Applied Text Analytics & Natural Language Processing

with Dr. Mahdi Roozbahani
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Support Vector Machine – Part 1

Learning Objectives

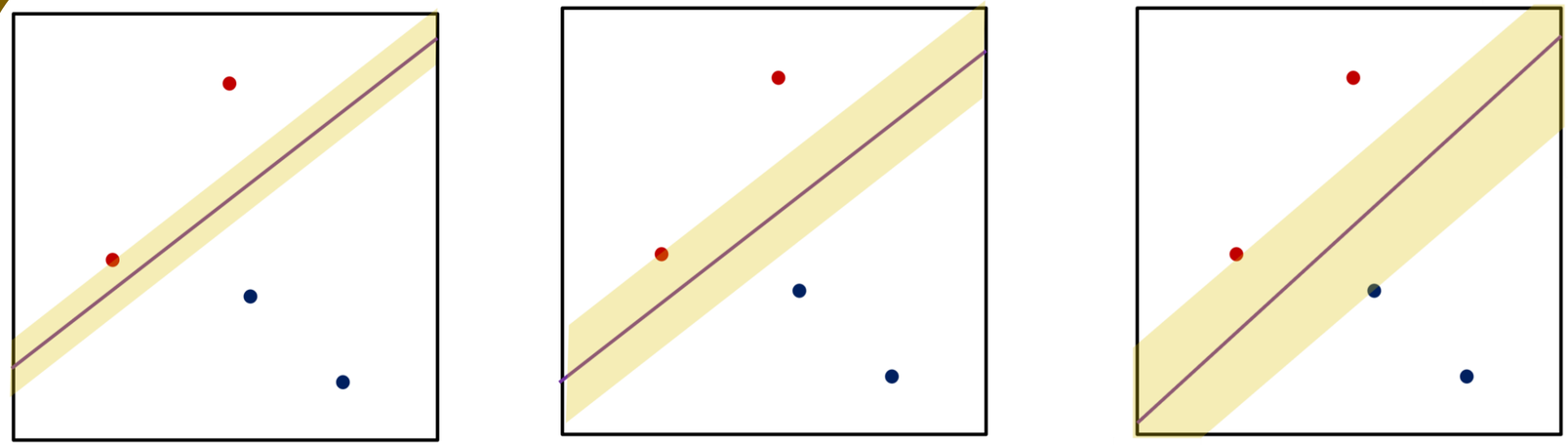
In this lesson, you will learn another linear text classifier

- Large Margin Classifier
- SVM
- Dual Form and Primal Form
- Kernel Trick

Linear Separation

We can have different separating lines

Let’s refer back to perceptron, are all these graphs a viable solution for perceptron?



Which line is the best?

- Why is the bigger margin better?
- What $\boldsymbol{\theta}$ maximizes the margin?

All cases, error is zero and they are linear, so they are all good for generalization.

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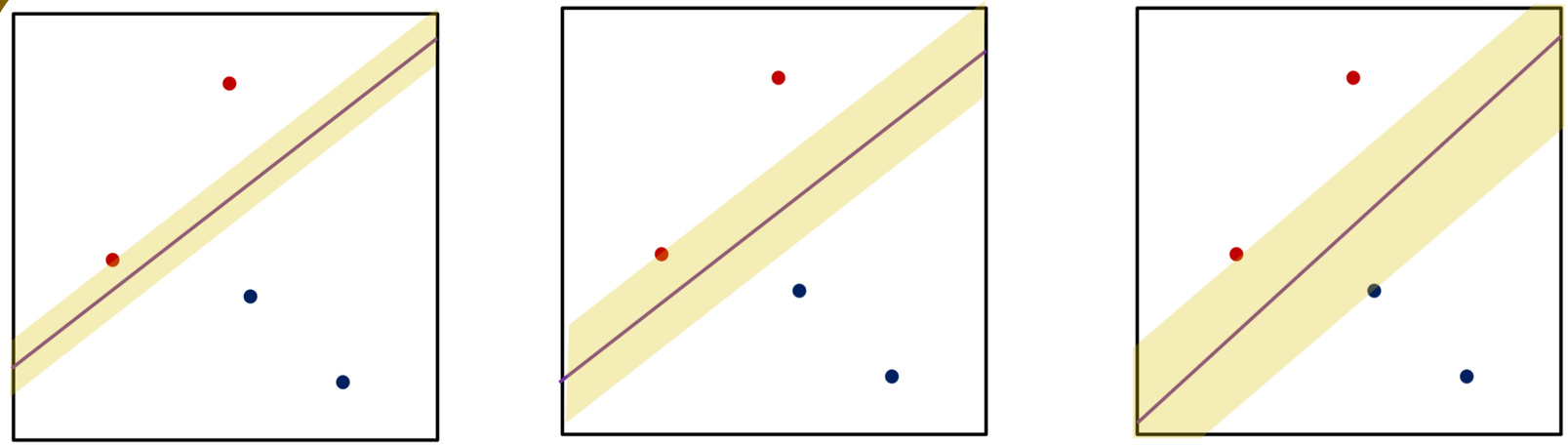

