

INTERNATIONAL WORKSHOP ON ADVANCED DEEP LEARNING (IWADL) AT IIT MANDI

Part A: Intuition of Neural Networks

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Presentation at IWADL@IITMandi

(*Slides : A friendly introduction to Deep Learning and Neural Networks by Luis Serrano)

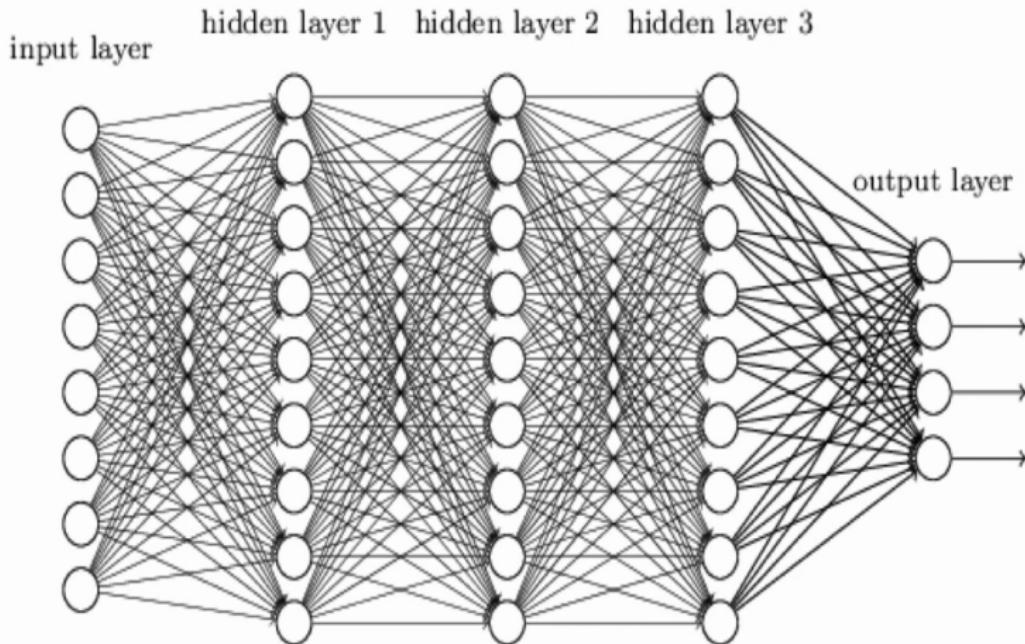
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July 16-20, 2018

Neural Networks



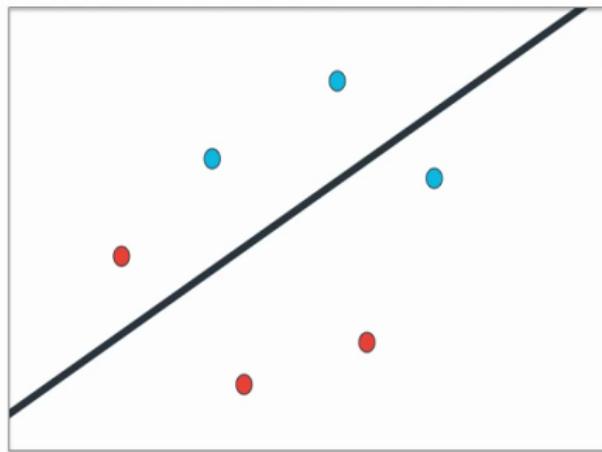
Neural Networks



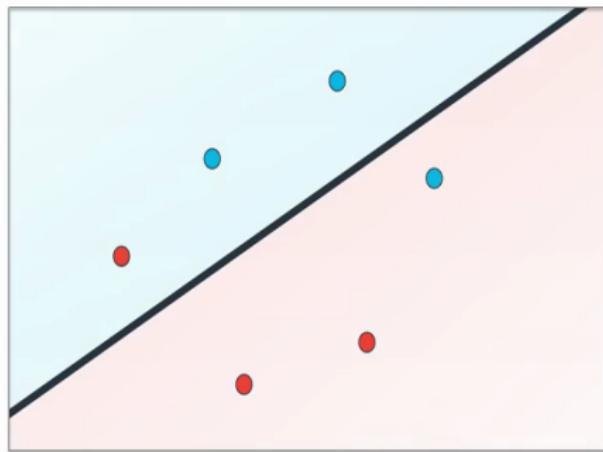
Neural Networks



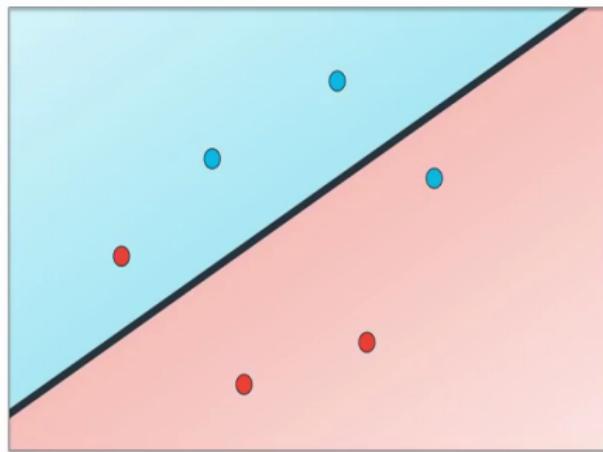
Goal: Split Data



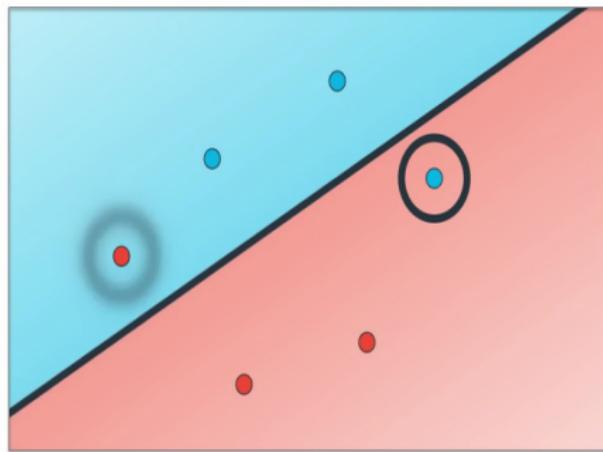
Goal: Split Data



Goal: Split Data

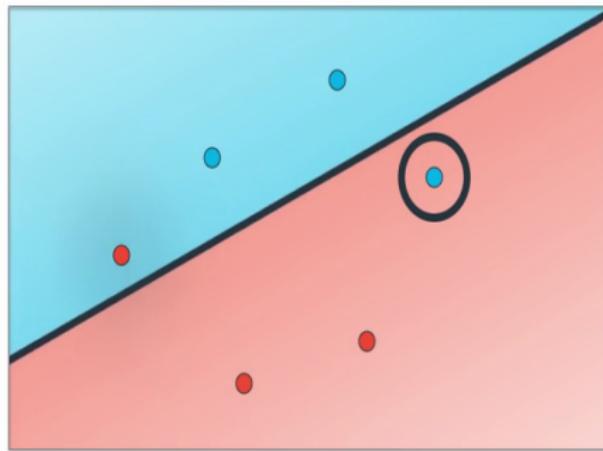


Goal: Split Data



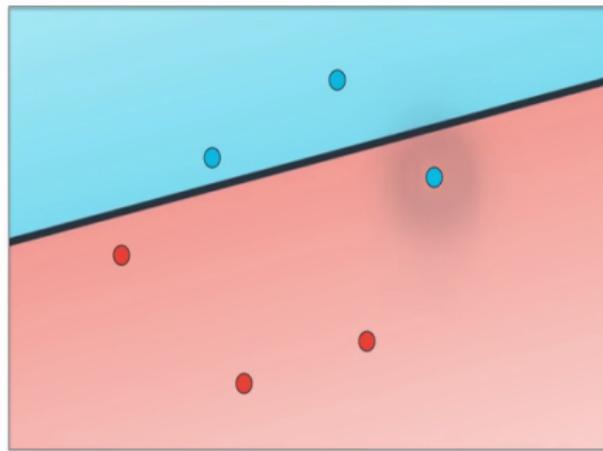
2 errors

Goal: Split Data



2 errors

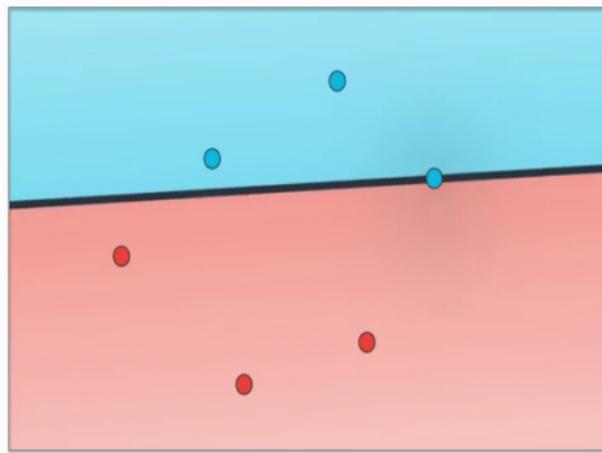
Goal: Split Data



1 error

Warmer

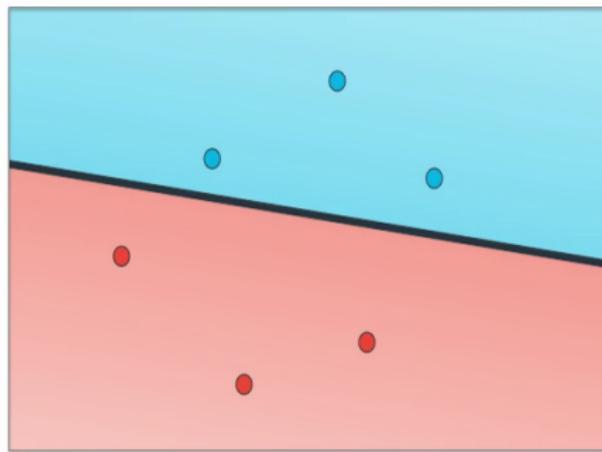
Goal: Split Data



1 error

Warmer

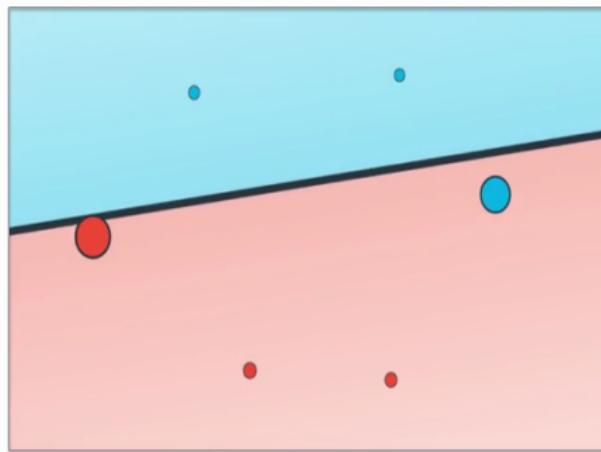
Goal: Split Data



0 errors

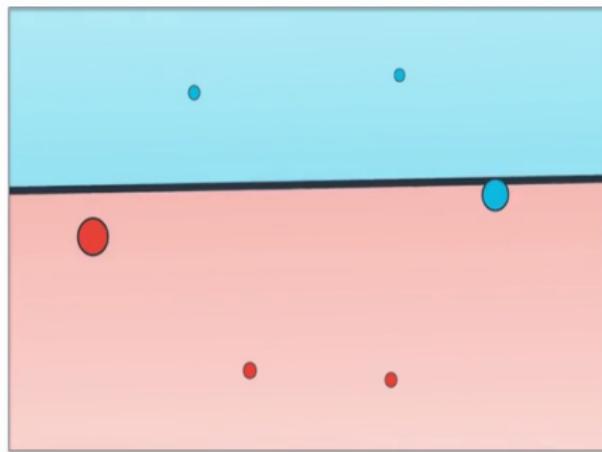
Hot!

Logistic Regression



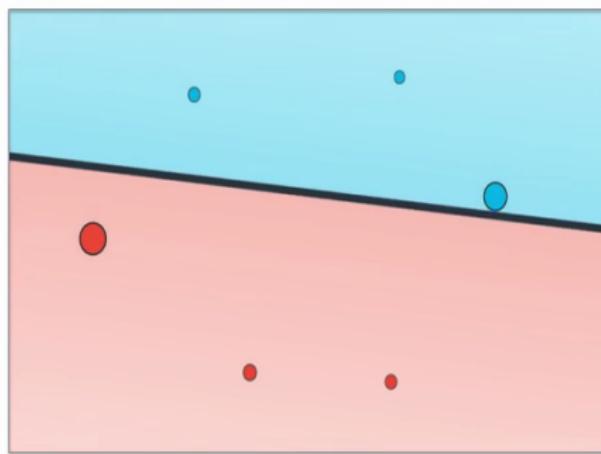
$$\text{Error} = \text{•} + \text{•} + \text{○} + \text{○} + \text{•} + \text{•}$$

Logistic Regression



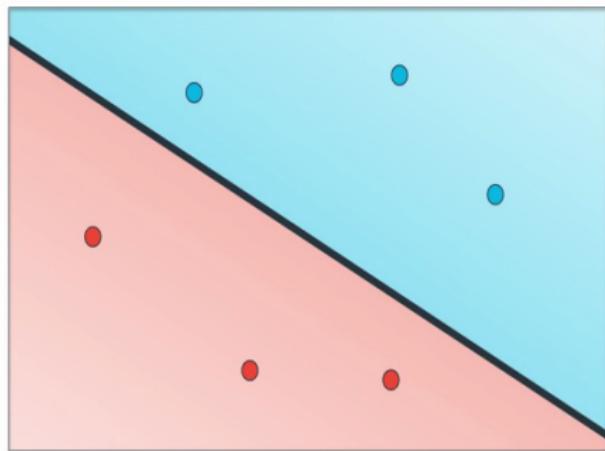
$$\text{Error} = \cdot + \cdot + \textcolor{blue}{\circlearrowleft} + \textcolor{red}{\circlearrowright} + \cdot + \cdot$$

Logistic Regression



$$\text{Error} = \text{ } + \text{ }$$

Logistic Regression



$$\text{Error} = 0 + 0 + 1 + 1 + 0 + 0 + 0$$

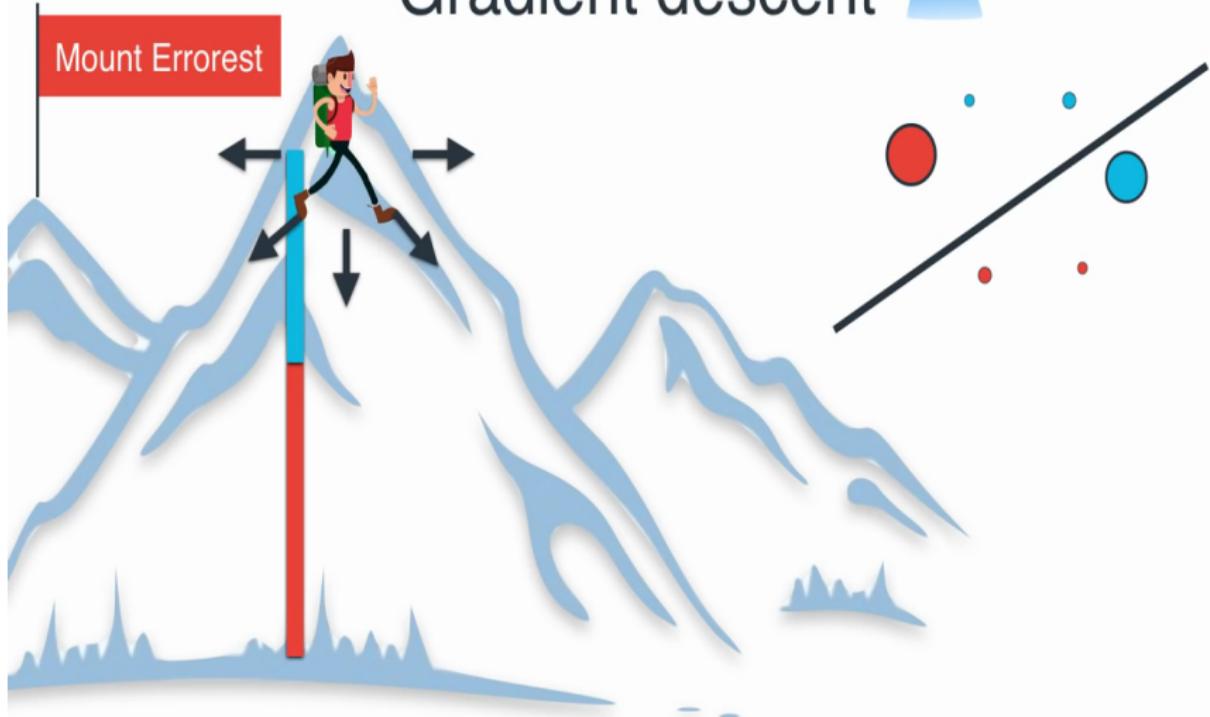
$$\text{Error} = 0 + 0 + 0 + 0 + 0 + 0 + 0$$

