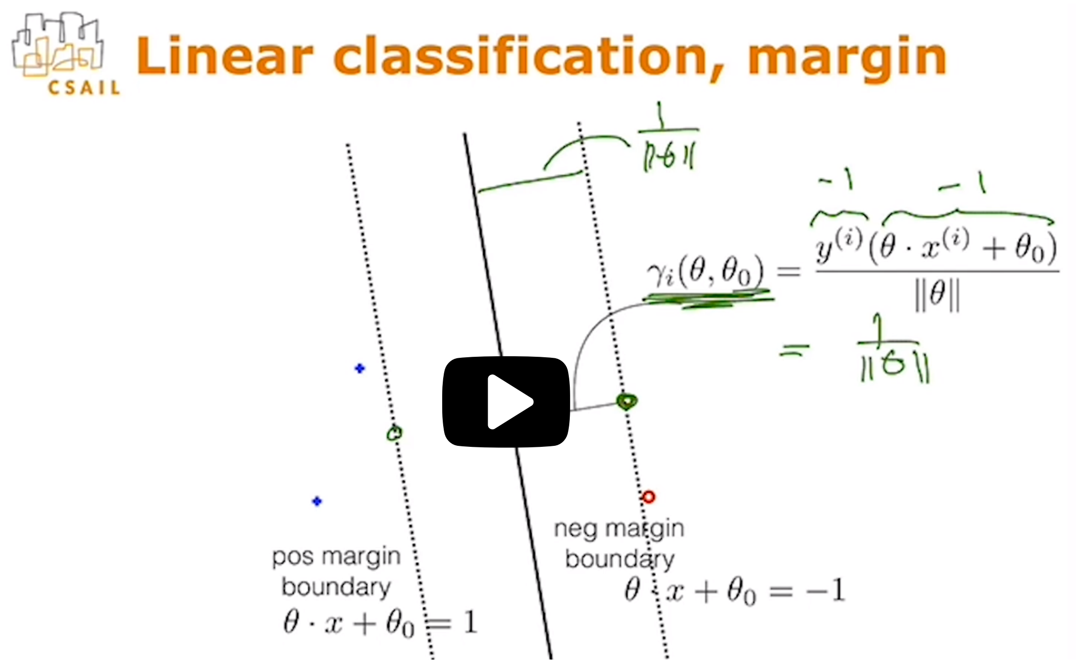
3. Margin Boundary

Margin Boundary



the distance would actually be minus 1 over norm of theta.

6:59 / 6:59 1.25x

So this is called a sine distance.

It is sine distance because it measures

the distance of a point from the decision boundary

but also the side on which it lies.

So if it lies on the correct side of the decision boundary,

the distance is positive.

But if we have a negatively labeled point here,

the distance would actually be minus 1 over norm of theta.

End of transcript. Skip to the start.

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

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

Submit 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 $|| \theta ||$?

- (selected, correct) 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

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

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

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