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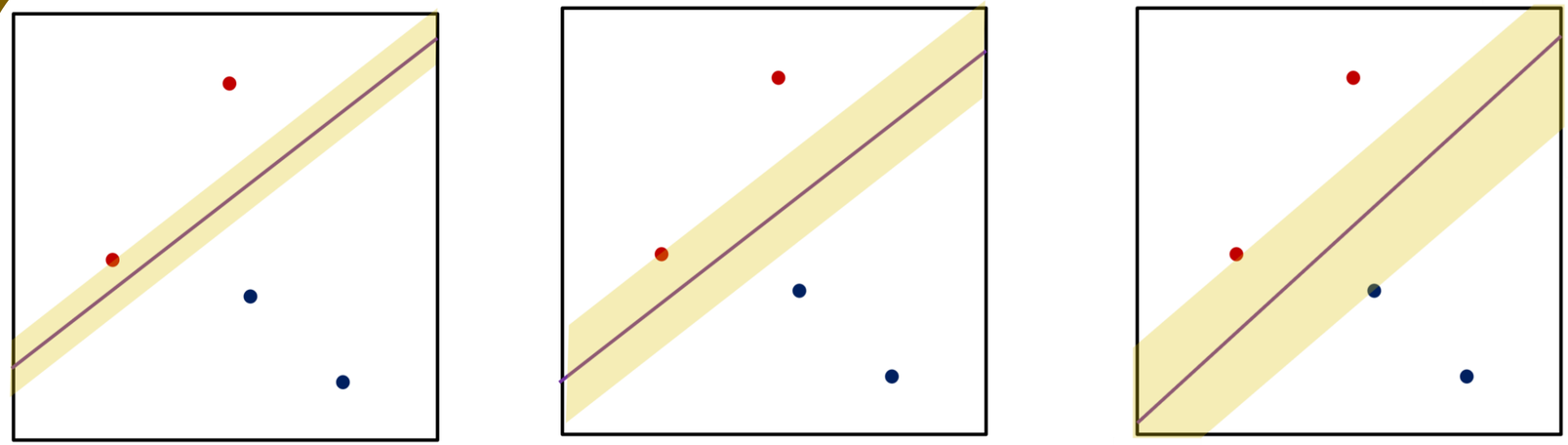