Minimize error

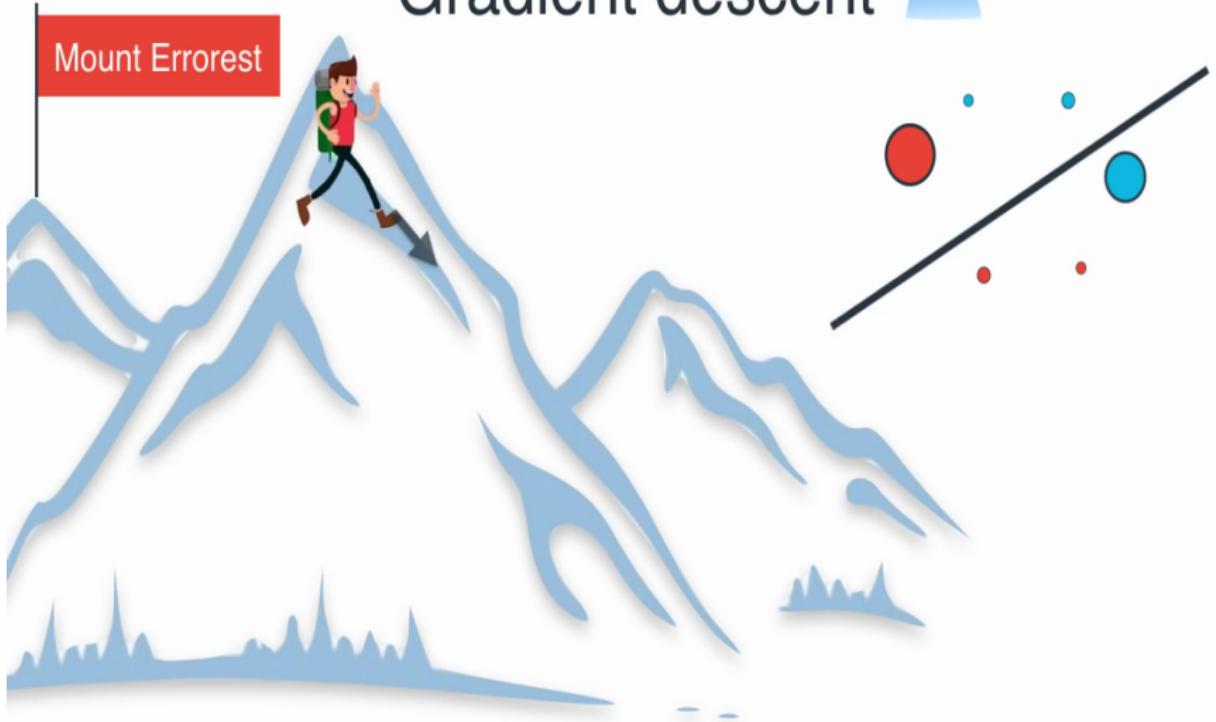


Gradient descent

Gradient descent



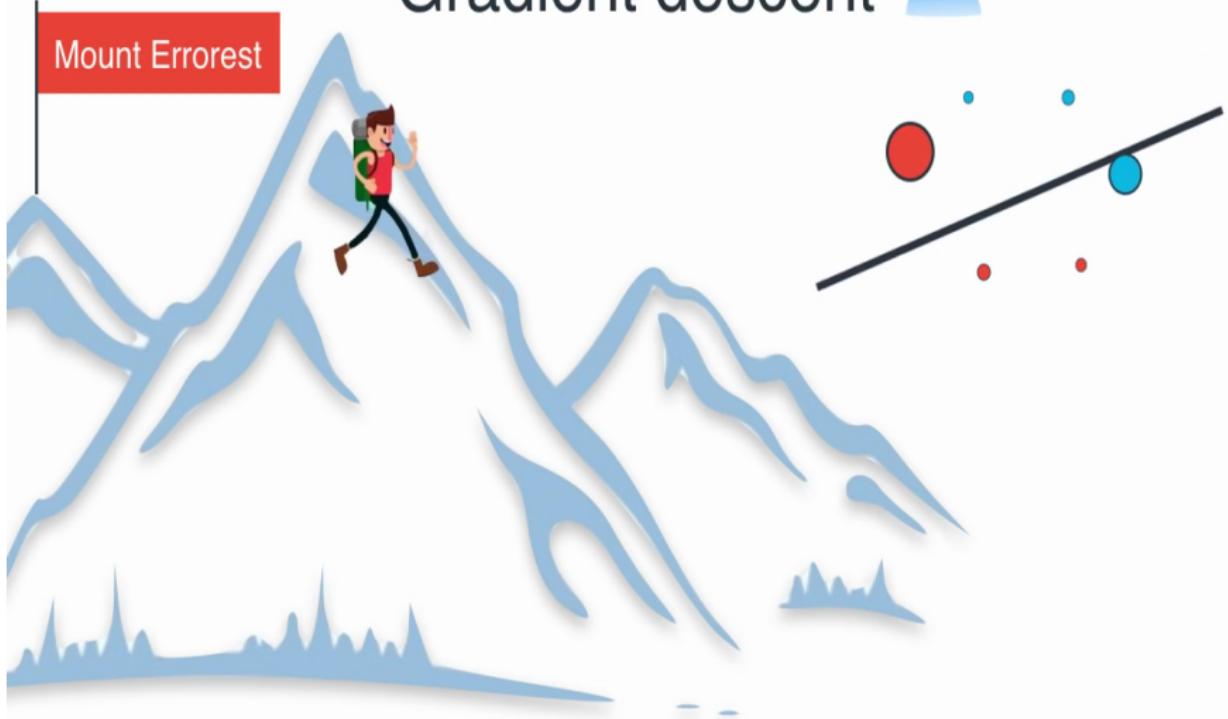
Gradient descent



Gradient descent



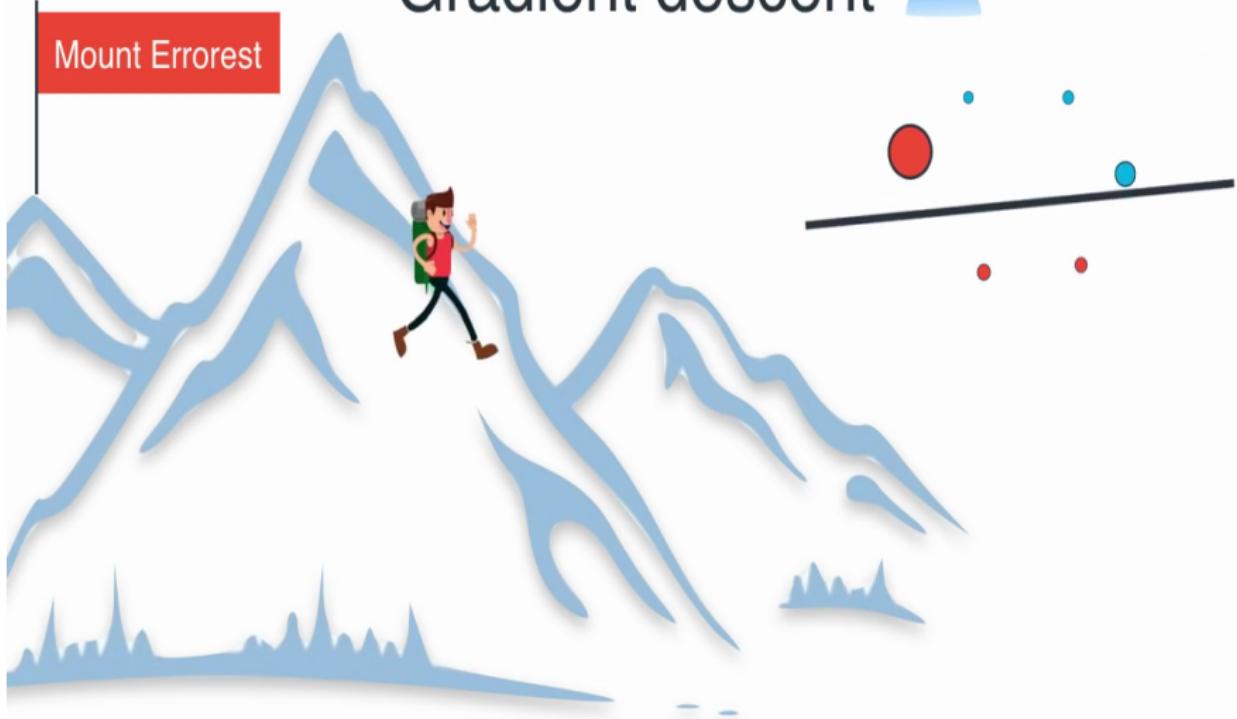
Gradient descent



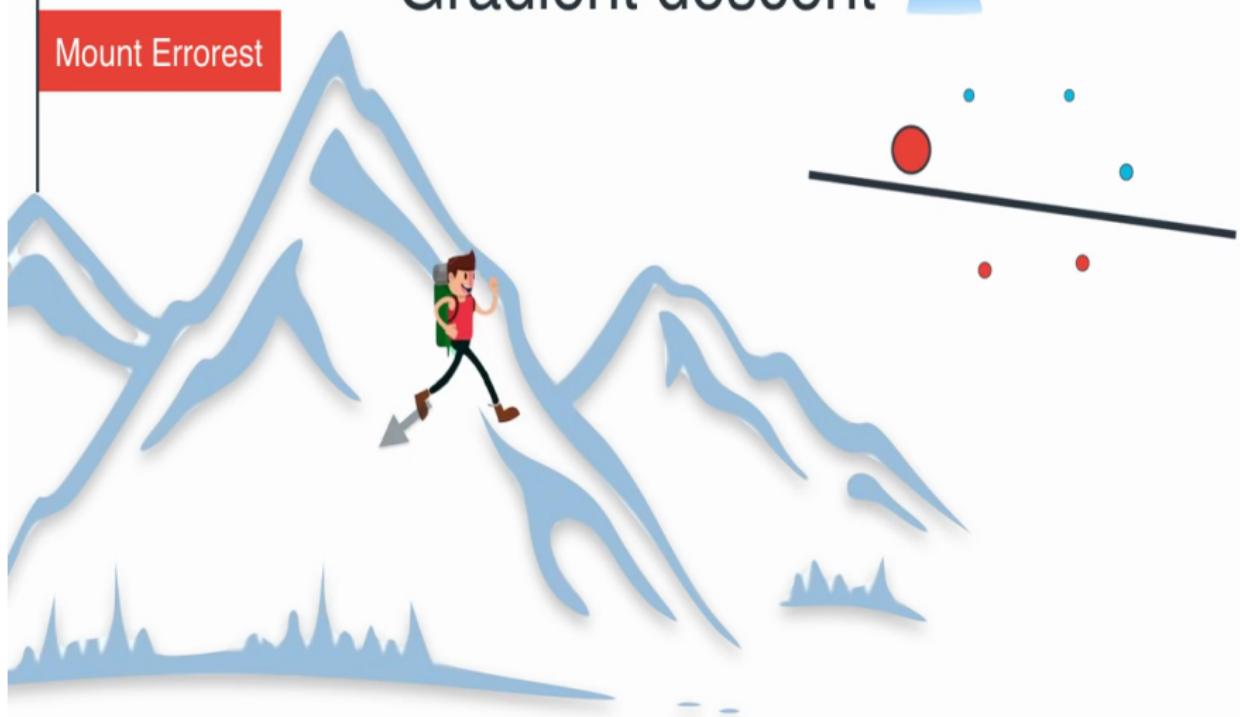
Gradient descent



Gradient descent



Gradient descent



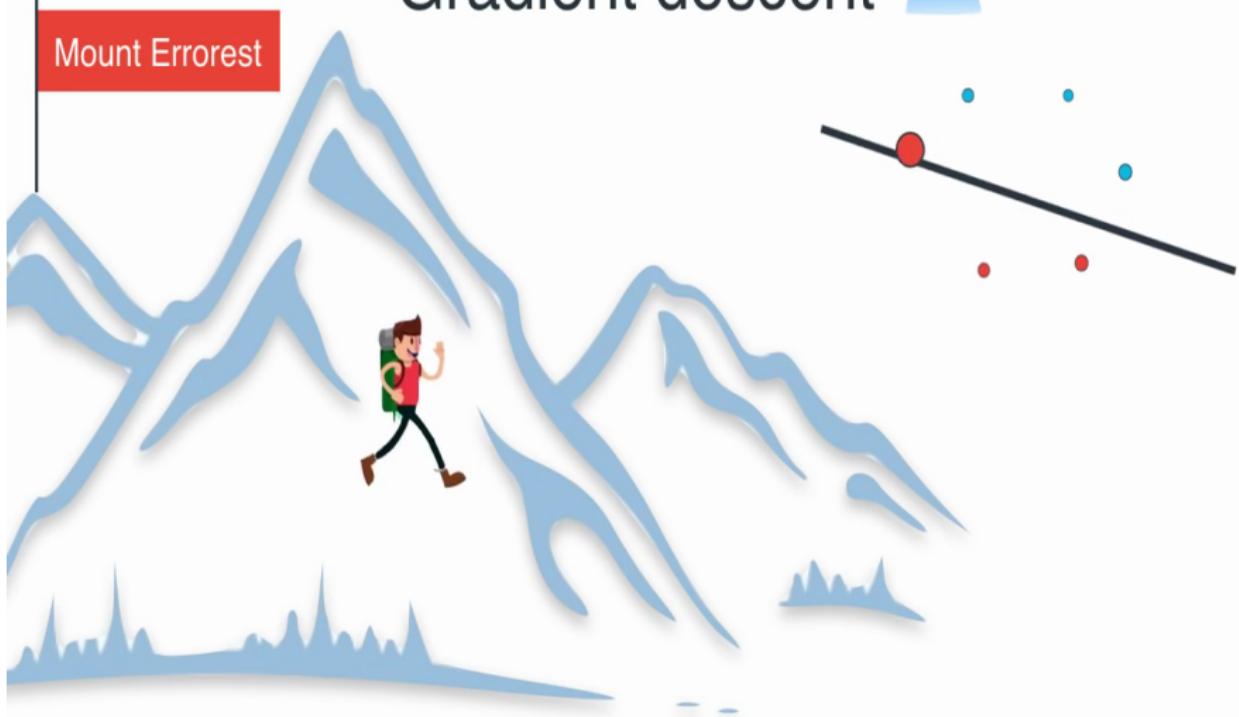
Slide

Gradient descent



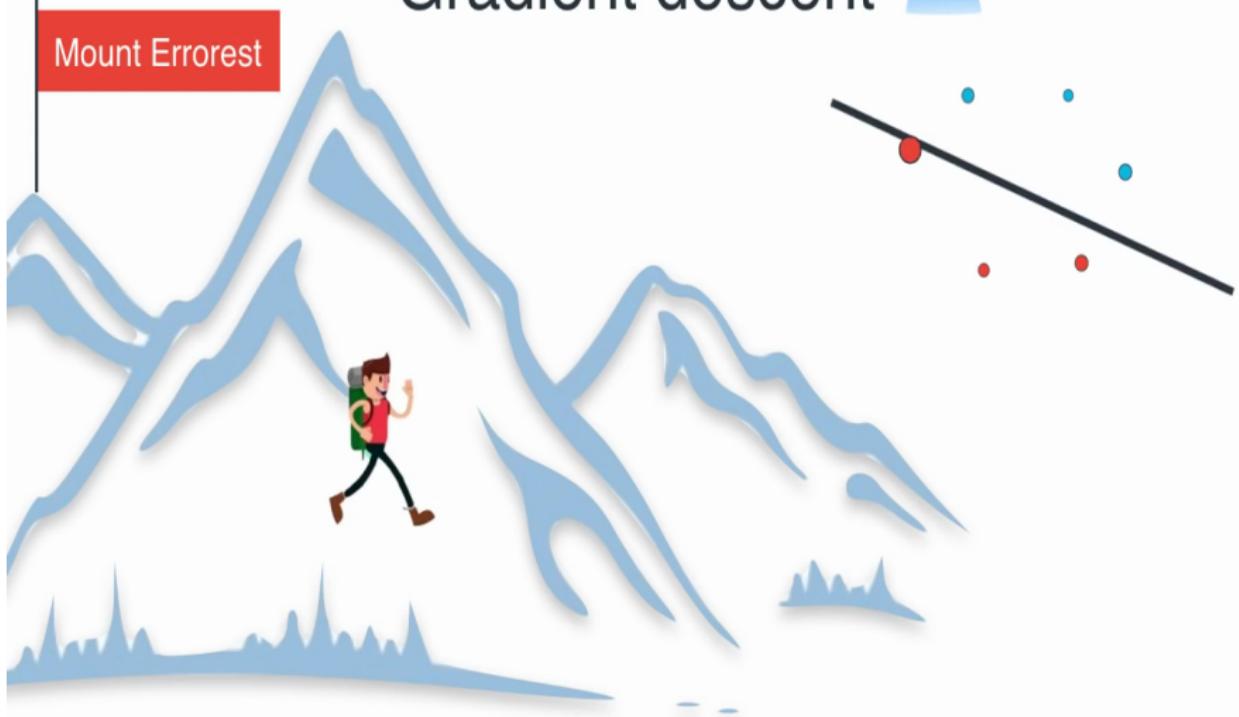
Slide

Gradient descent



Slide

Gradient descent

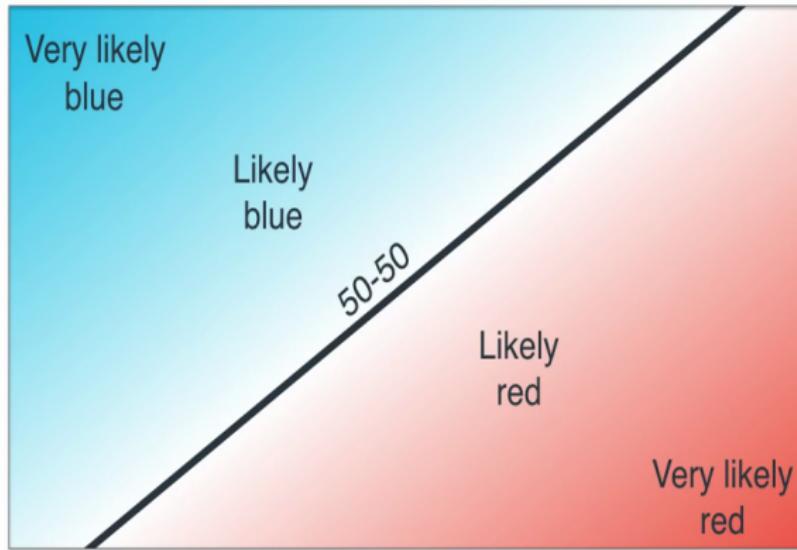


Gradient descent

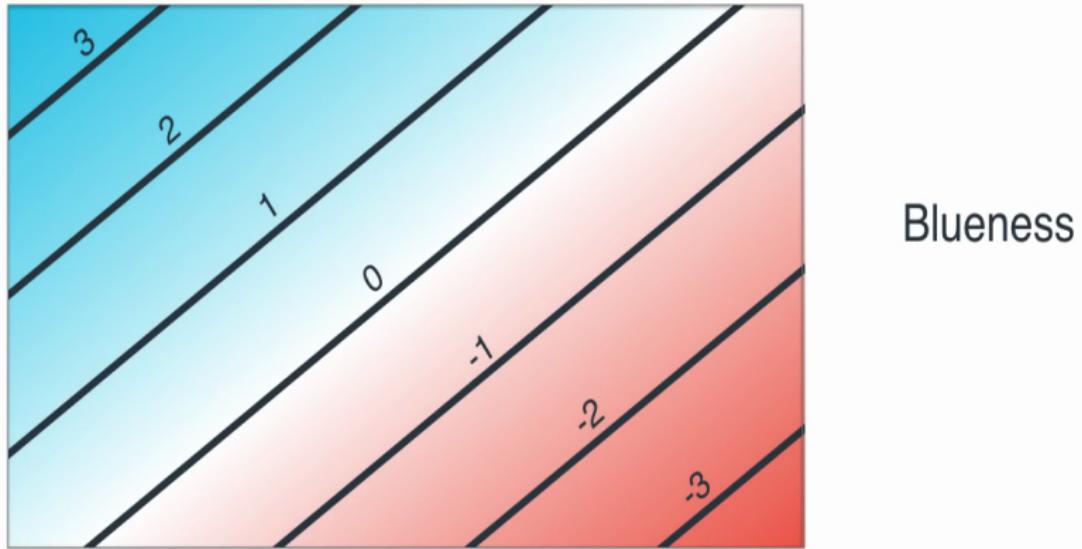


Error function?

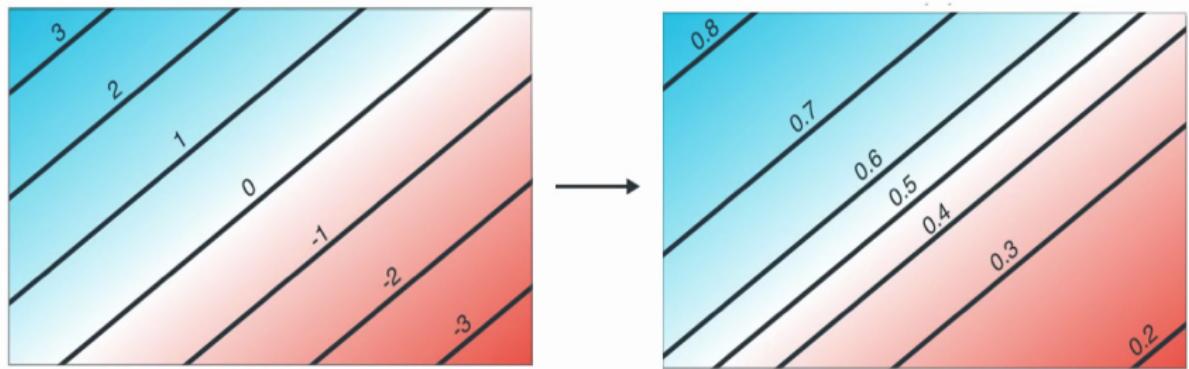
Probability



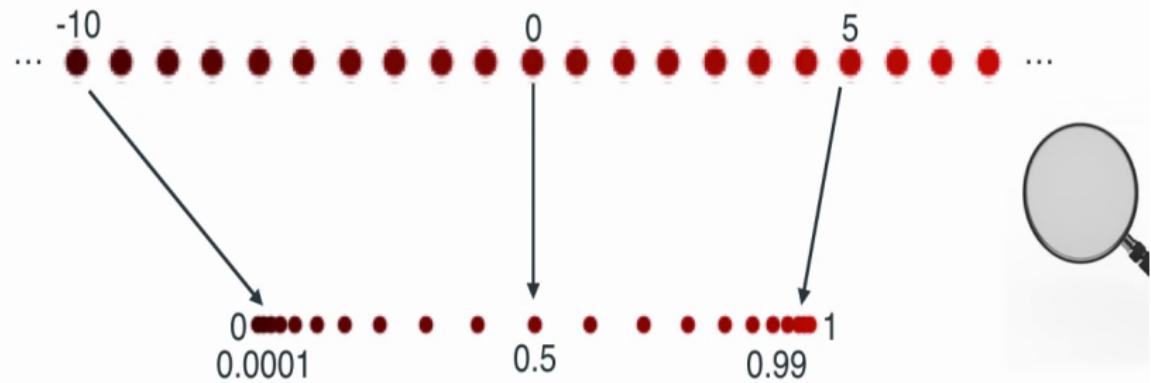
Probability



