



人工智能——人工神经网络I

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Perceptron Learning Algorithm

- 对连续型属性做统一处理。
- 离散型属性需要转化为连续随机变量。
- 对于拥有 d 个特征的 $\mathbf{x}=(x_1, x_2, \dots, x_d)$, 计算它的带权“分数”。

如果 $\sum_{k=1}^d w_k x_k > threshold$, 预测为+1(good)

如果 $\sum_{k=1}^d w_k x_k < threshold$, 预测为-1(bad)

- $\mathbf{y}=\{+1(\text{good}), -1(\text{bad})\}$

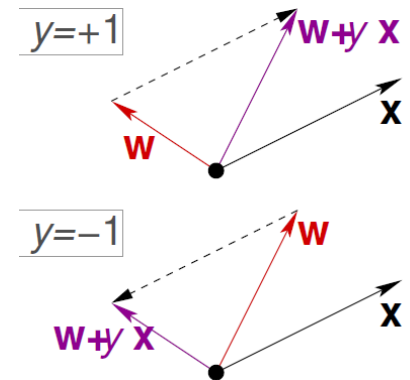
$$h(\mathbf{x}) = \text{sign} \left(\left(\sum_{k=1}^d w_k x_k \right) - threshold \right)$$

Perceptron Learning Algorithm

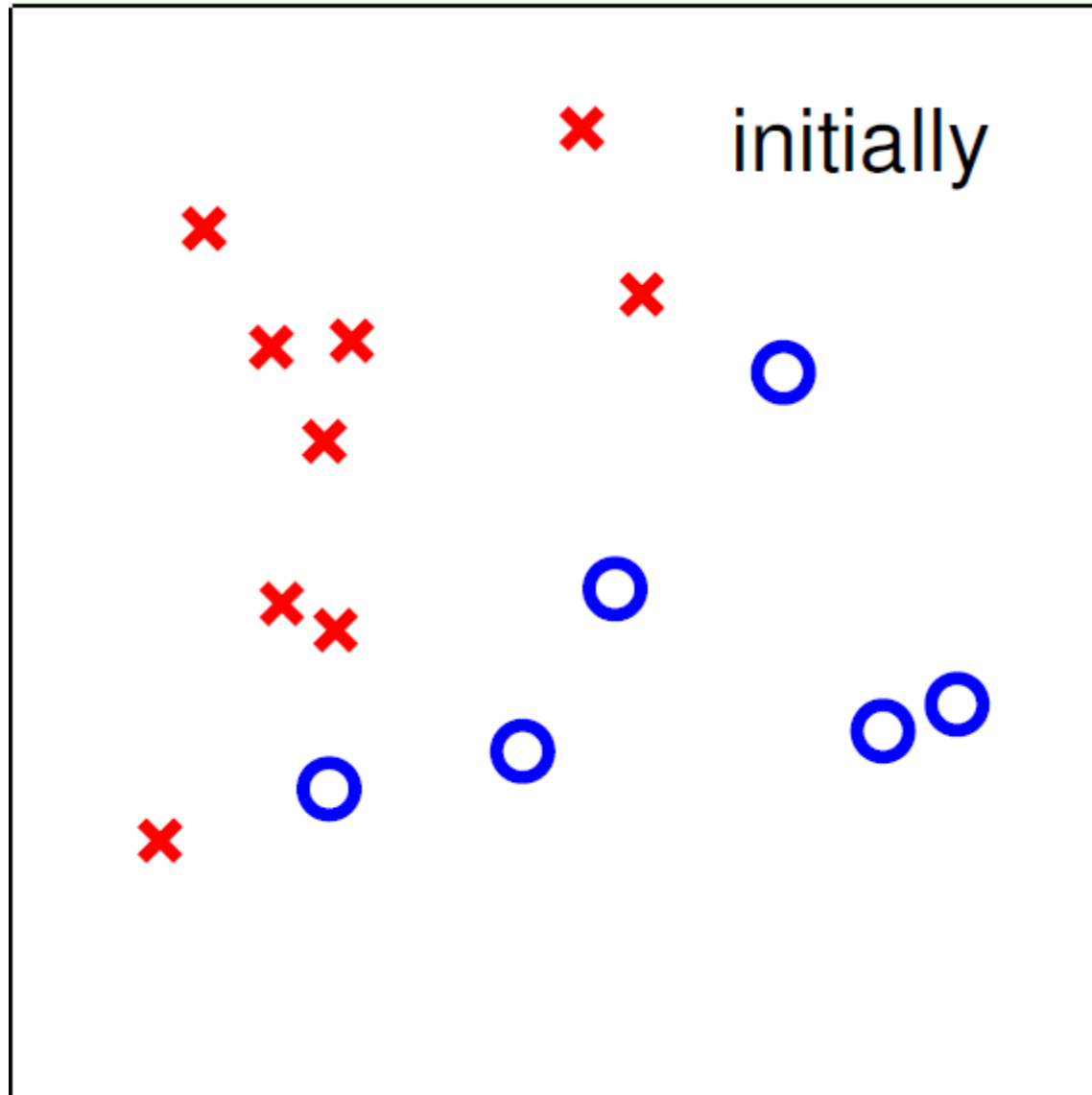
$$\begin{aligned}h(\mathbf{x}) &= \text{sign} \left(\left(\sum_{k=1}^d w_k x_k \right) - \text{threshold} \right) \\&= \text{sign} \left(\left(\sum_{k=1}^d w_k x_k \right) + \underbrace{(-\text{threshold})}_{w_0} \cdot \underbrace{(+1)}_{x_0} \right) \\&= \text{sign} \left(\sum_{j=0}^d w_j x_j \right) \\&= \text{sign} \left(\tilde{\mathbf{W}}^T \tilde{\mathbf{X}} \right)\end{aligned}$$

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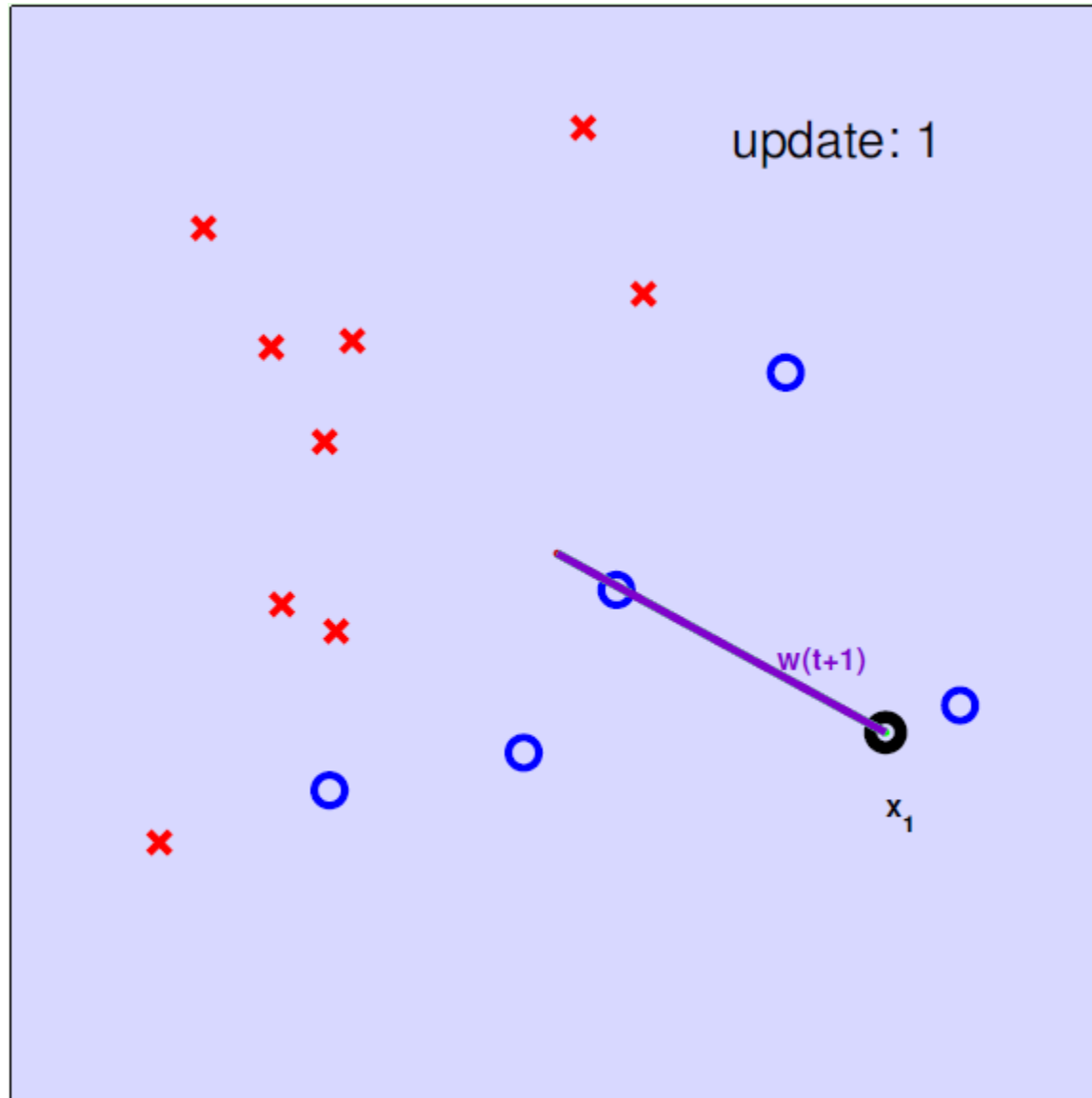
- 难点: 函数 $h(\mathbf{x})$ 有无限多种可能
- 想法: 先初始化 $\mathbf{w}_{(0)}$, 然后根据 D 来修正 \mathbf{w} 。
- For $t = 0, 1, \dots$
 - 找到 $\mathbf{w}_{(t)}$ 预测错的数据 $(\mathbf{x}_{i(t)}, y_{i(t)})$
$$\text{sign}(\tilde{\mathbf{w}}_{(t)}^T \tilde{\mathbf{x}}_{i(t)}) \neq y_{i(t)}$$