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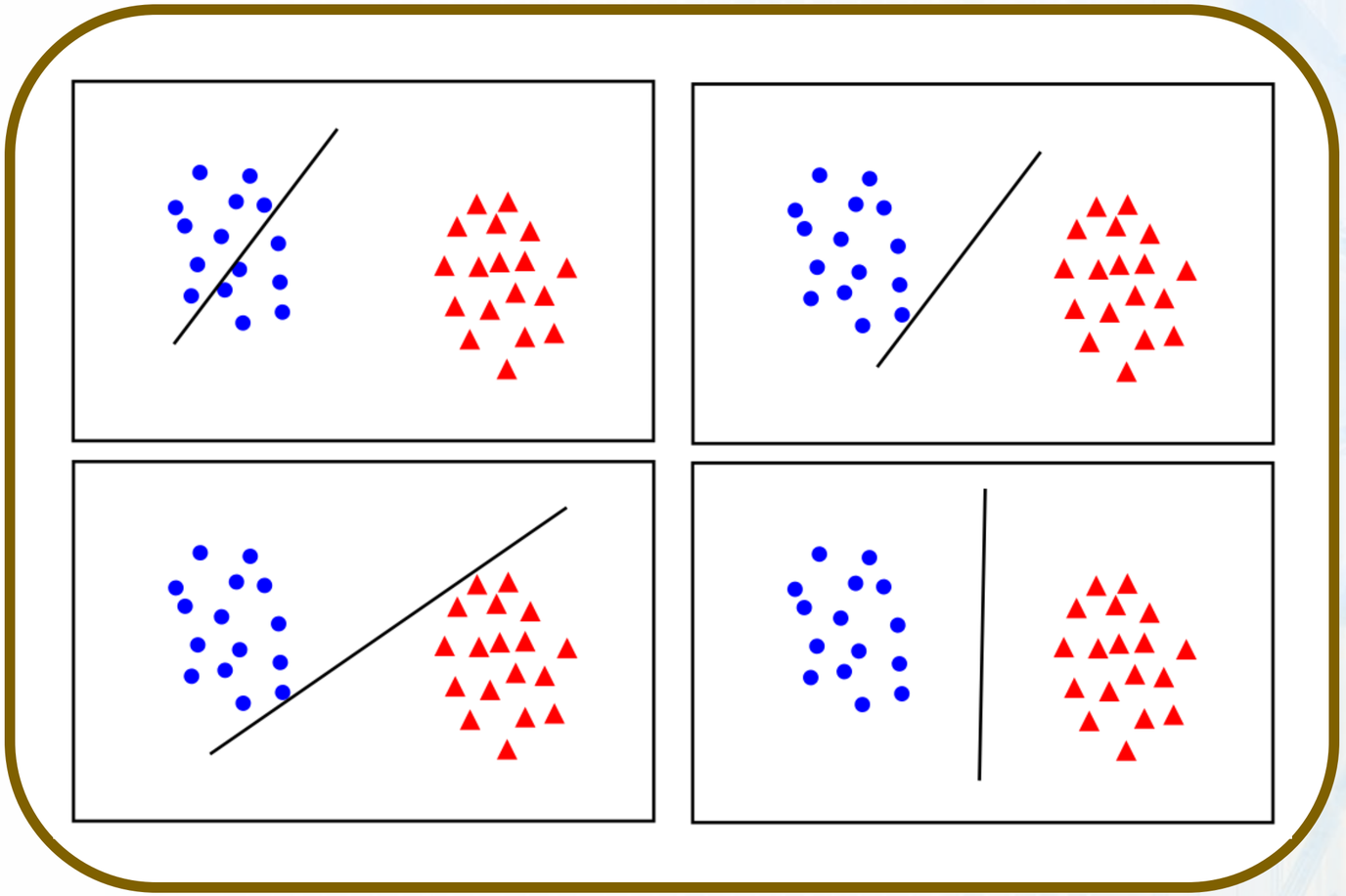
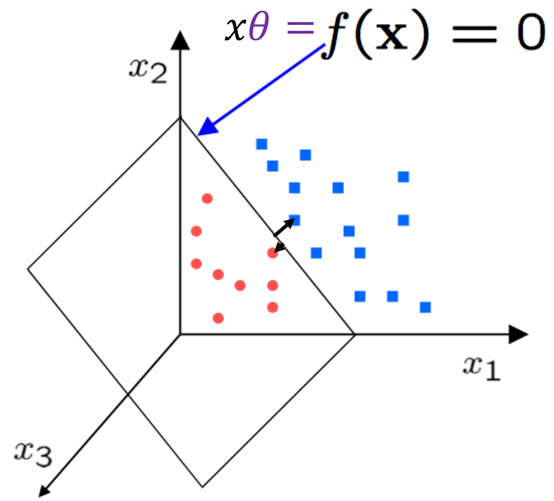
What is the Best θ?



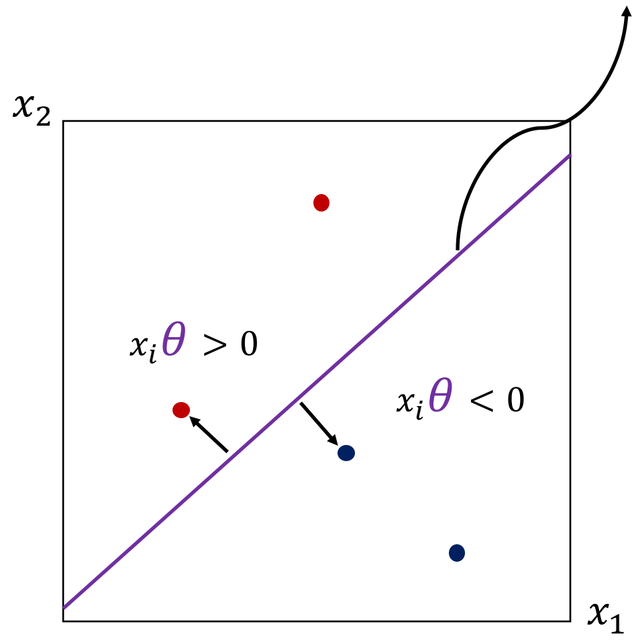
- Maximum margin solution: most table under perturbations of the inputs