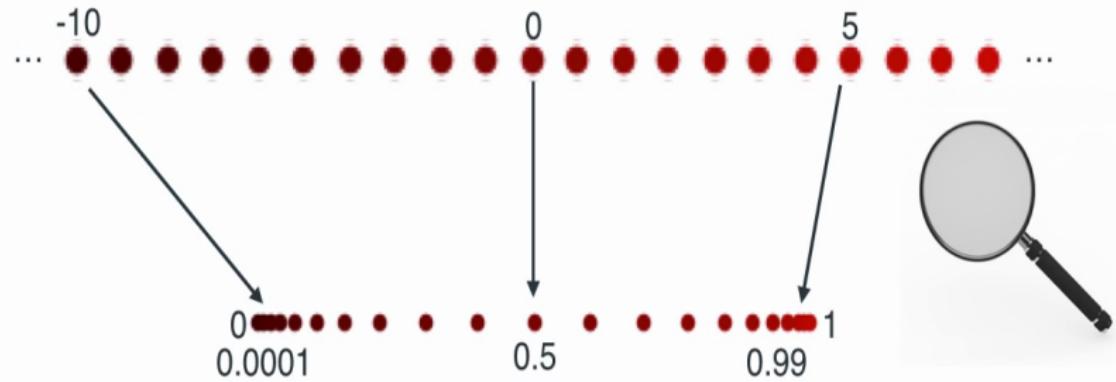
Probability



Activation function

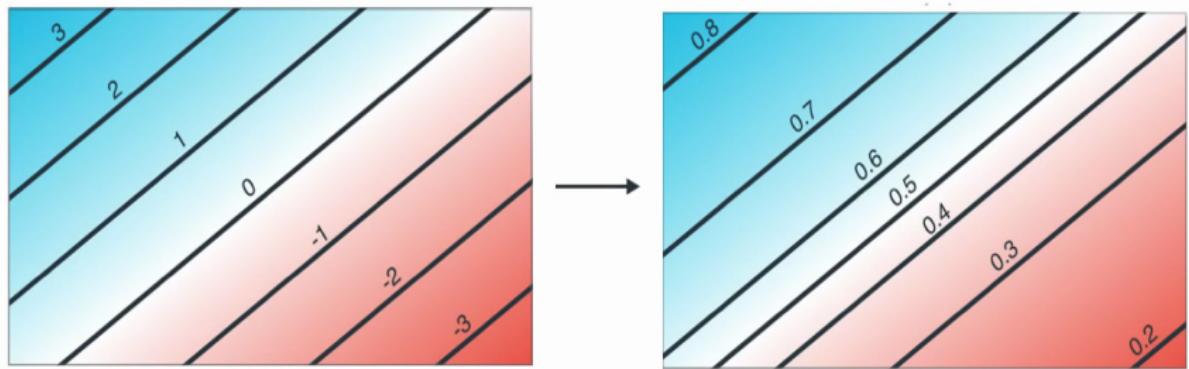


Activation function

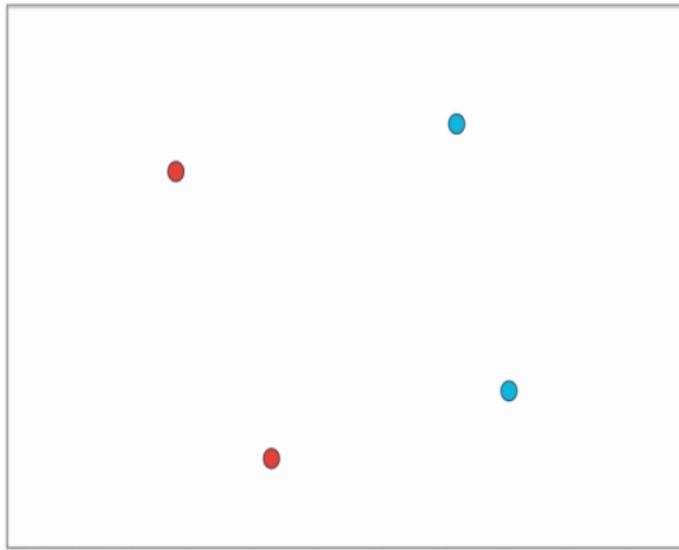


$$f(x) = \frac{1}{1 + e^{-x}}$$

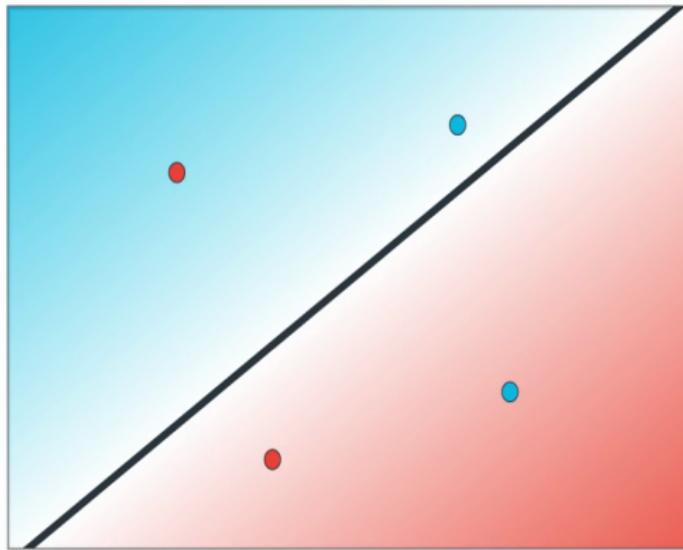
Probability



Probability

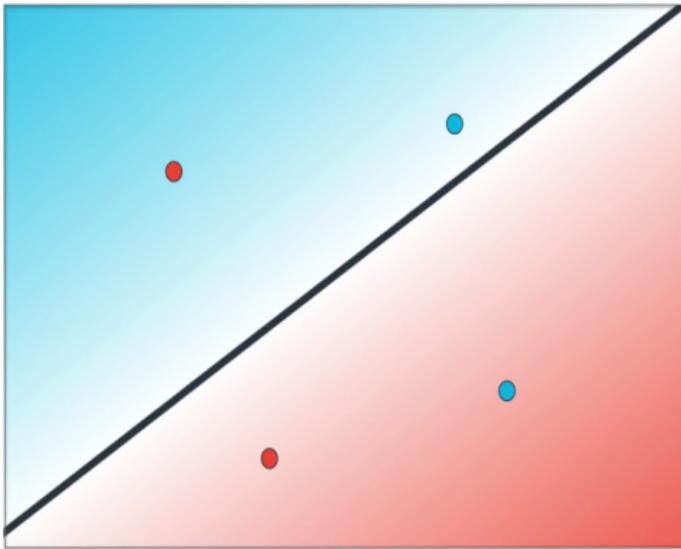


Probability



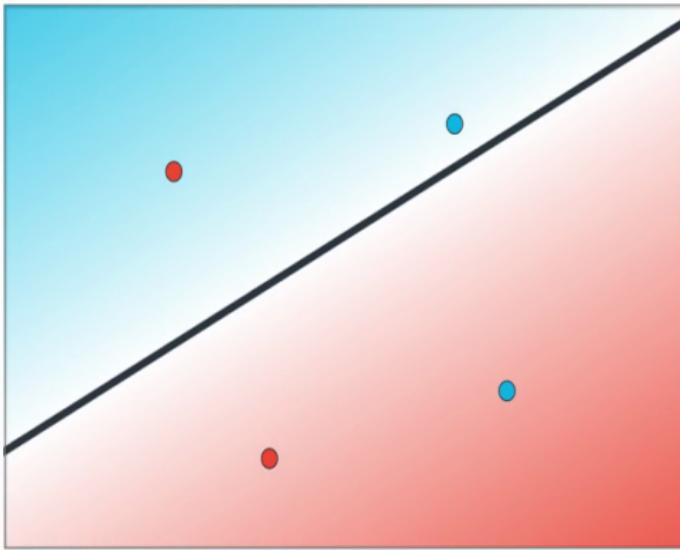
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



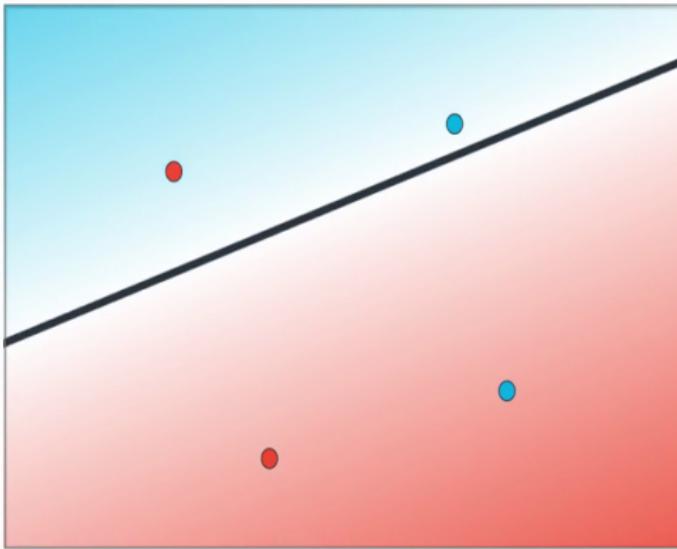
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



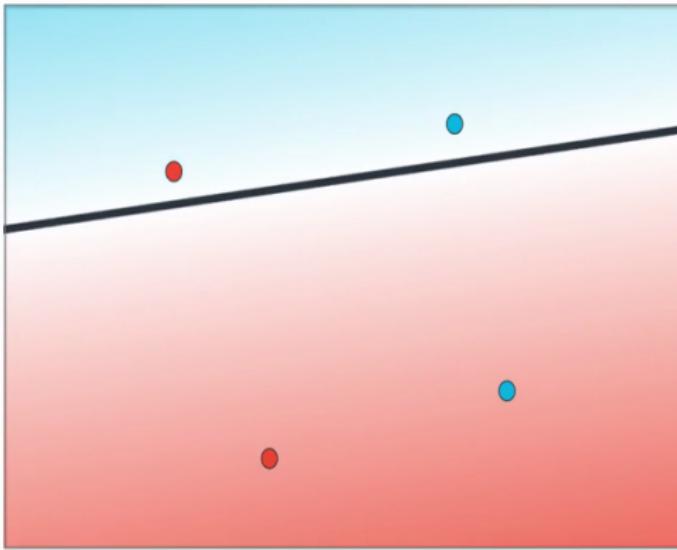
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



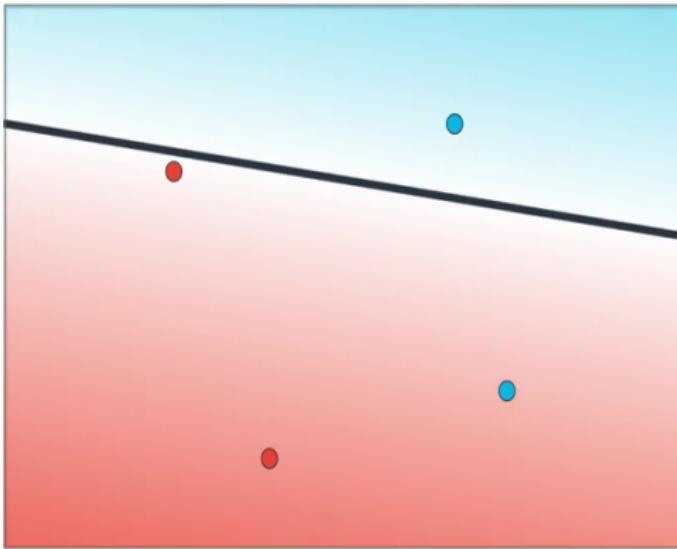
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