 - (尝试) 用下面的方法修正错误
$$\tilde{\mathbf{w}}_{(t+1)} \leftarrow \tilde{\mathbf{w}}_{(t)} + y_{i(t)} \tilde{\mathbf{x}}_{i(t)}$$
 - 直到没有错误
- 返回最终的 \mathbf{W} (called \mathbf{W}_{PLA})



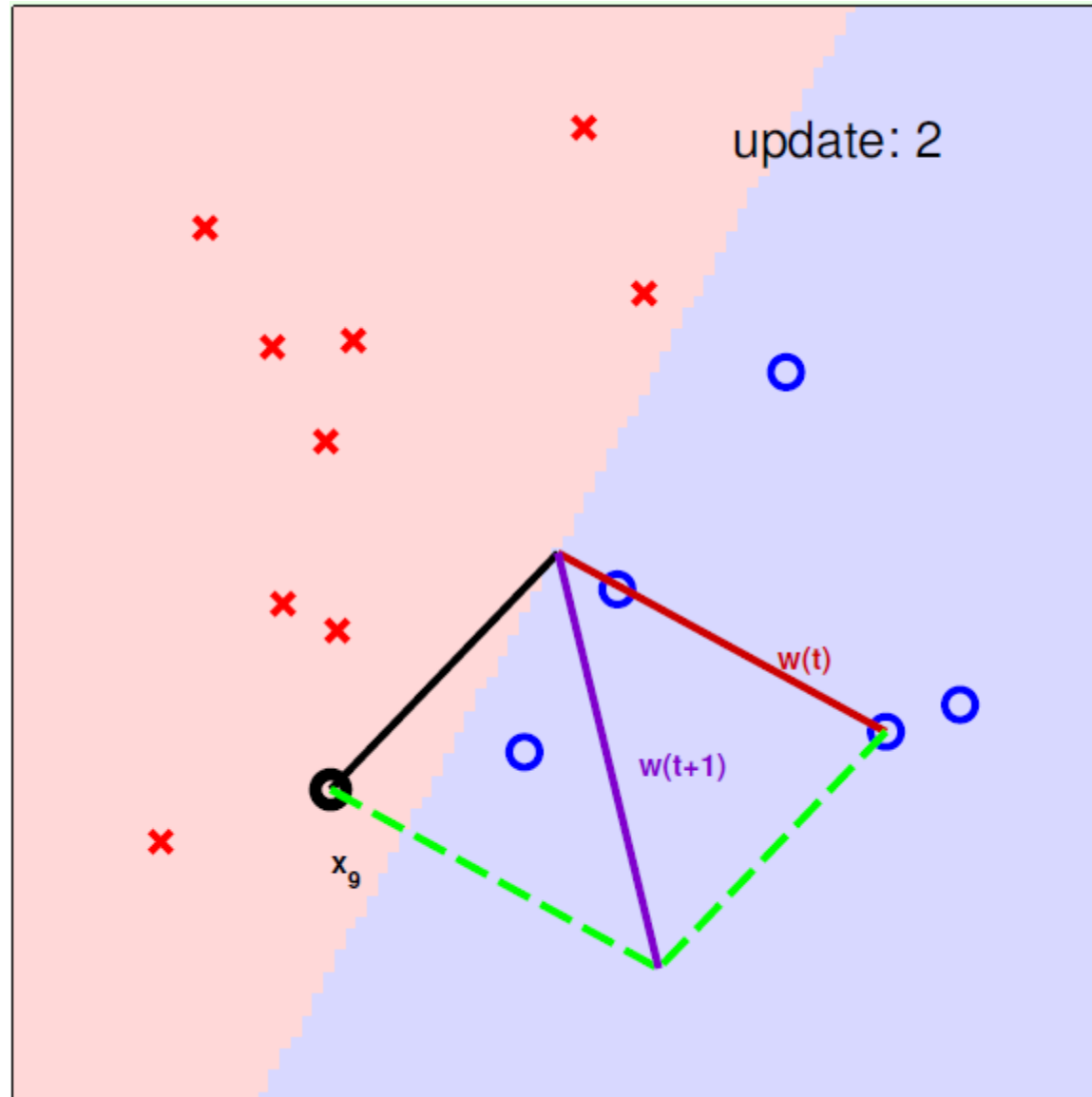
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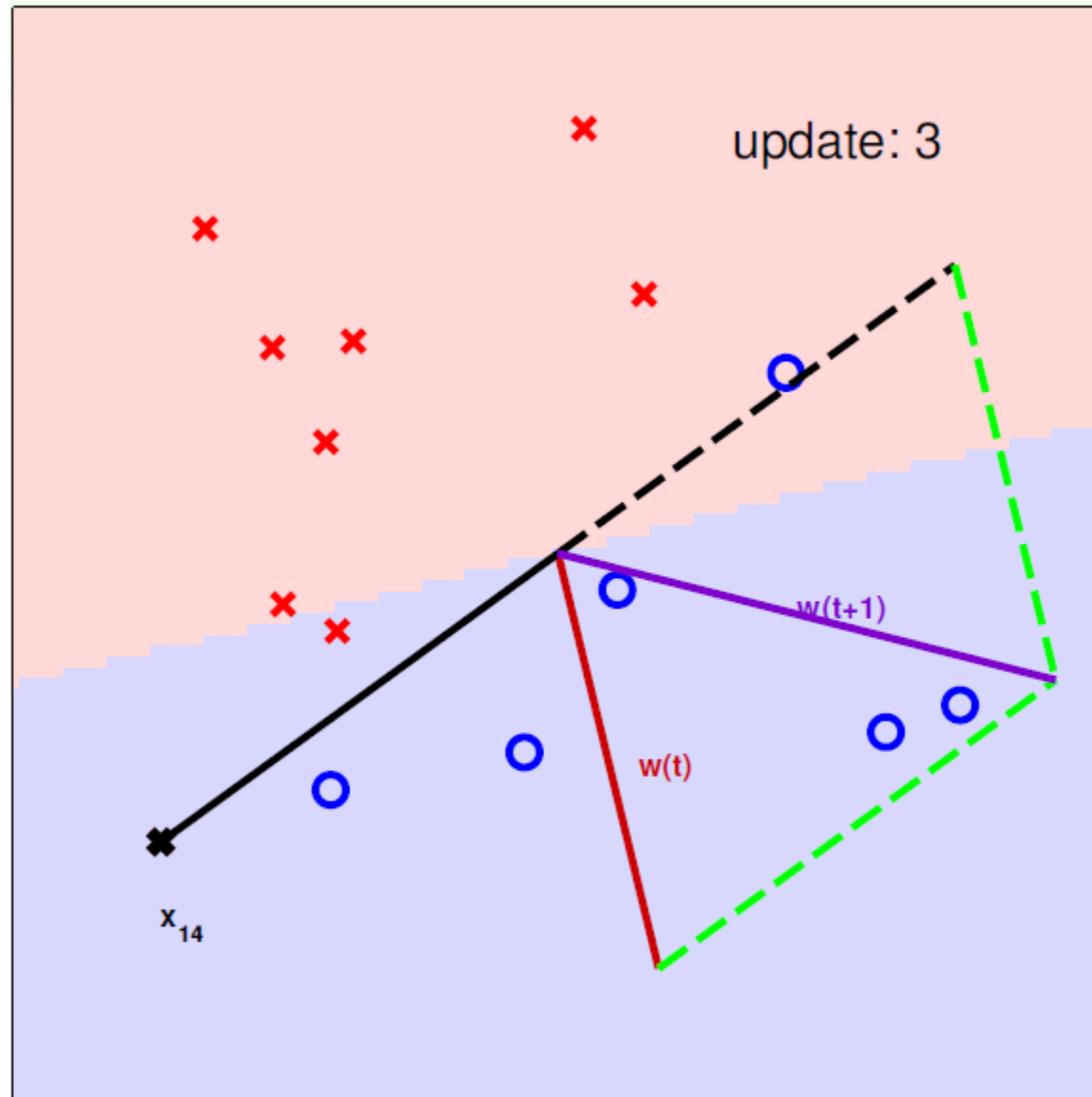