Finding θ that Maximizes Margin

Solution (decision boundary) of the line: $x\theta = 0$



Let x_i to be the nearest data point to the line (plane):



Decision boundary would be: $x\theta + b = 0$

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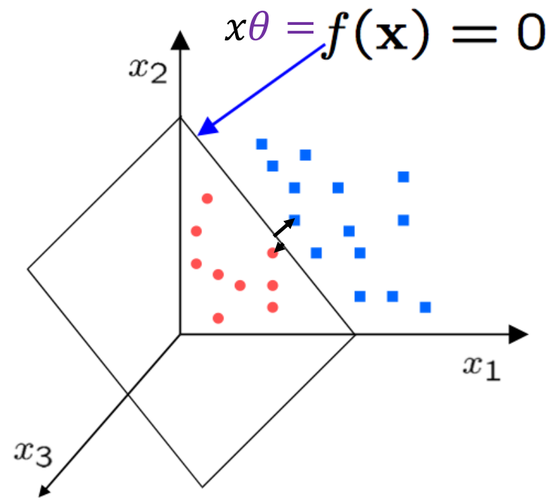

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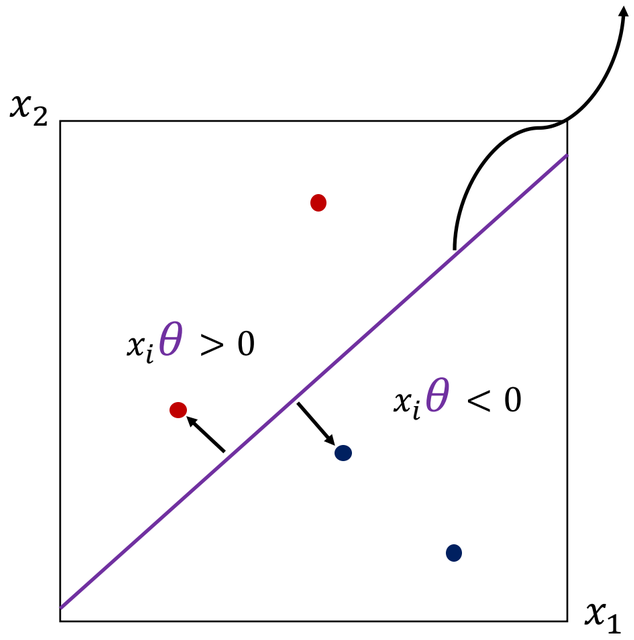

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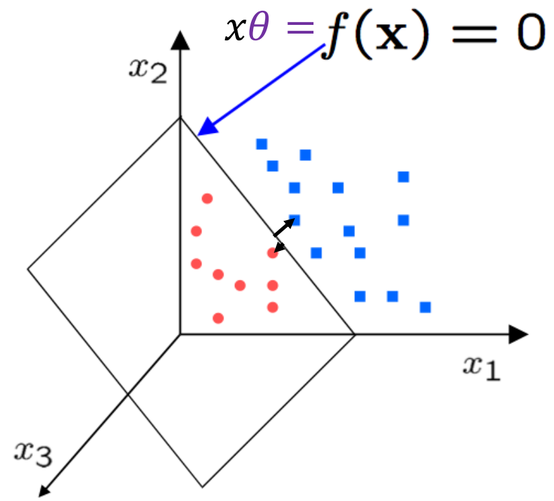