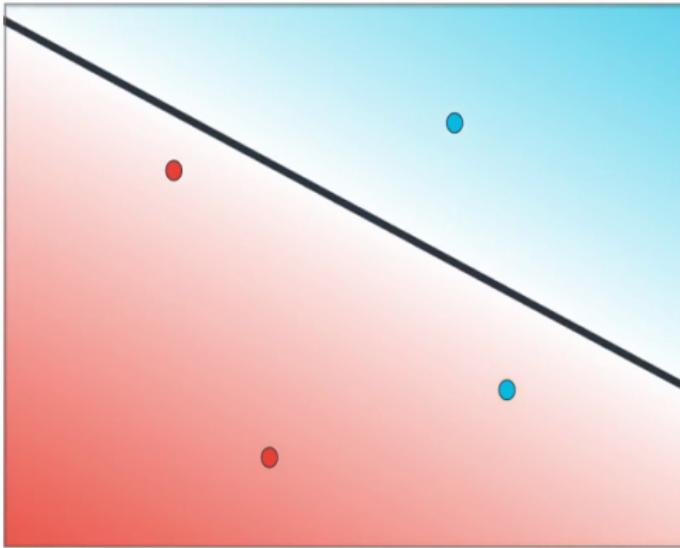
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



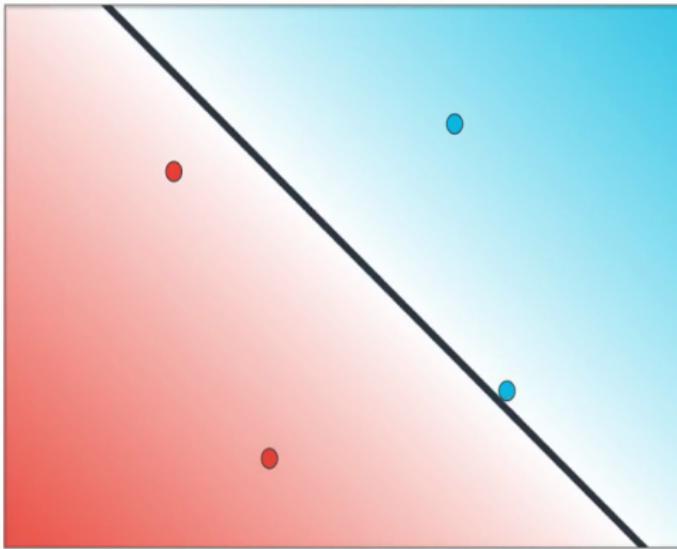
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



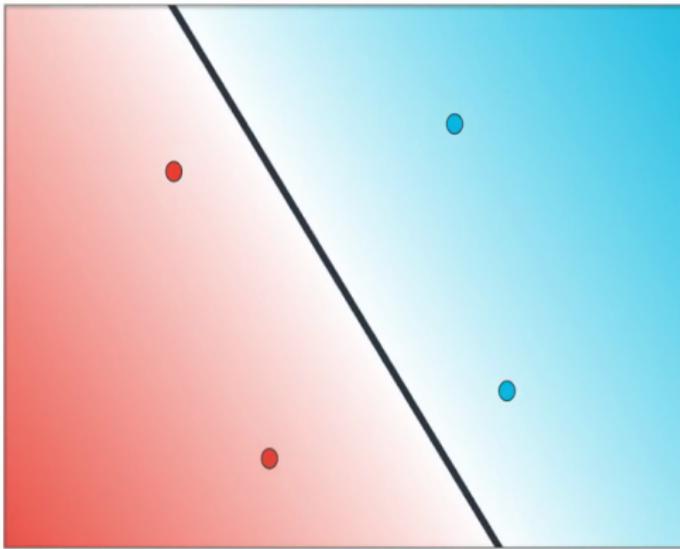
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



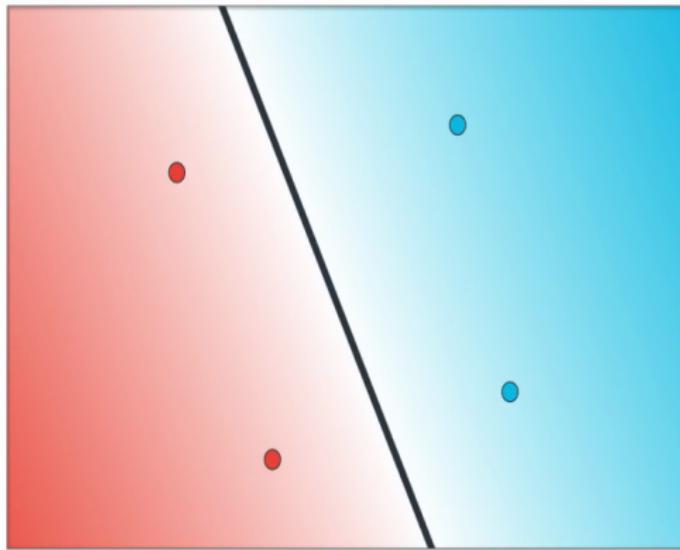
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



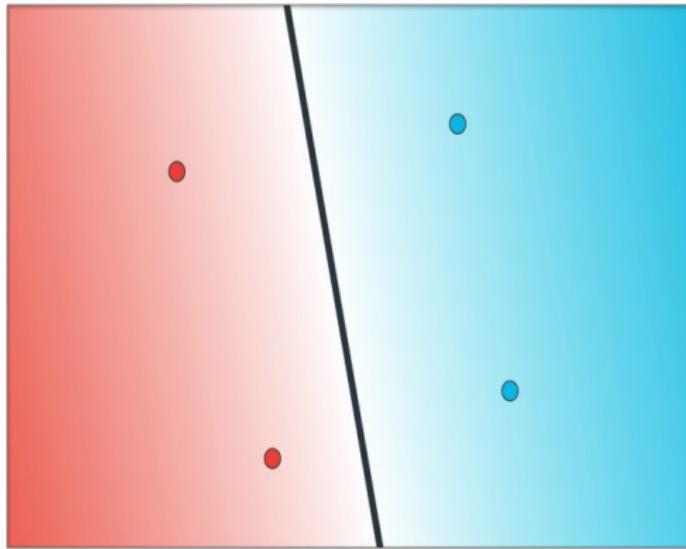
$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability



$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

Probability

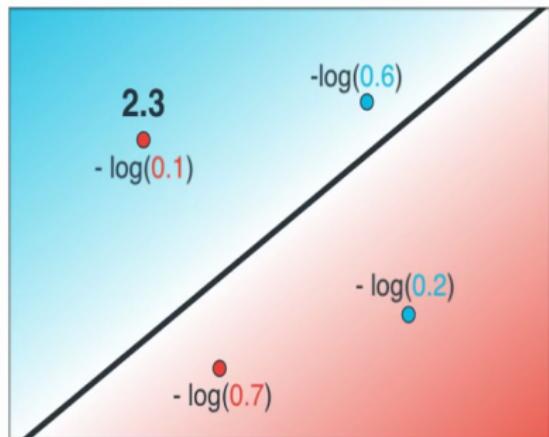


$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

$$0.7 * 0.9 * 0.8 * 0.6 = 0.3024$$

Maximum Likelihood

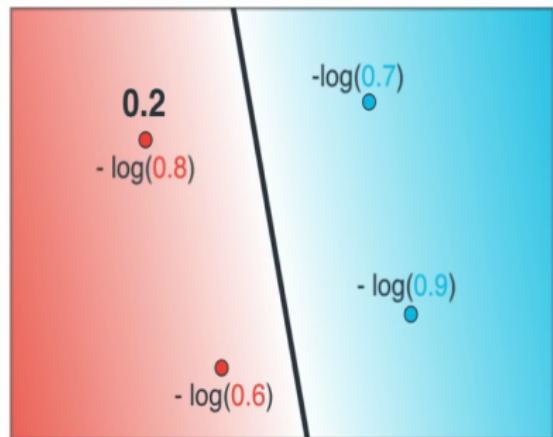
Error function



$$0.6 * 0.2 * 0.1 * 0.7 = 0.0084$$

$$-\log(0.6) - \log(0.2) - \log(0.1) - \log(0.7) = 4.8$$

2.3



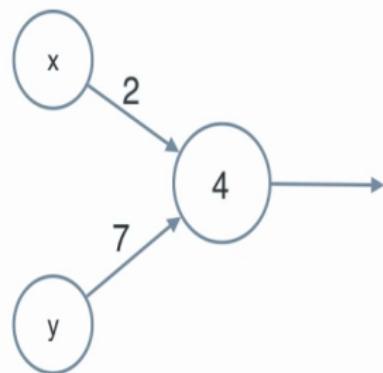
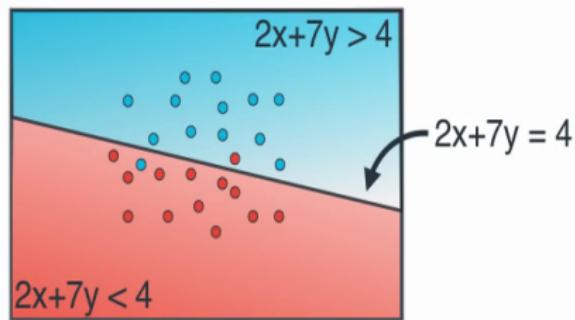
$$0.7 * 0.9 * 0.8 * 0.6 = 0.3024$$

$$-\log(0.7) - \log(0.9) - \log(0.8) - \log(0.6) = 1.2$$

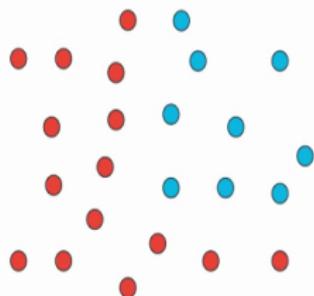
0.2



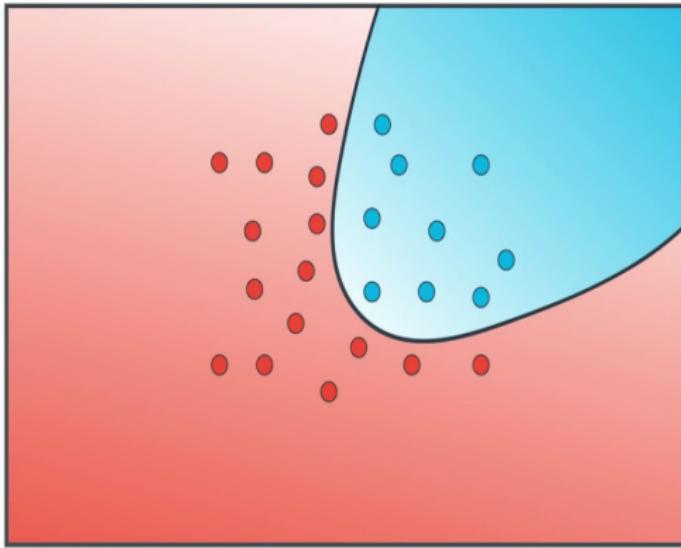
Neuron



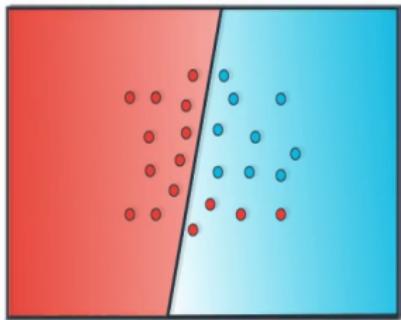
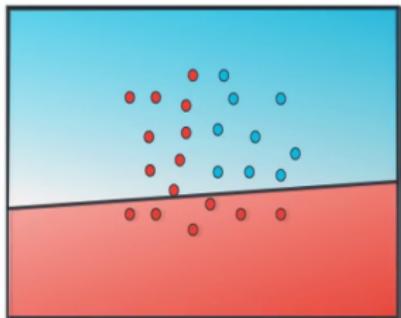
Non-linear regions



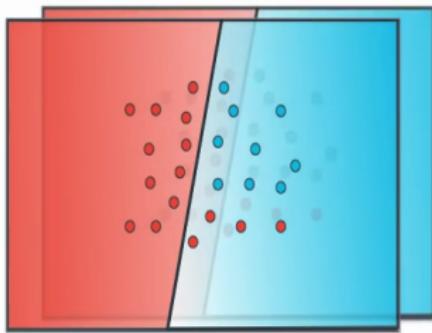
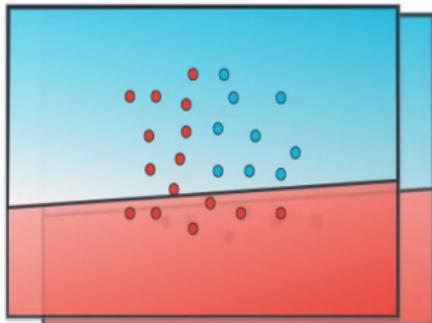
Non-linear regions



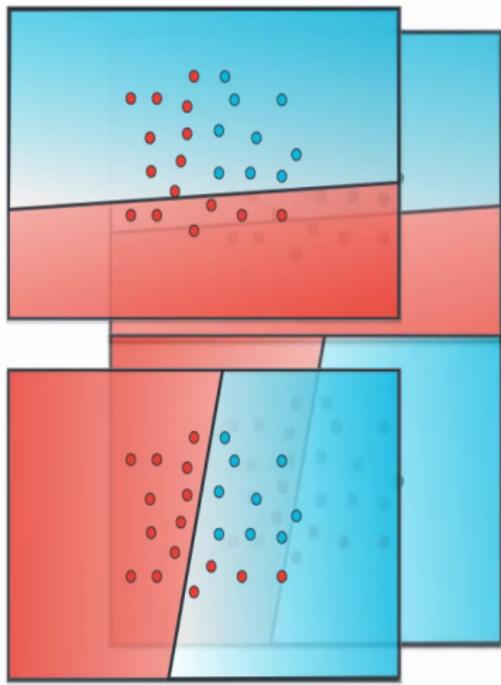
Combining Regions



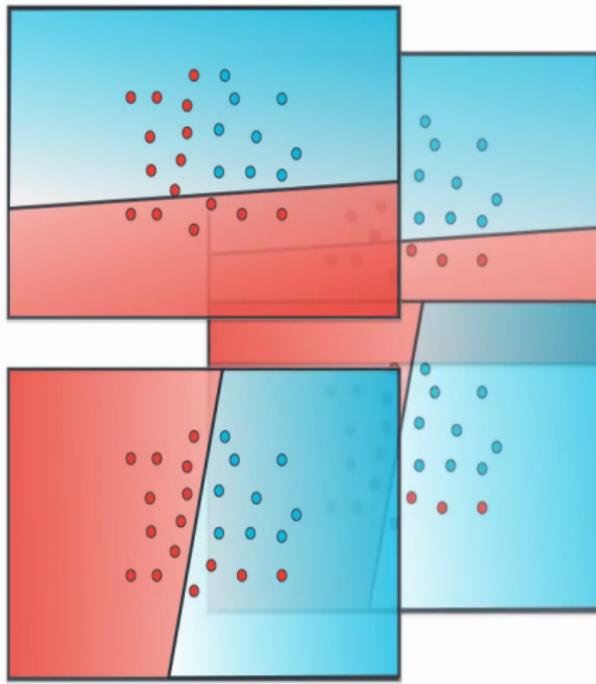
Combining Regions



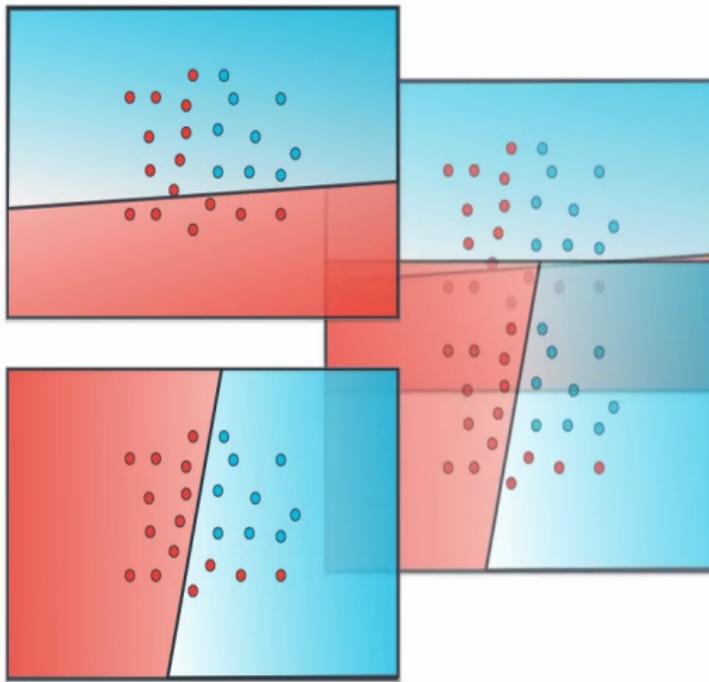
Combining Regions



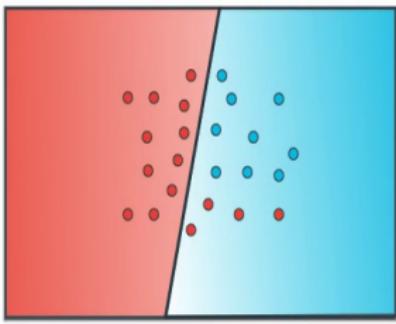
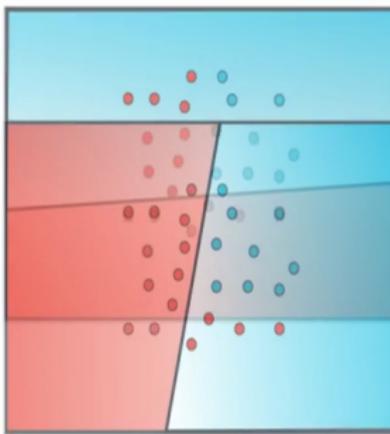
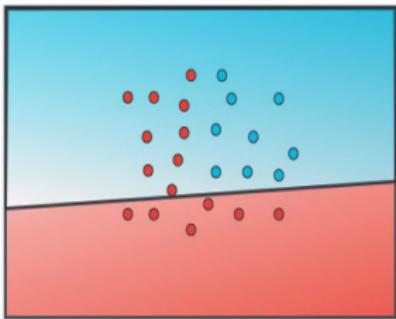
Combining Regions