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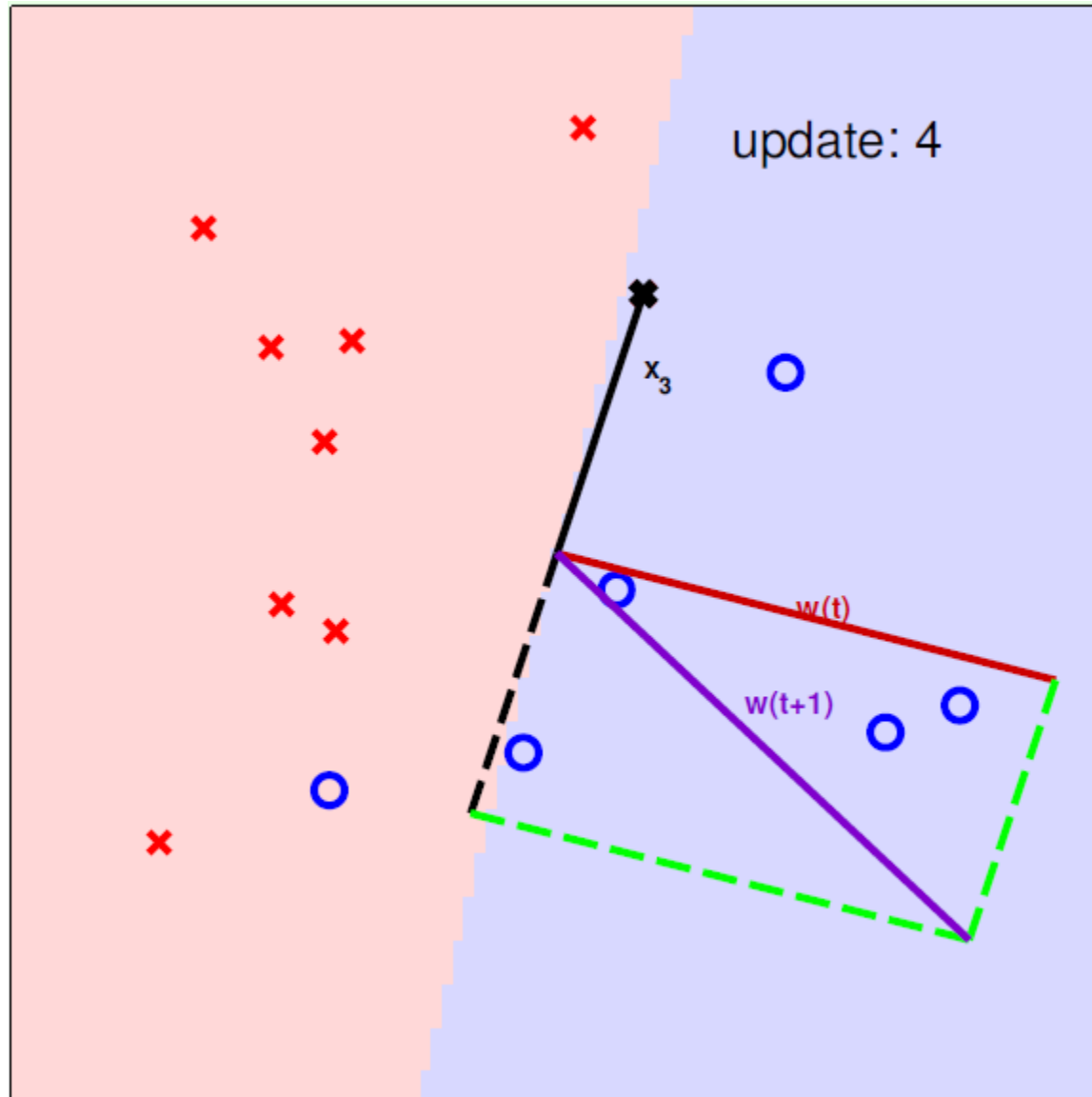
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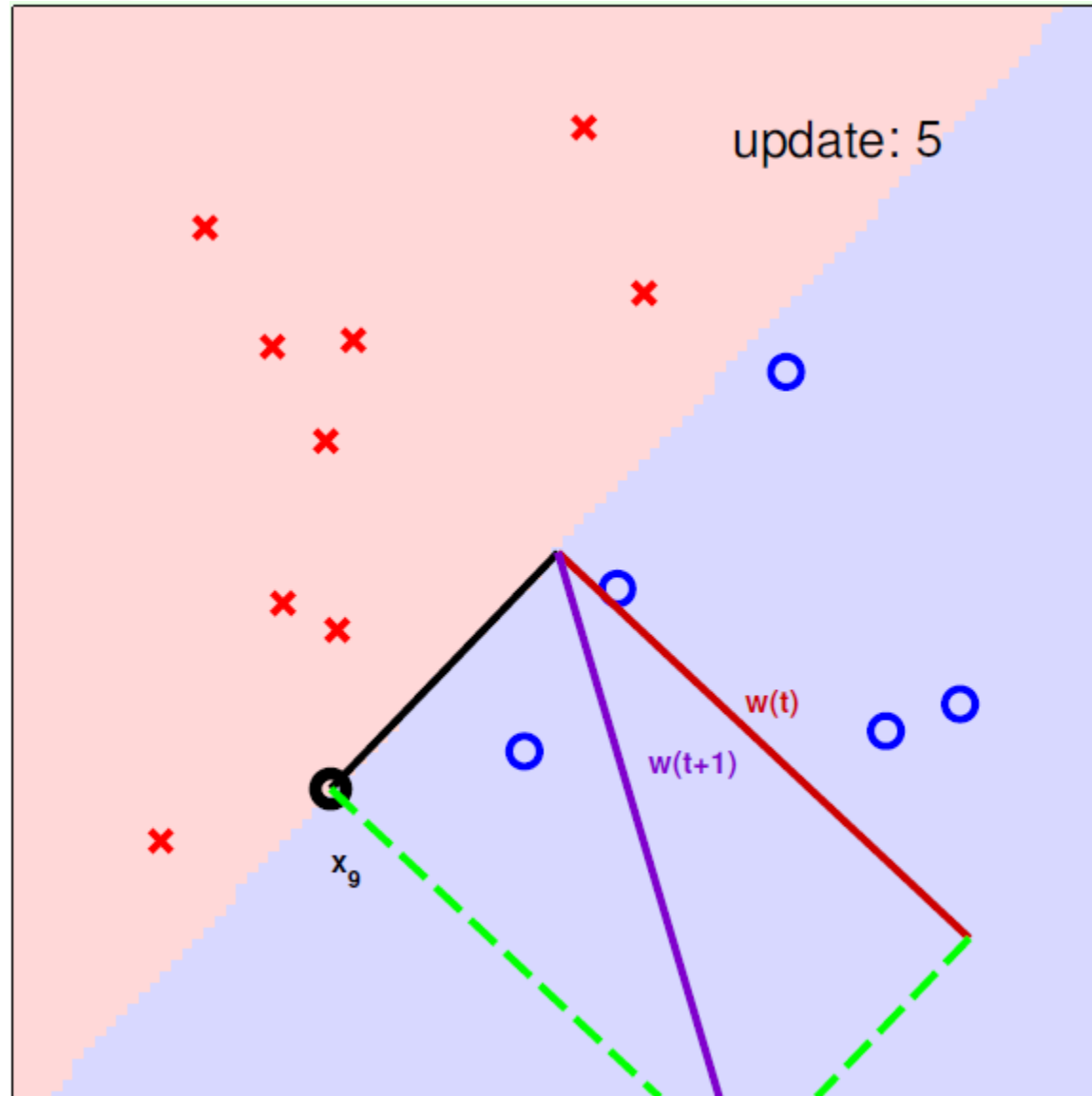
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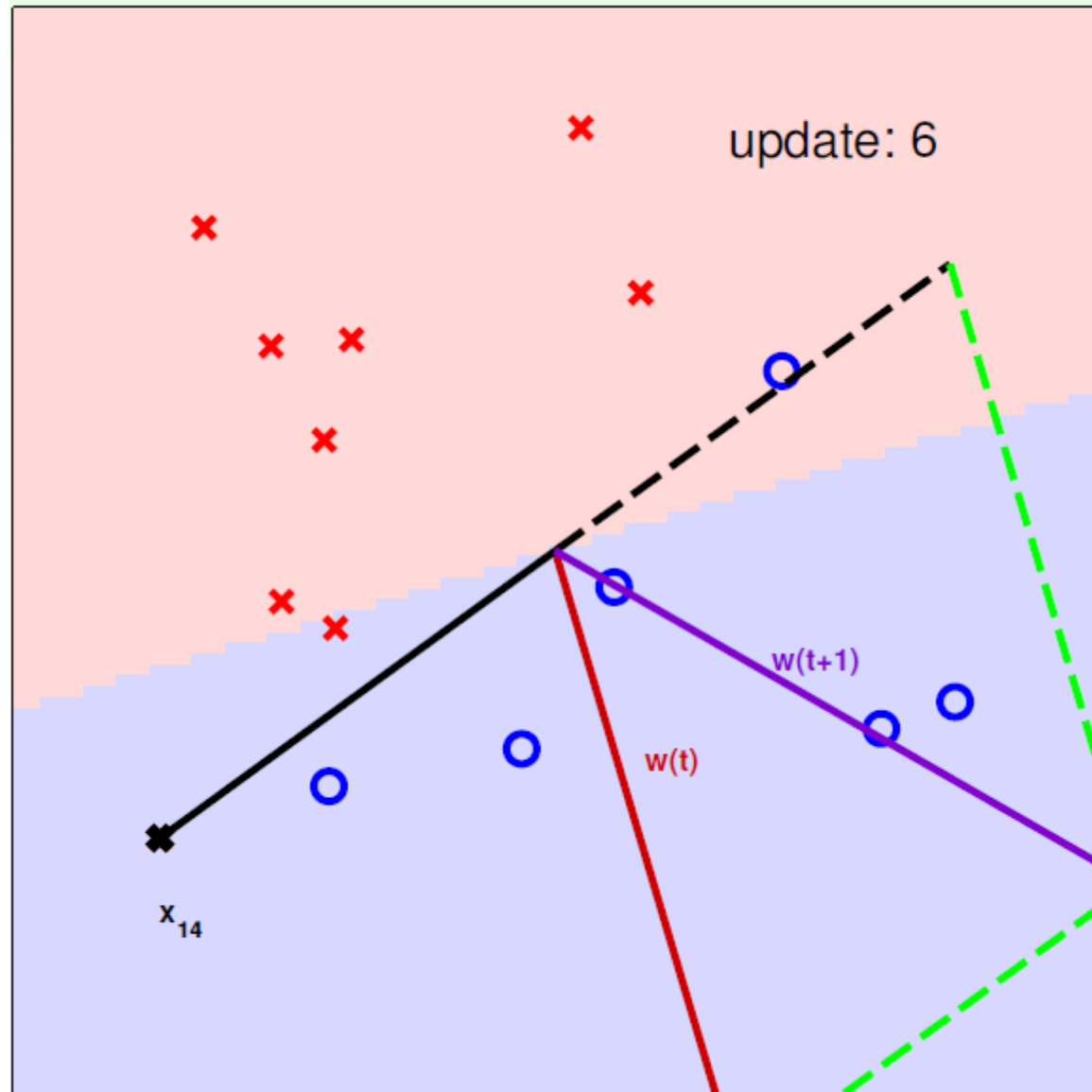