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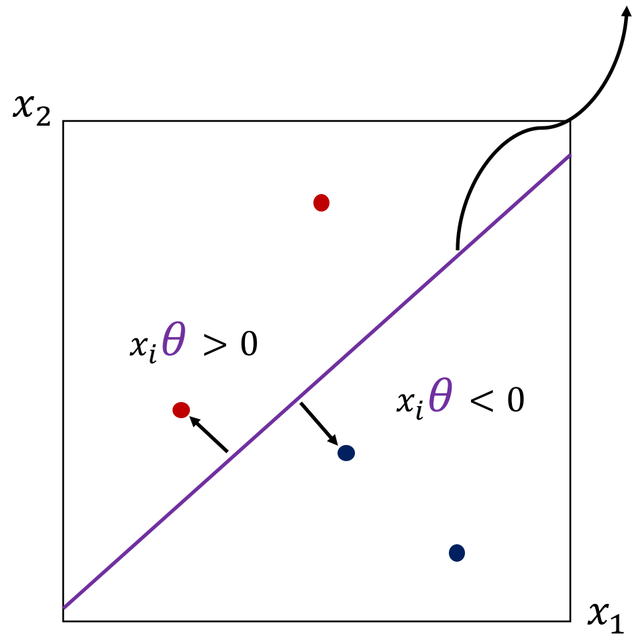

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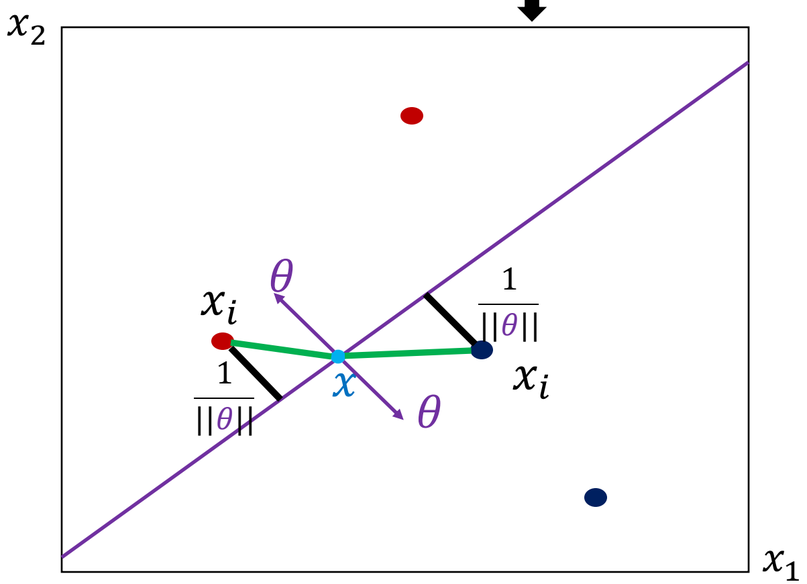
What is the Length of My Large Margin?

$$\text{distance} = \frac{1}{||\theta||}|(x_i\theta - x\theta)|$$

$$= \frac{1}{||\theta||}|(\underbrace{x_i\theta + b}_{\text{My constraint}} \underbrace{- x\theta - b}_{\text{A point on the decision line}})|$$

$$|x_i\theta + b| = 1 \qquad x\theta + b = 0$$

$$= \frac{2}{||\theta||}$$ The total margin



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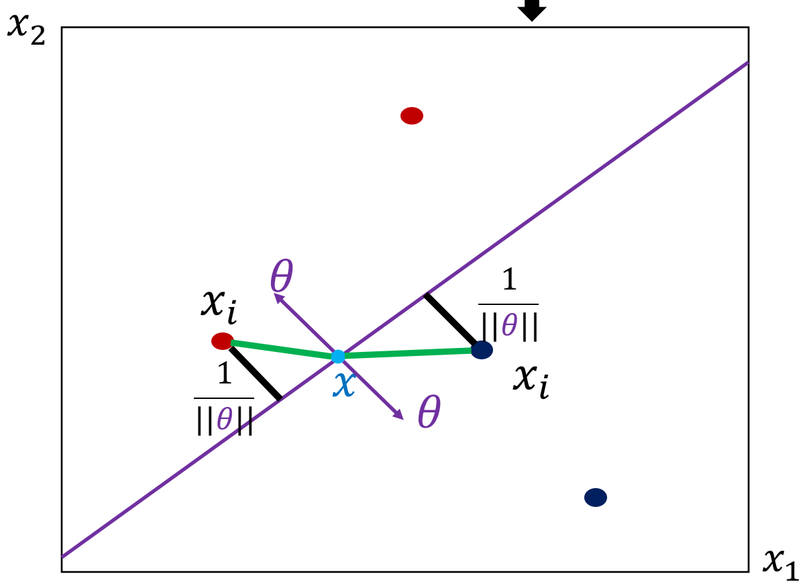

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