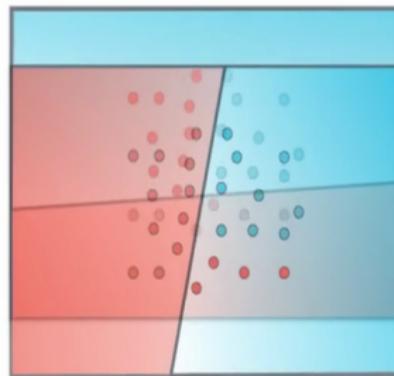
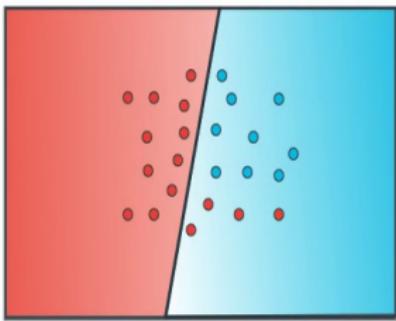
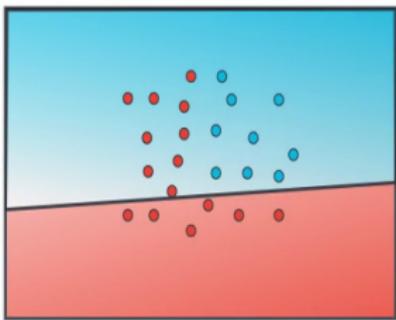
Combining Regions



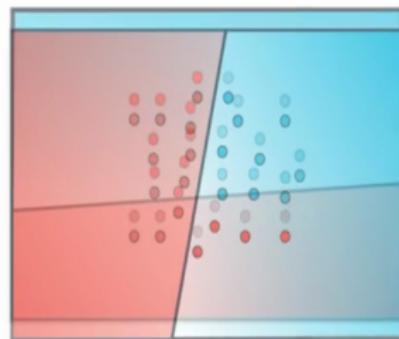
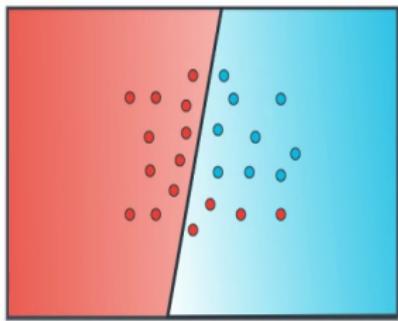
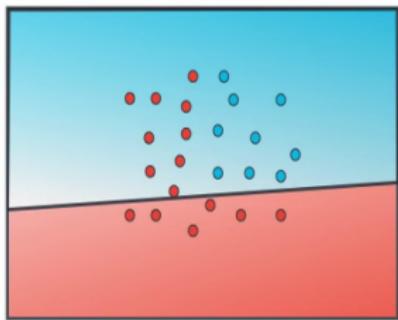
Combining Regions



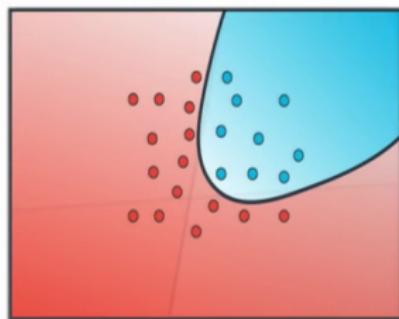
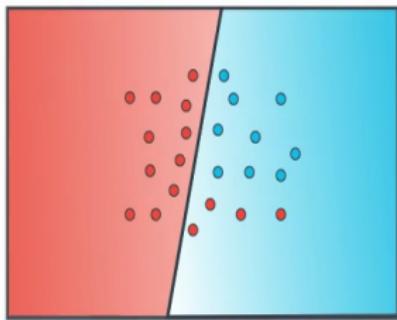
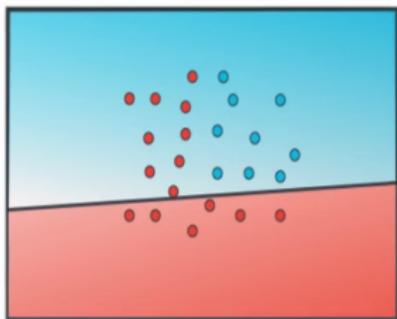
Combining Regions



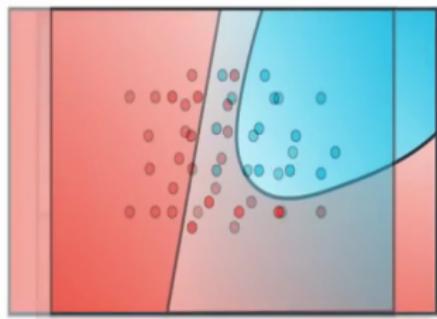
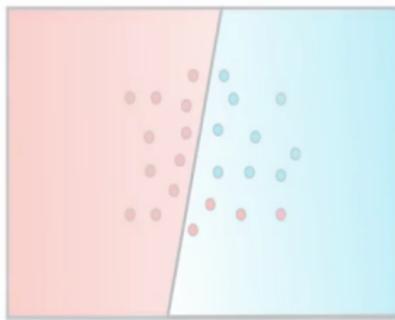
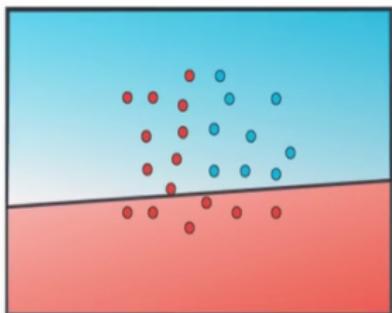
Combining Regions



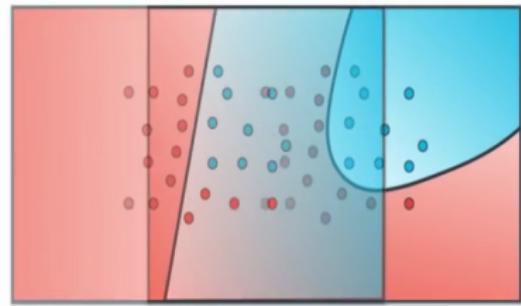
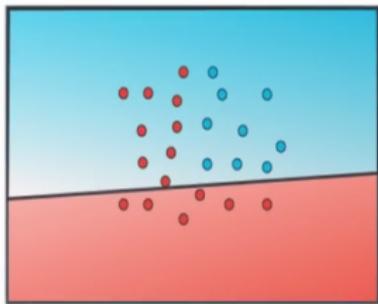
Combining Regions



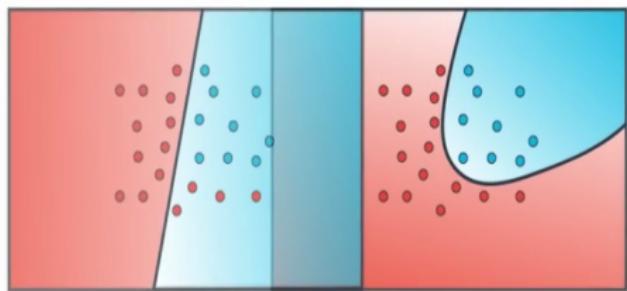
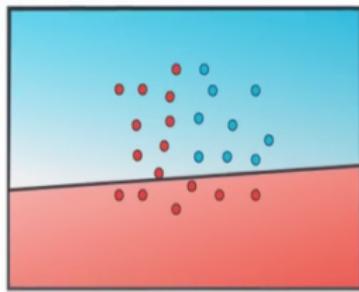
Combining Regions



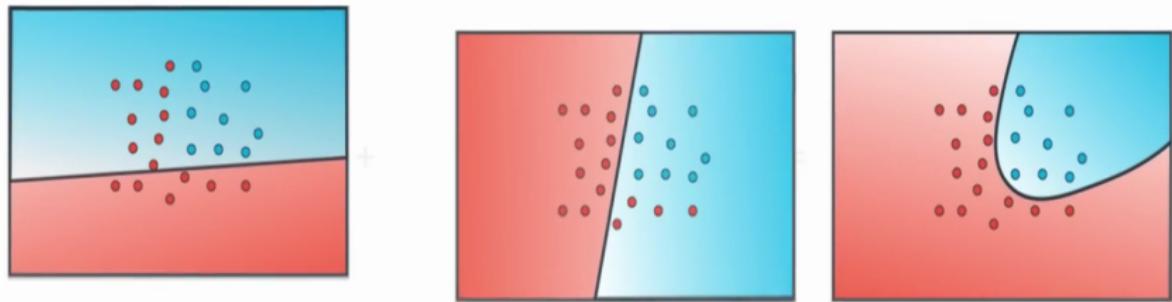
Combining Regions



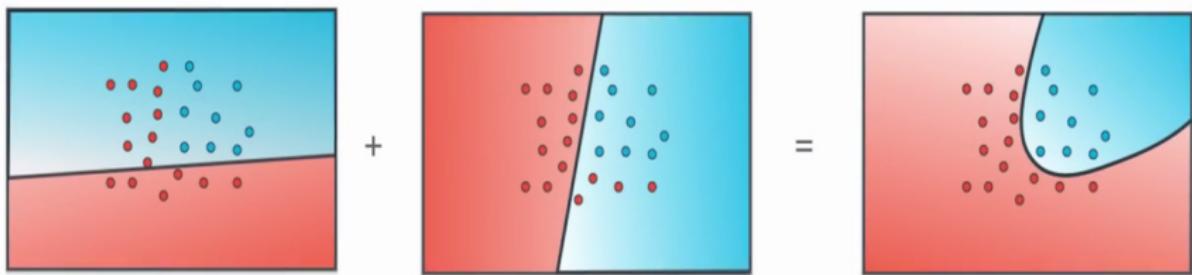
Combining Regions



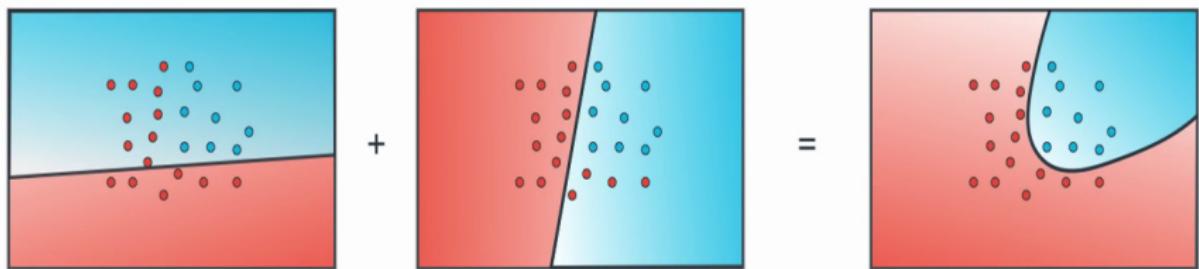
Combining Regions



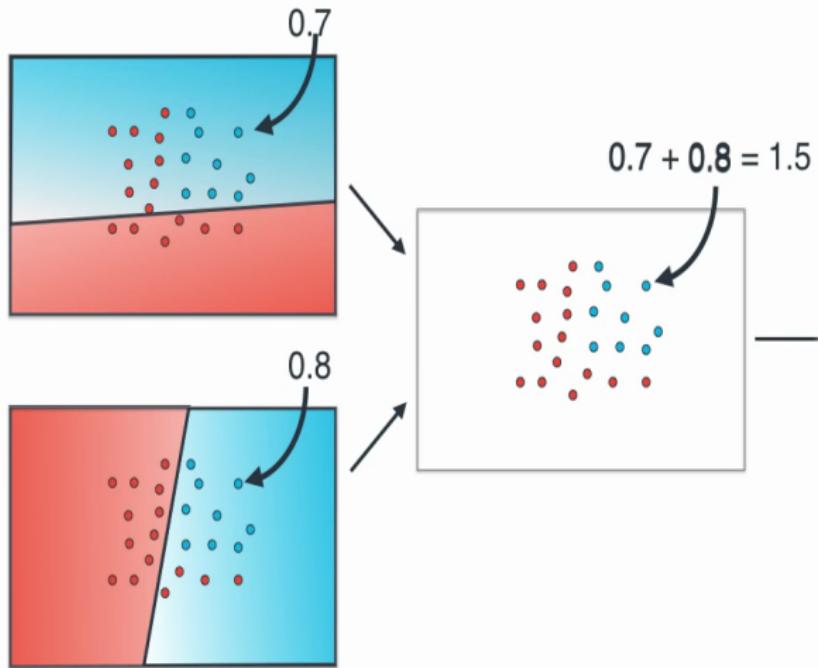
Combining Regions



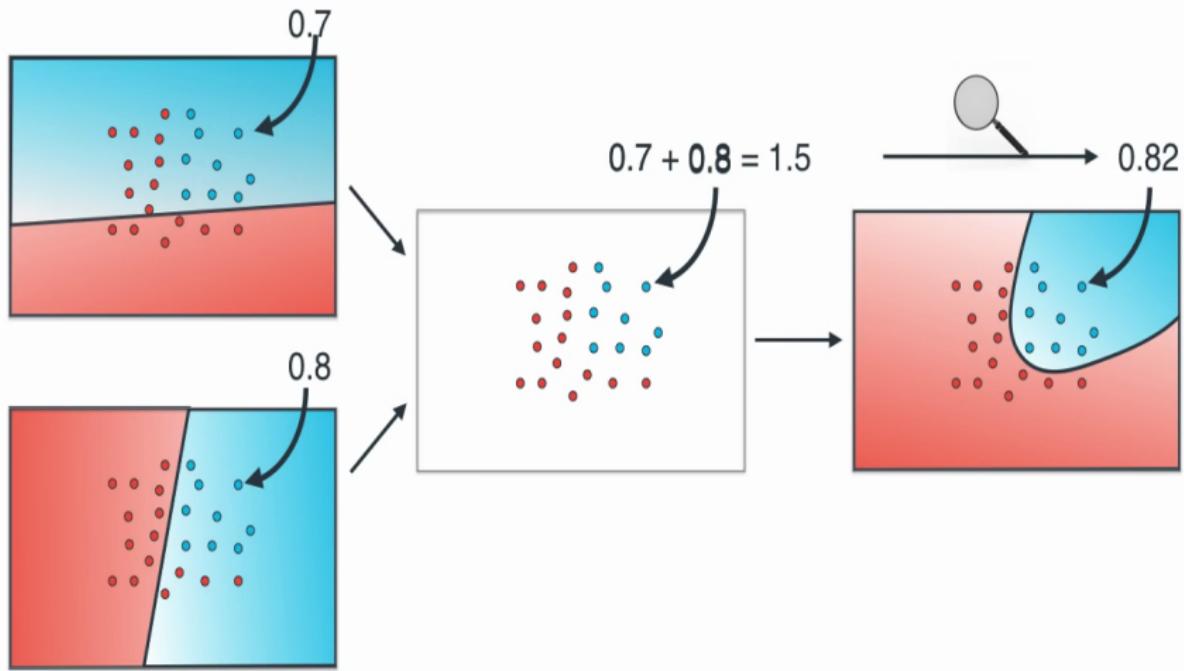
Combining Regions



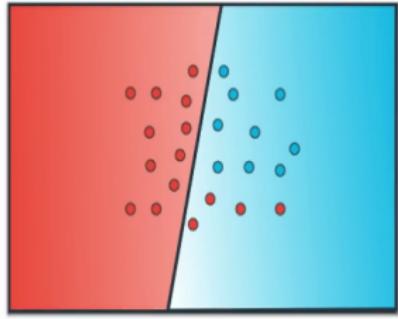
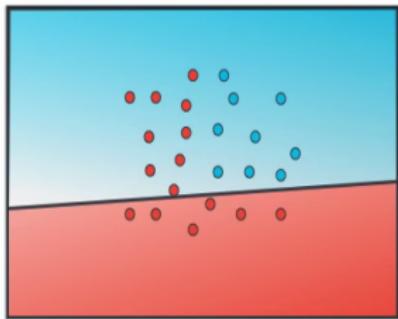
Neural Network