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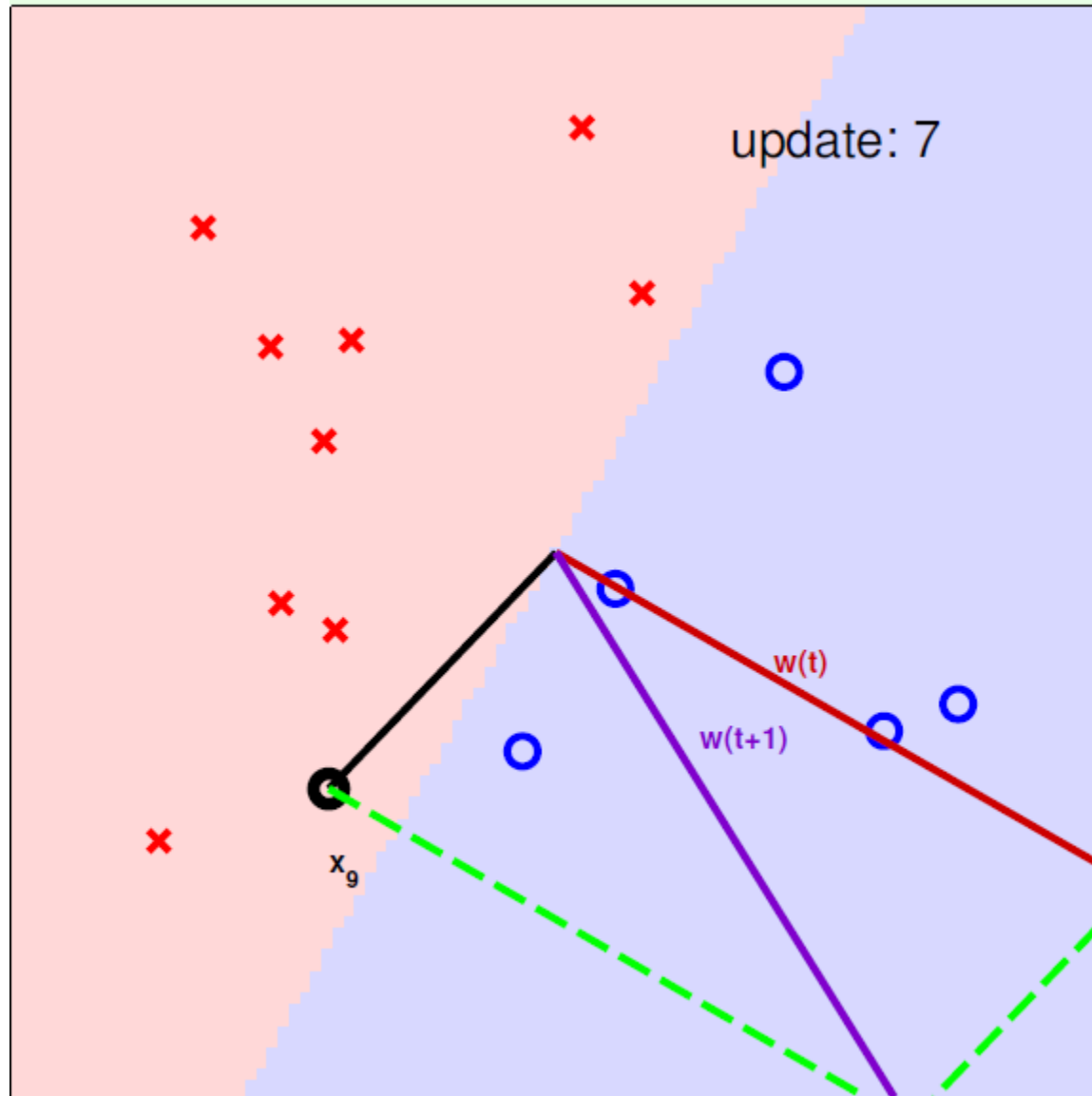
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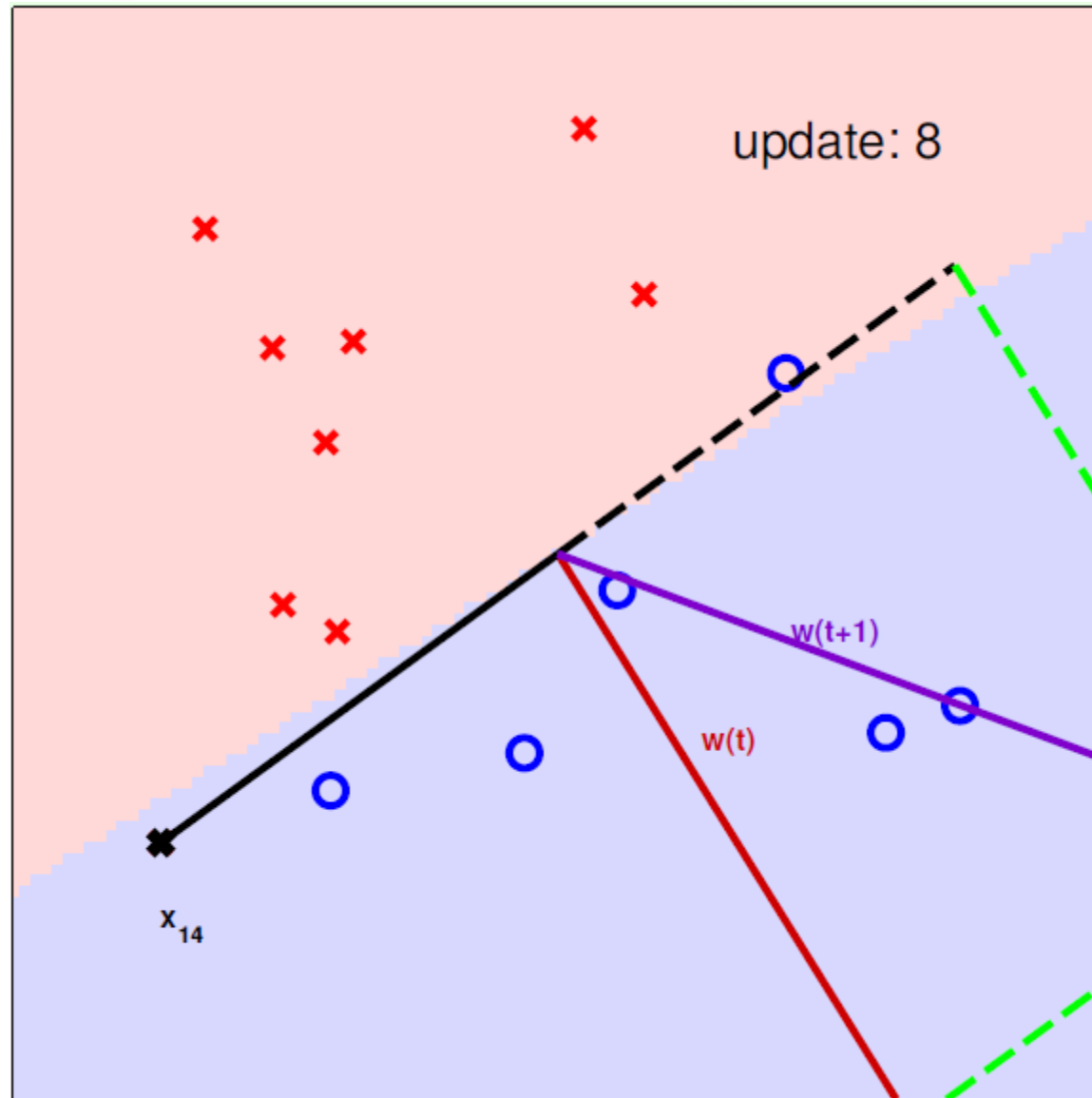
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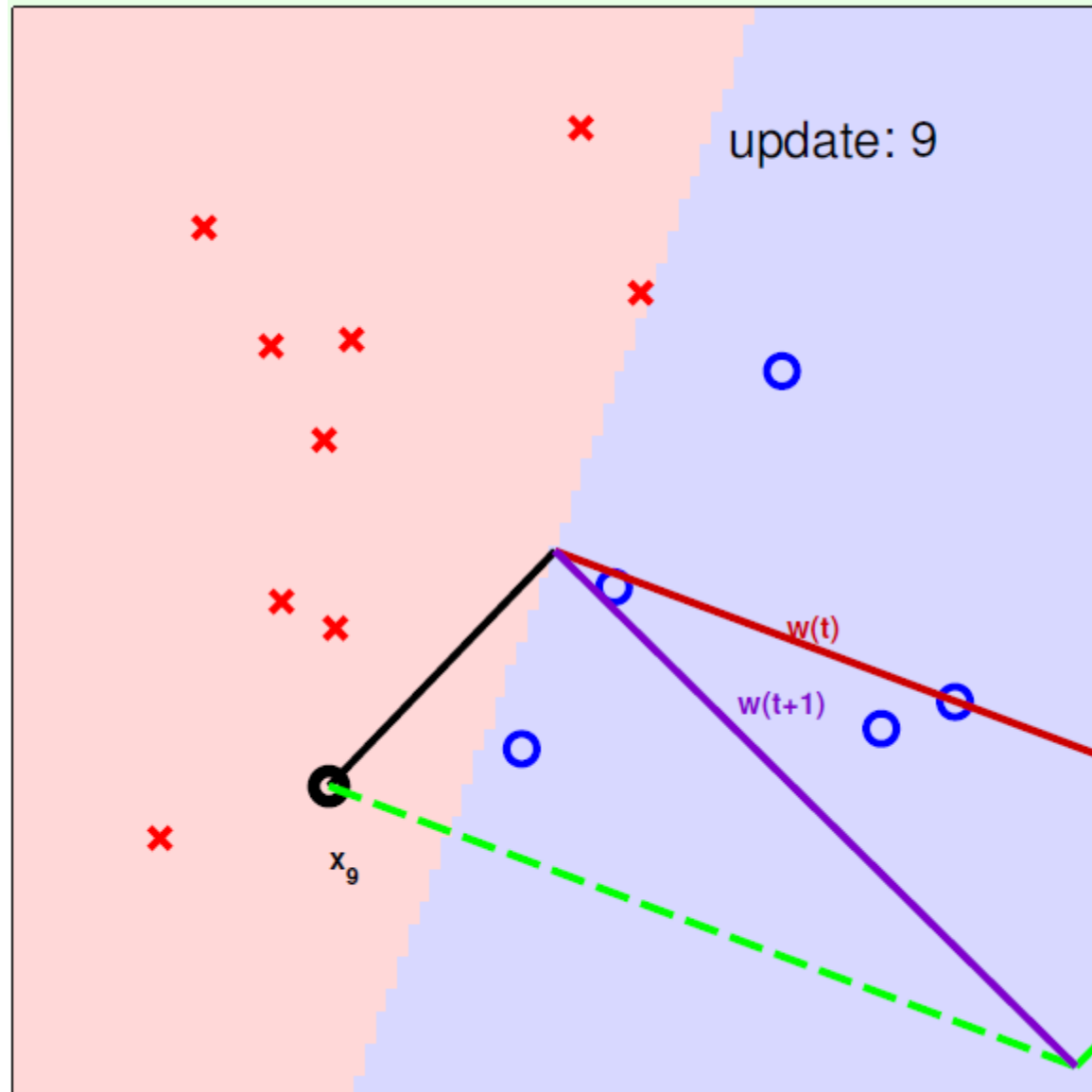
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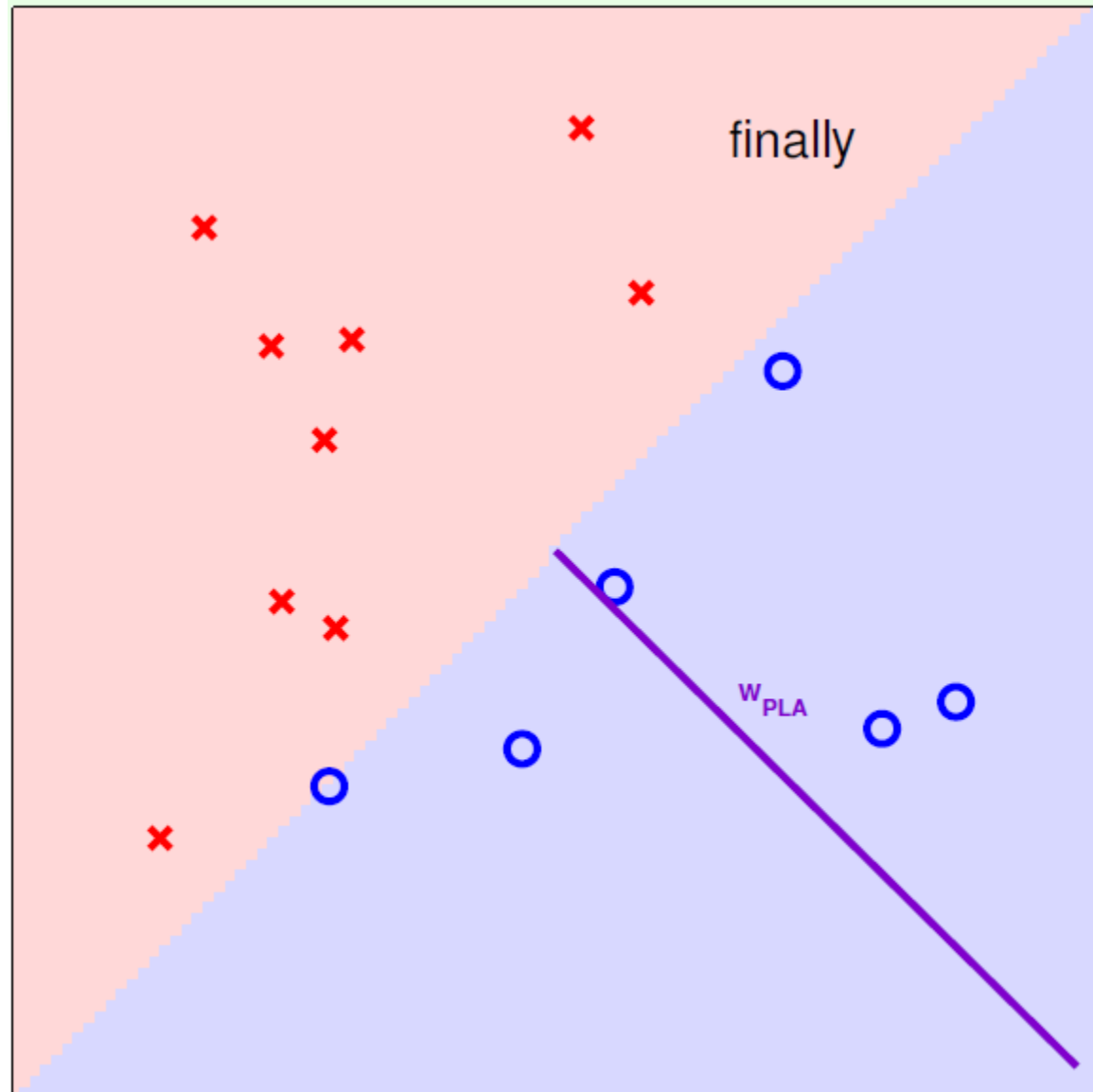