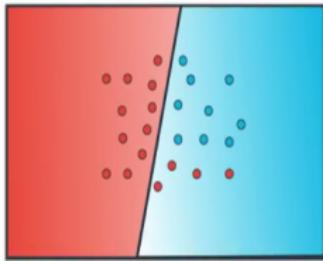
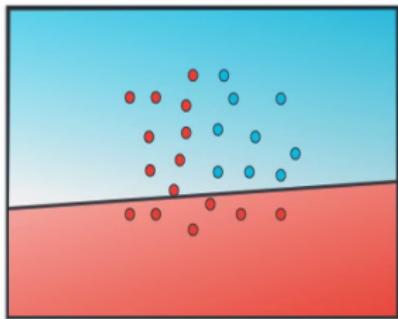
Neural Network



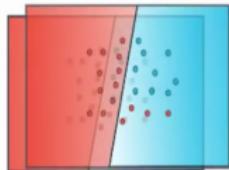
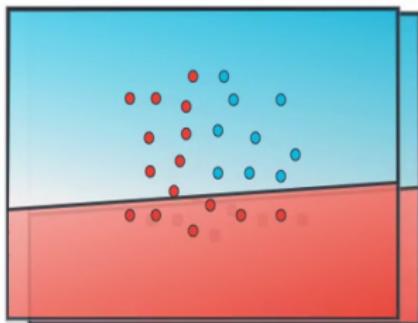
Combining Regions



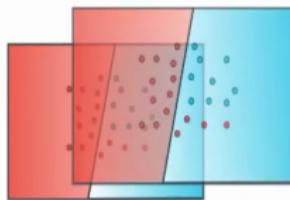
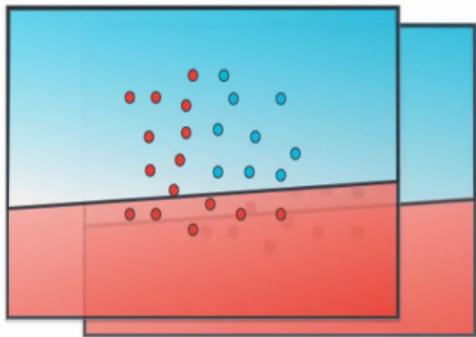
Combining Regions



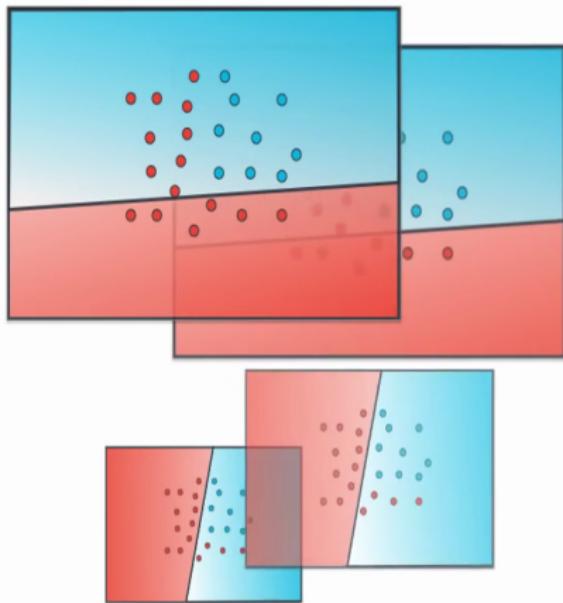
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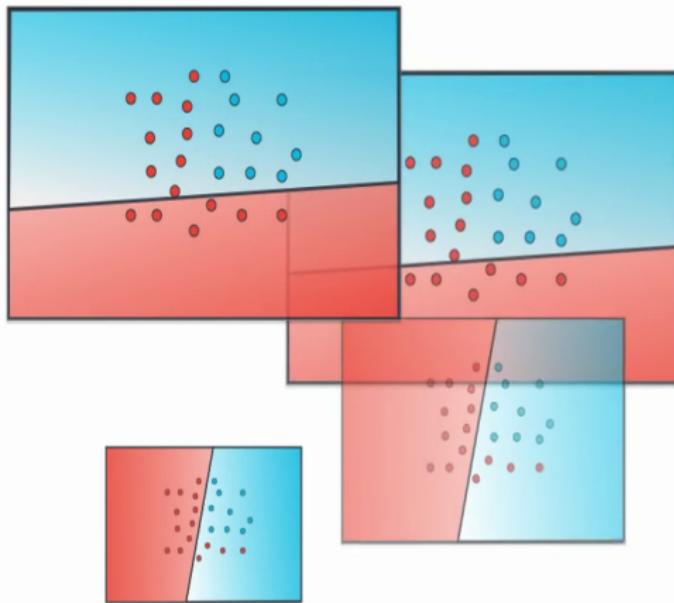
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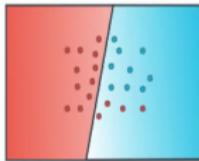
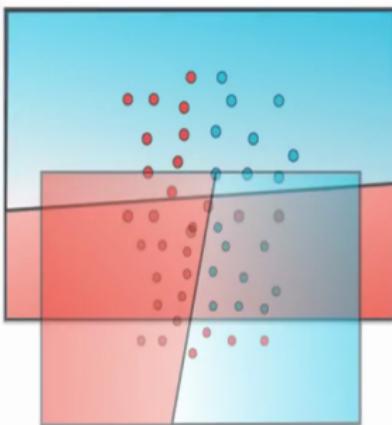
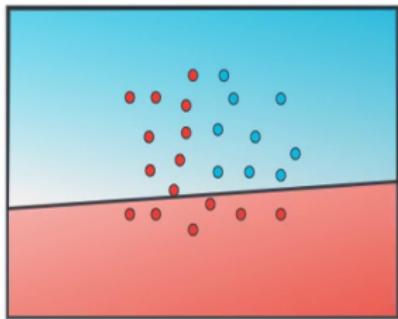
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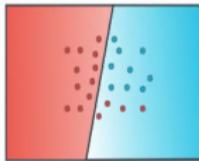
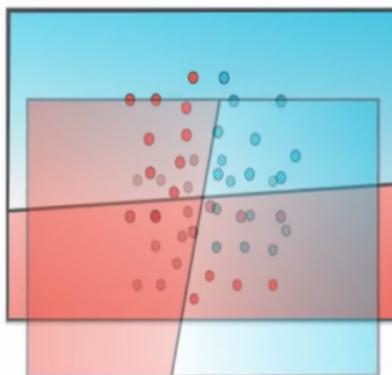
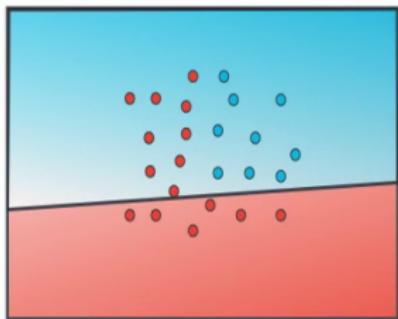
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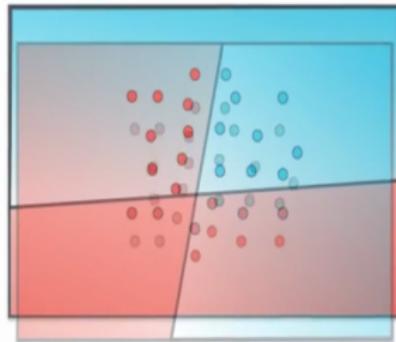
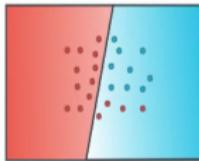
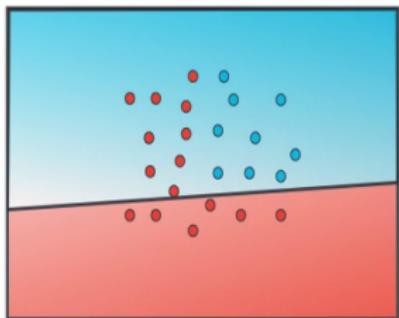
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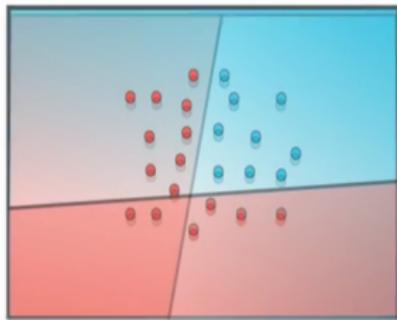
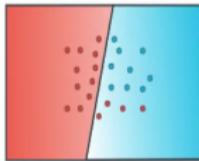
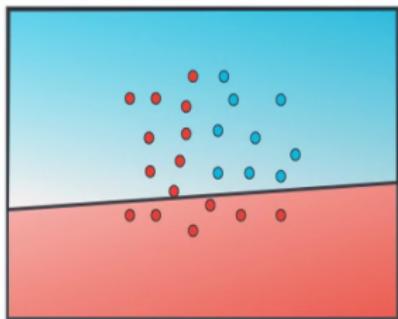
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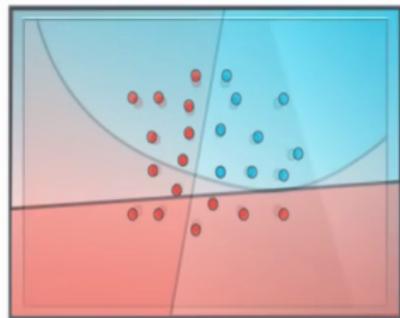
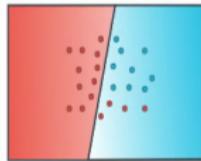
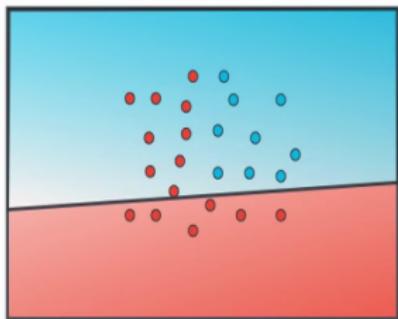
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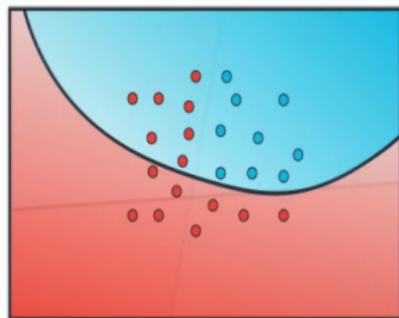
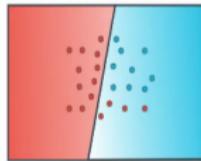
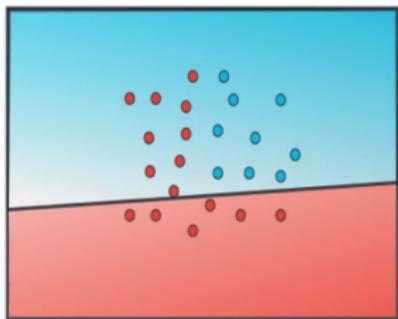
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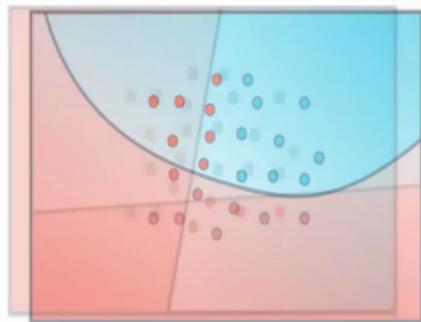
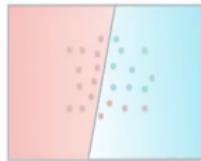
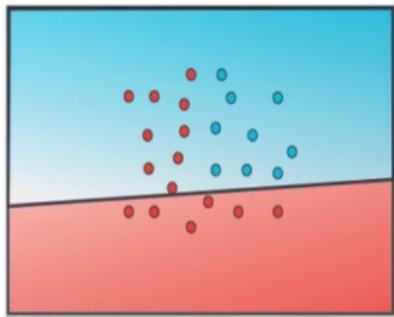
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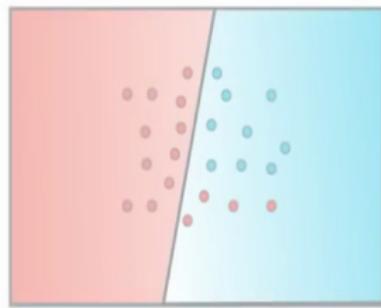
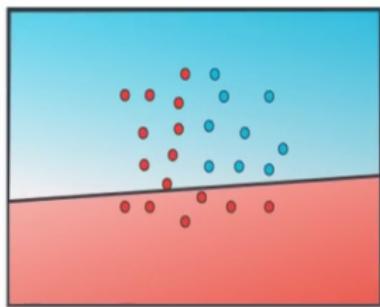
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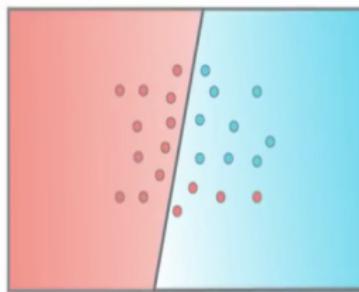
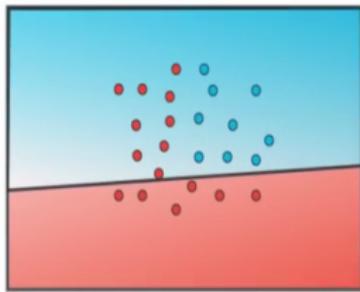
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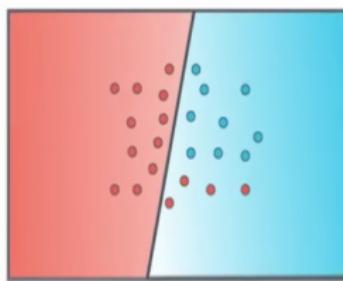
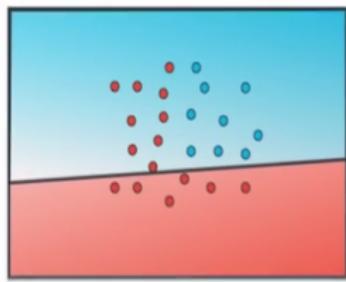
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Combining Regions

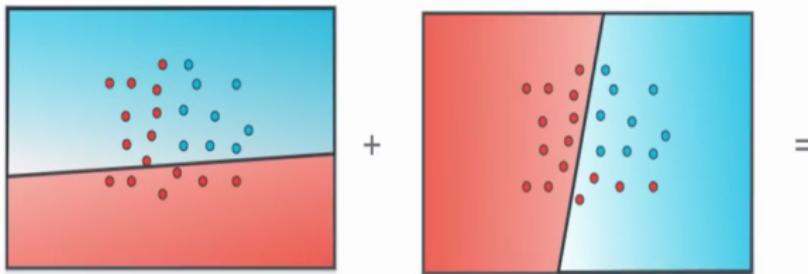


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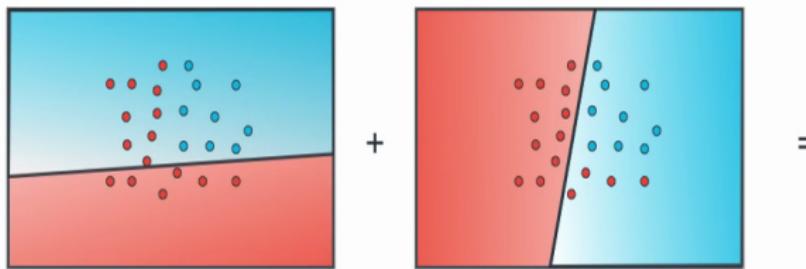
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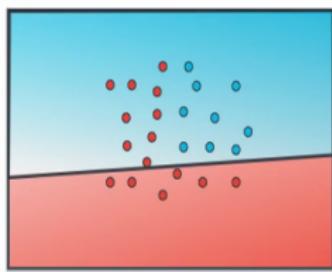
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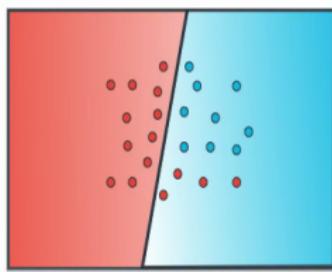


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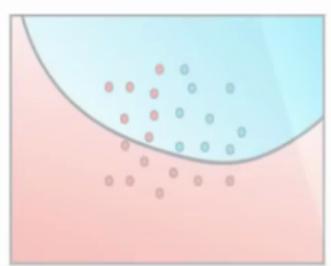
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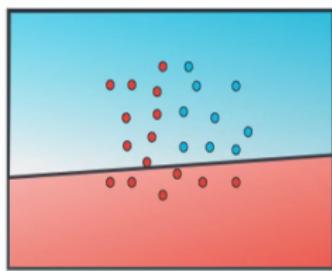


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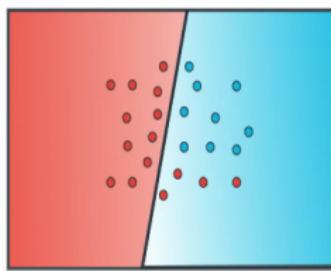