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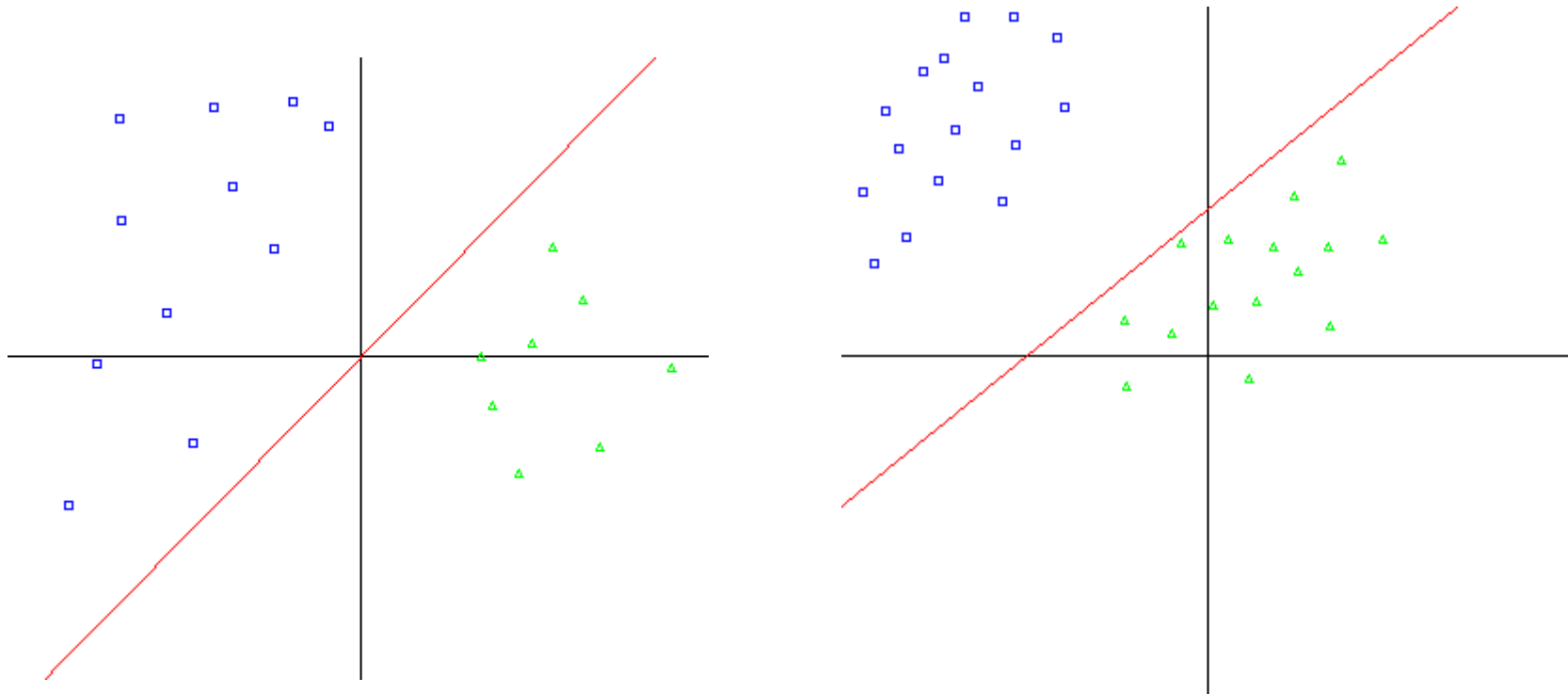
Perceptron Learning Algorithm



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Perceptron Learning Algorithm

- 仅当存在某个超平面，能够正确划分所有数据时，PLA算法会收敛；而且，遍历数据的顺序不同，可能会导致结果不同，因此有多个解存在。

Perceptron Learning Algorithm