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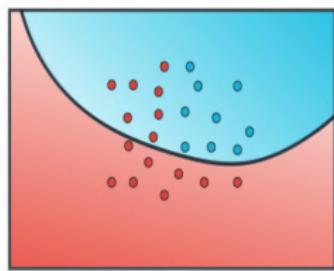
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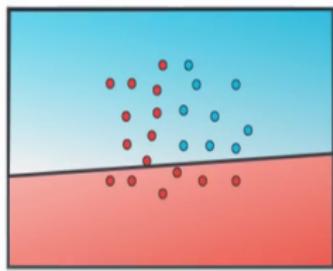


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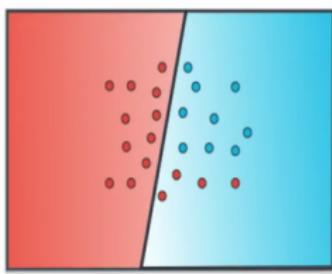


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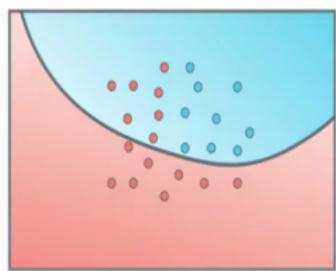
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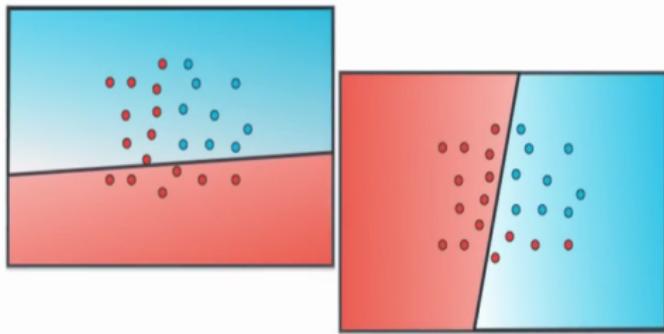
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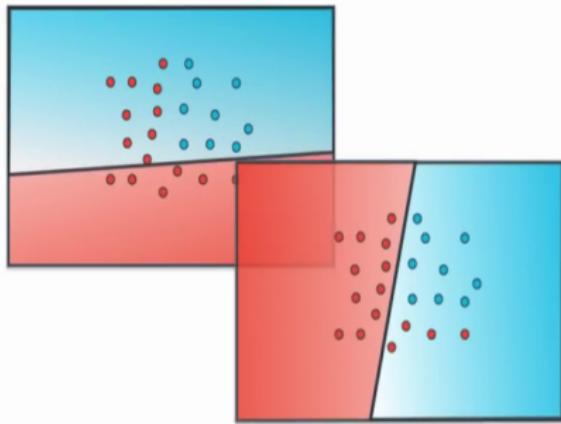
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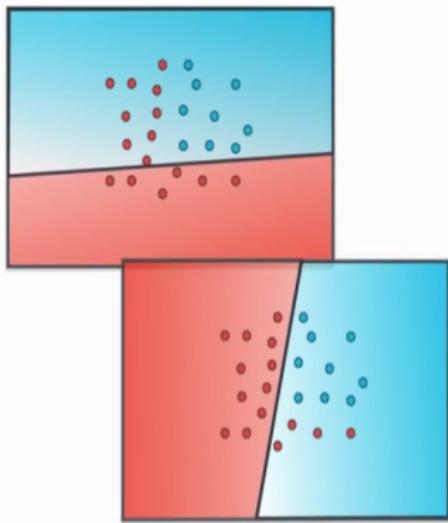
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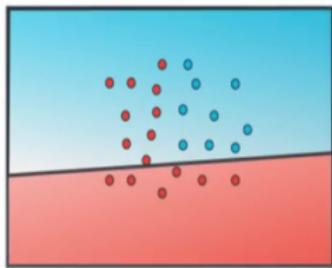
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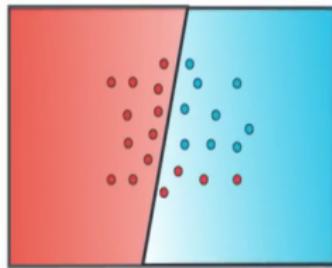


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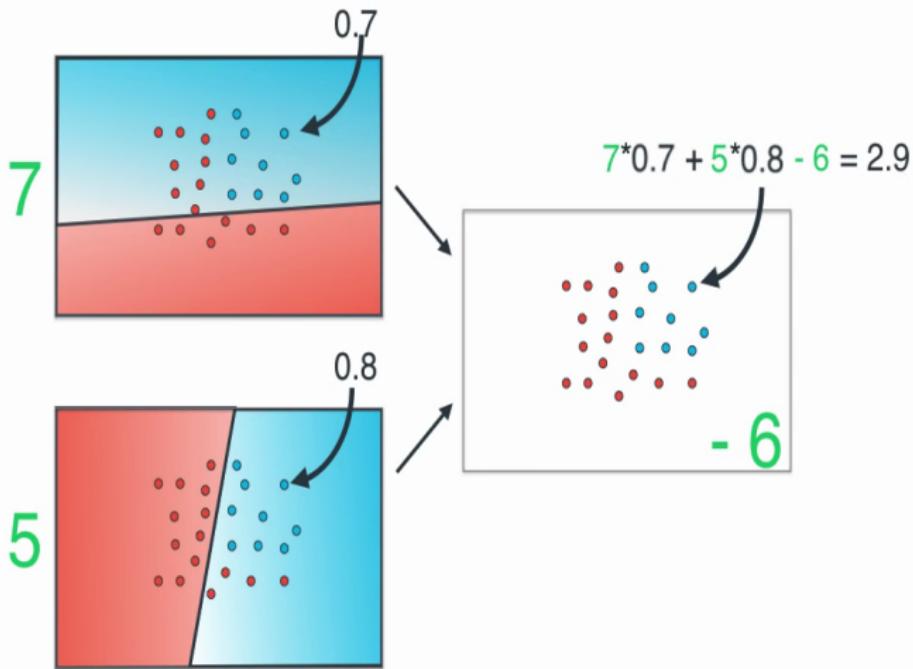
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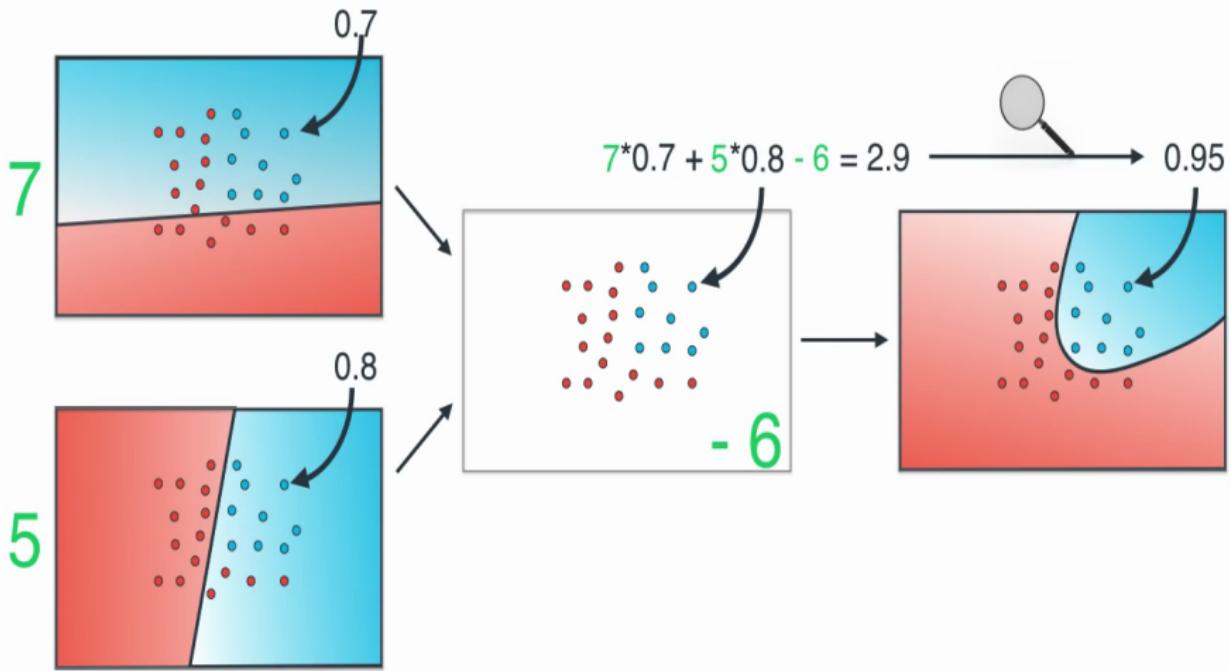
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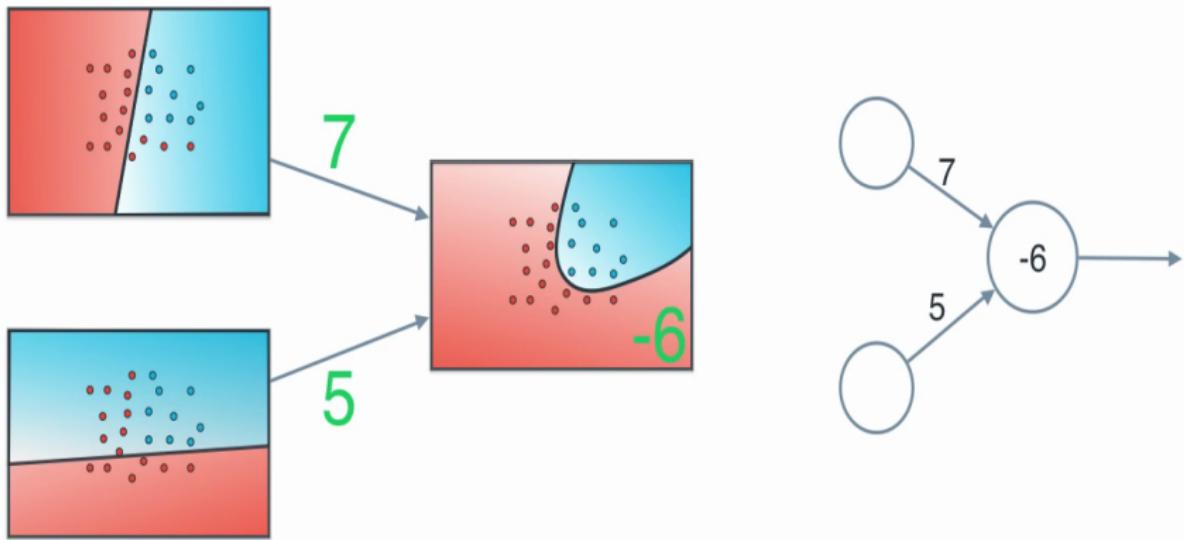
Neural Network



Neural Network

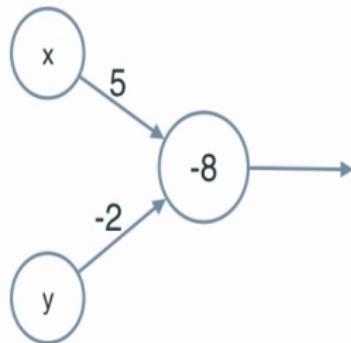
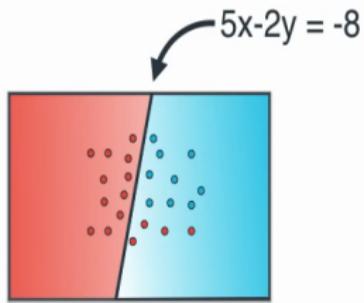


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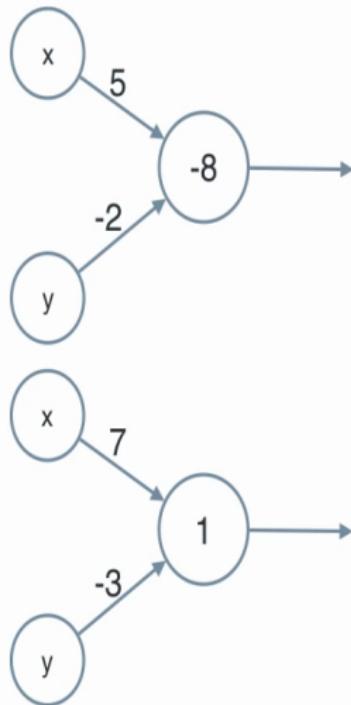
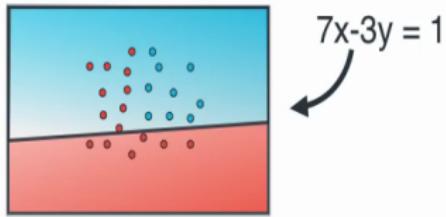
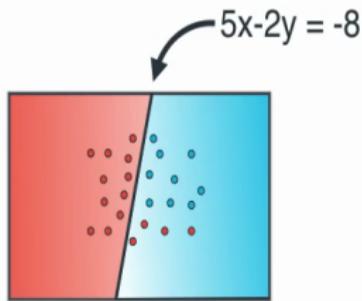


Neural Network

Neural Network

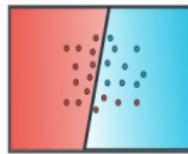
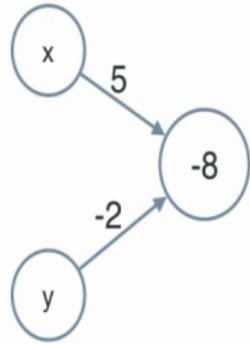


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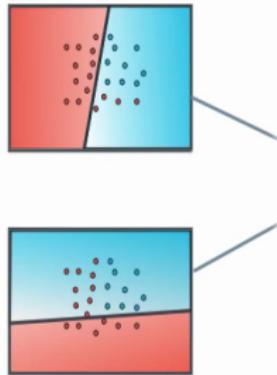
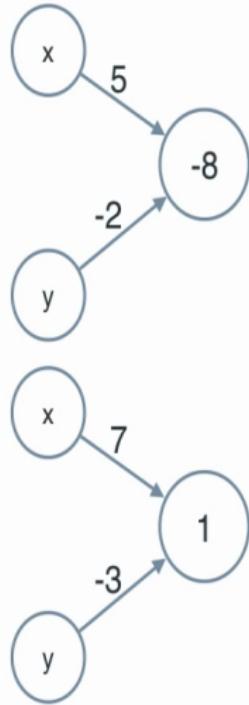


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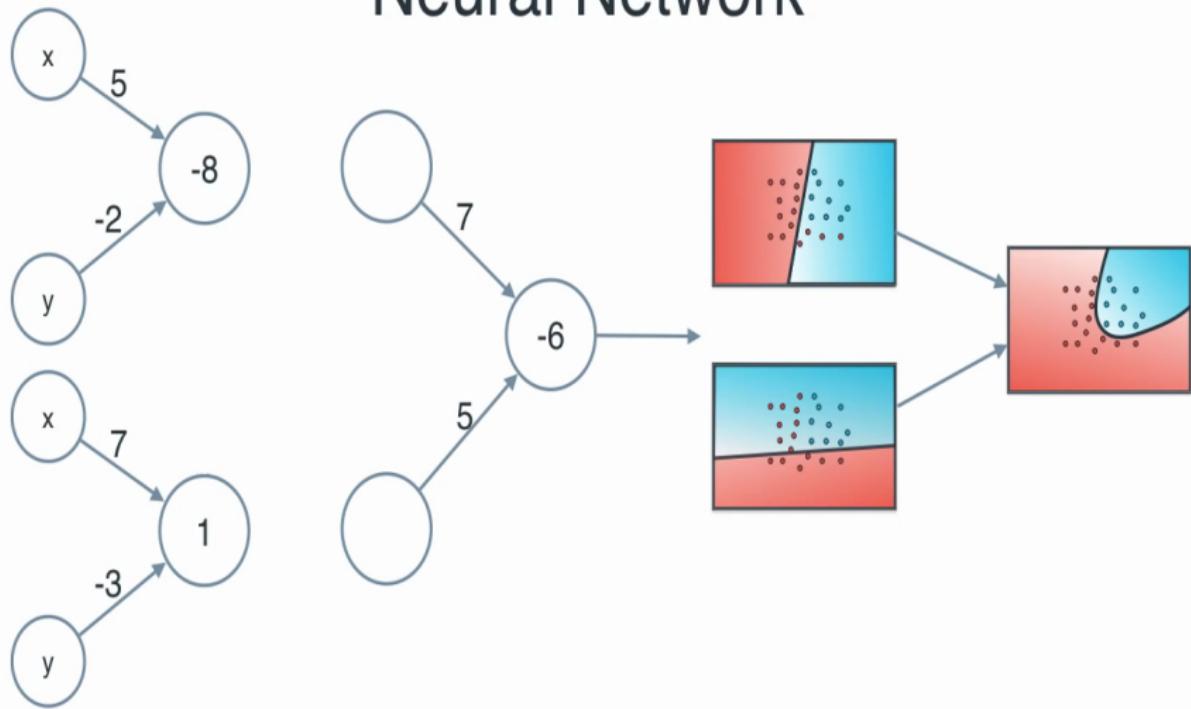
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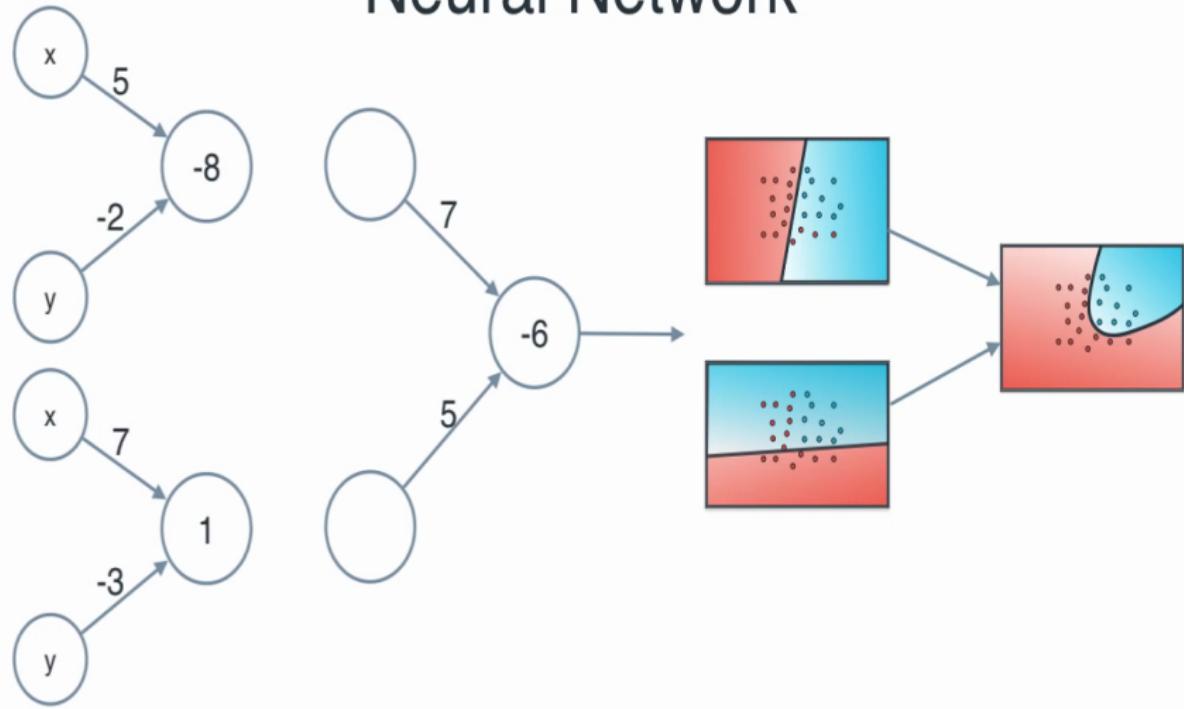
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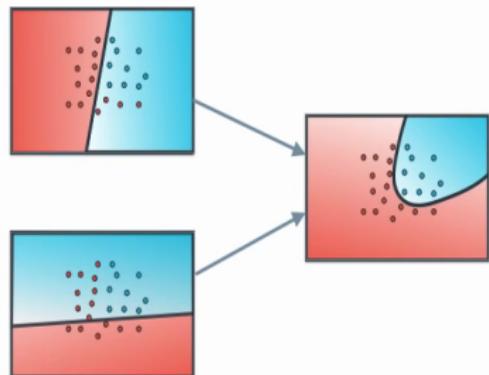
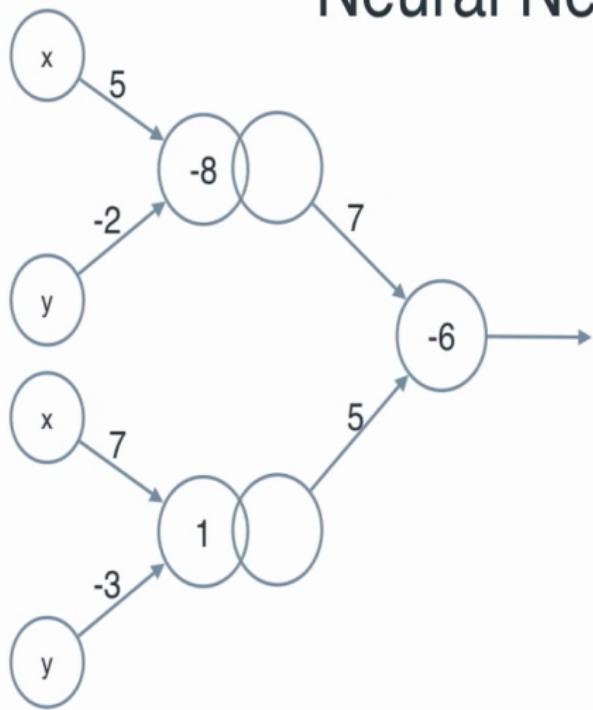
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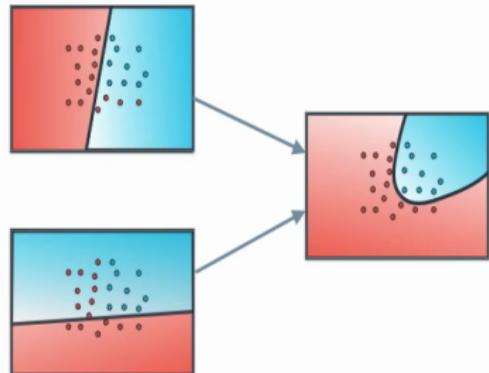
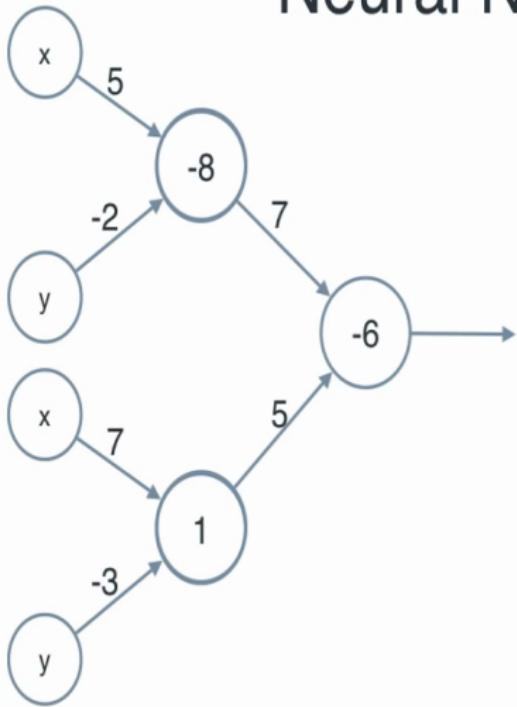
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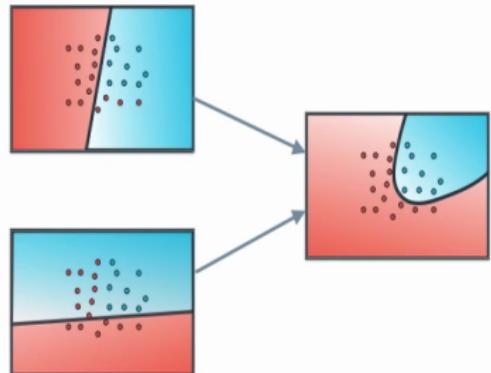
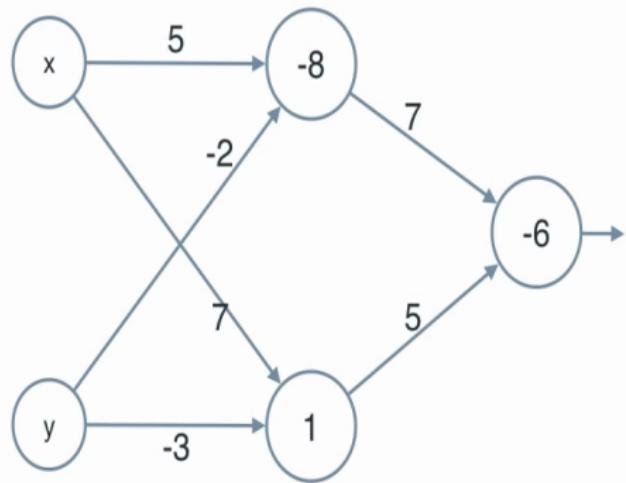
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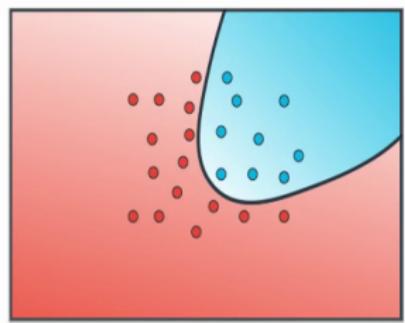
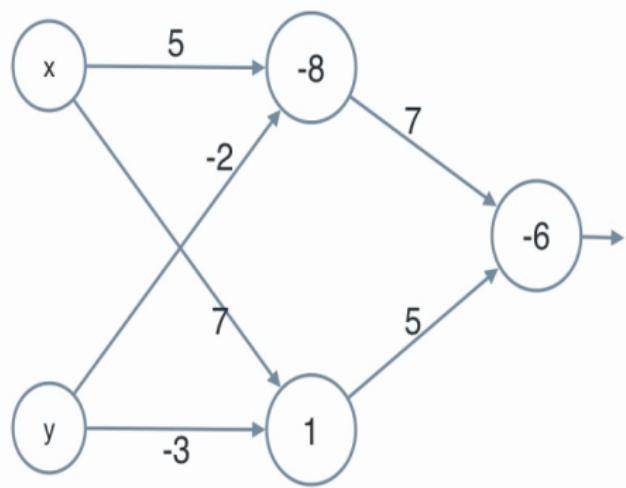
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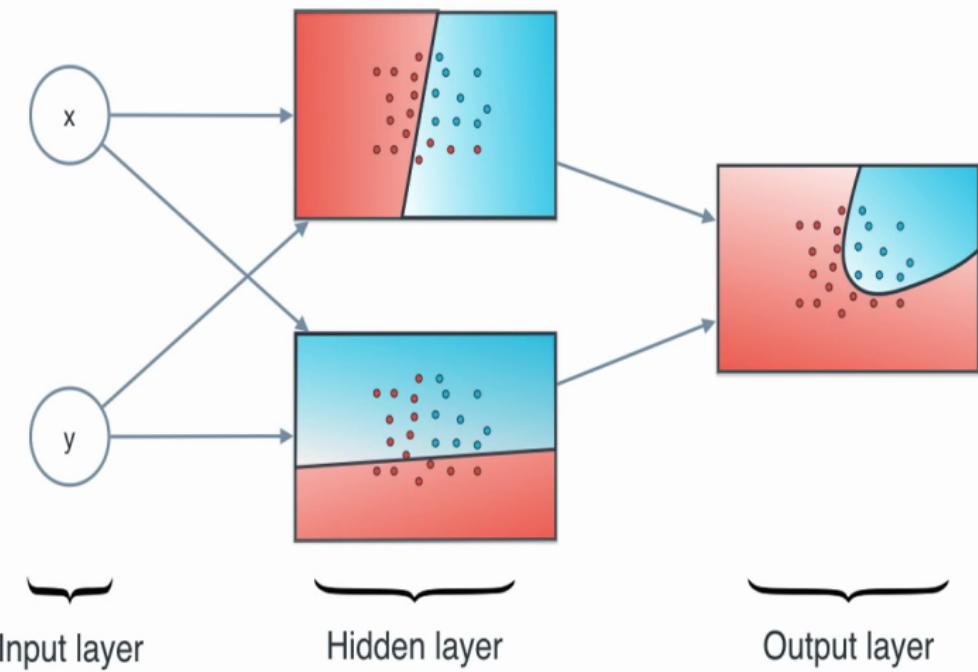
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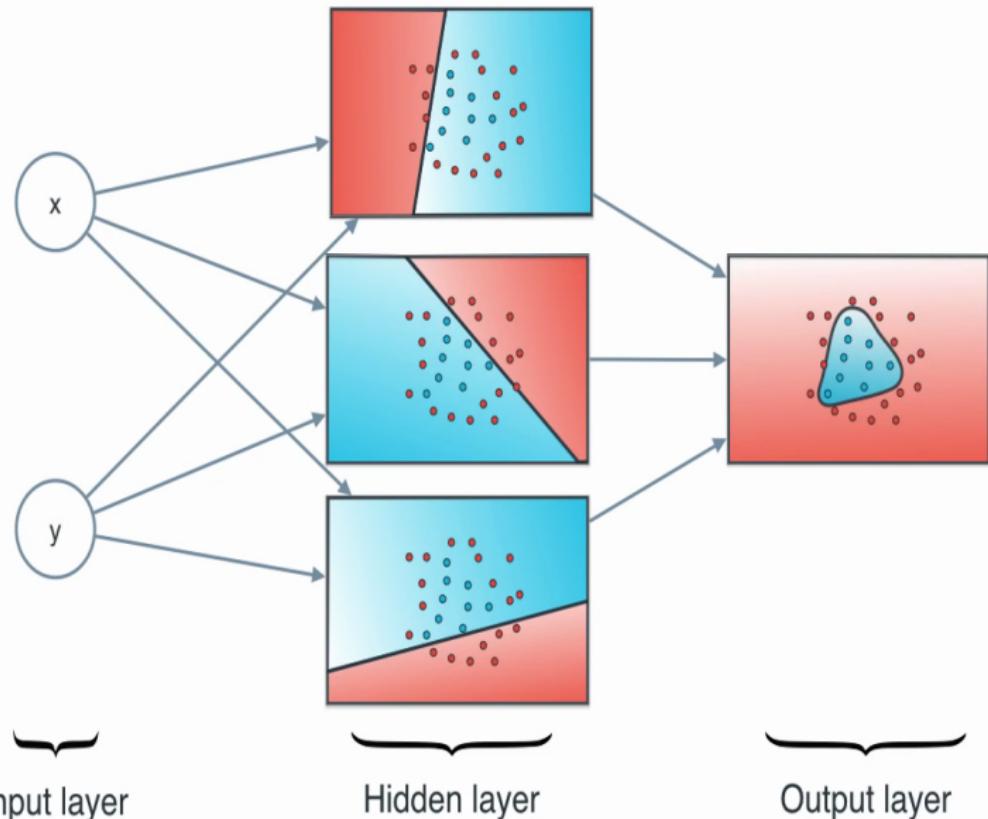
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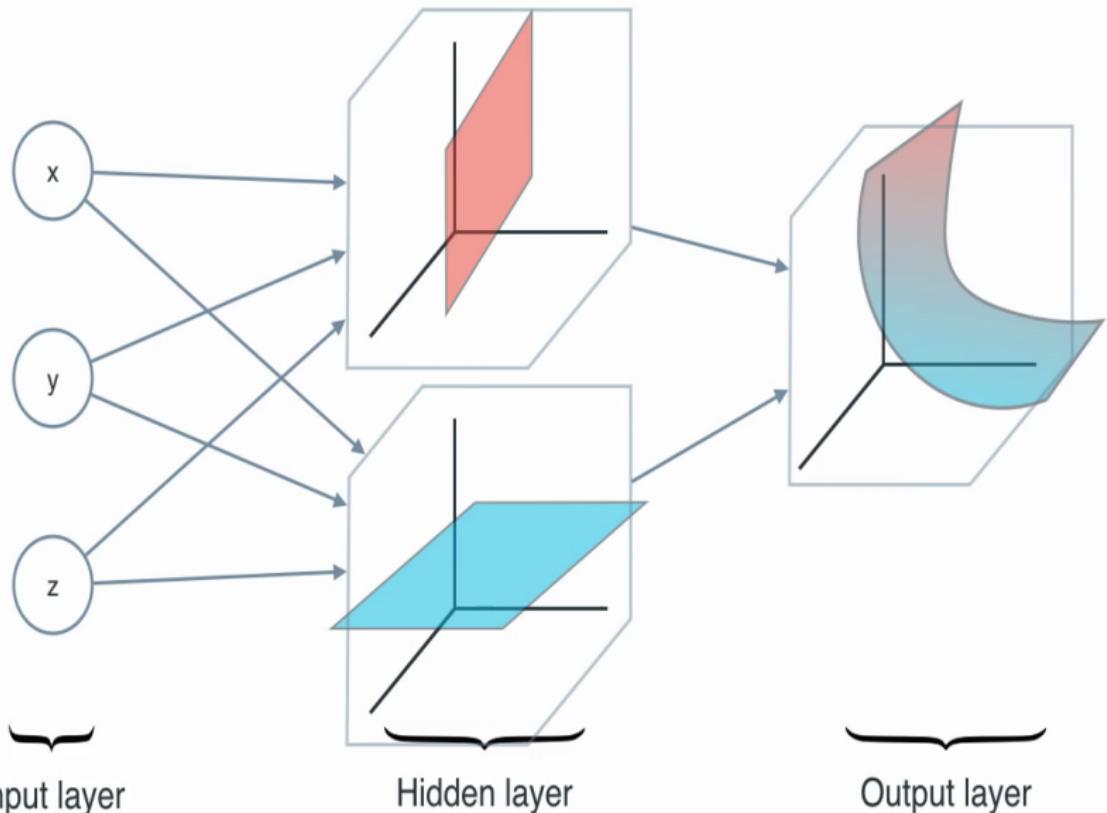
Neural Network



Slide



Slide



Input layer

Hidden layer

Output layer

Deep Neural Network

