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 $\mathbf{x}=(x_1,x_2,\ldots,x_d)$，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(good), -1(bad)}

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

Perceptron Learning Algorithm

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

$$= sign\left(\left(\sum_{k=1}^{d} w_k x_k\right) + \underbrace{(-threshold)}_{w_0} \cdot \underbrace{(+1)}_{x_0}\right)$$

$$= sign\left(\sum_{j=0}^{d} w_j x_j\right)$$

$$= sign\left(\tilde{\mathbf{w}}^{\mathrm{T}} \tilde{\mathbf{x}}\right)$$

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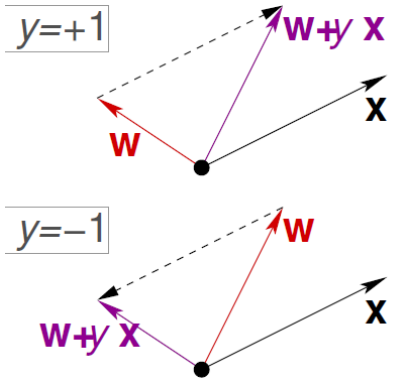
- 难点: 函数 $h(\mathbf{x})$ 有无限多种可能
- 想法: 先初始化$\mathbf{w}_{(0)}$, 然后根据D来修正$\mathbf{w}$。
- For t = 0, 1,…
  - **找到**$\mathbf{w}_{(t)}$ 预测错的数据 $(\mathbf{x}_{i(t)}, y_{i(t)})$

    $$sign\left(\tilde{\mathbf{w}}_{(t)}^{\mathrm{T}}\tilde{\mathbf{x}}_{i(t)}\right) \neq y_{i(t)}$$

  - (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 $\mathbf{W}_{\mathrm{PLA}}$)



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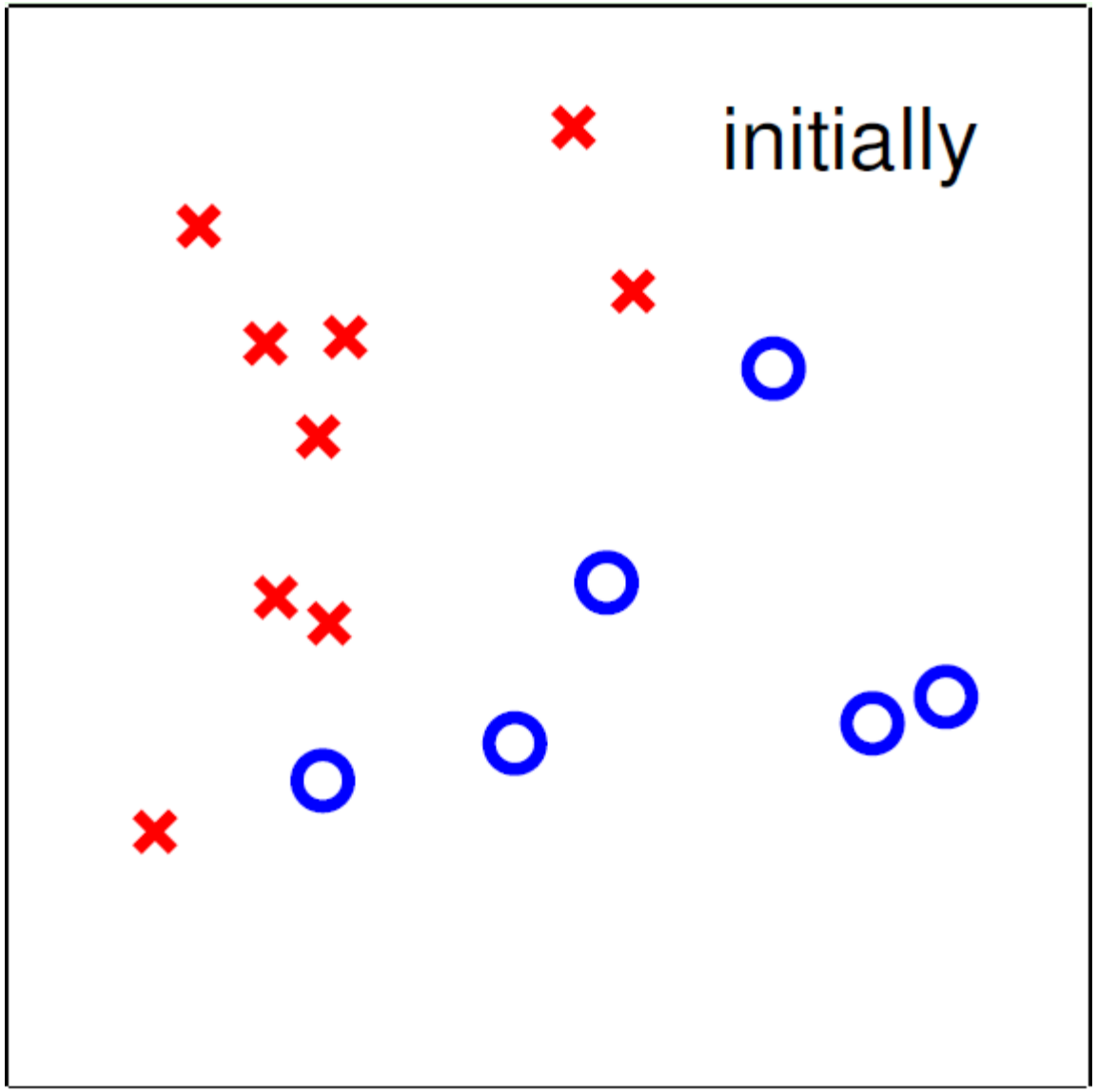

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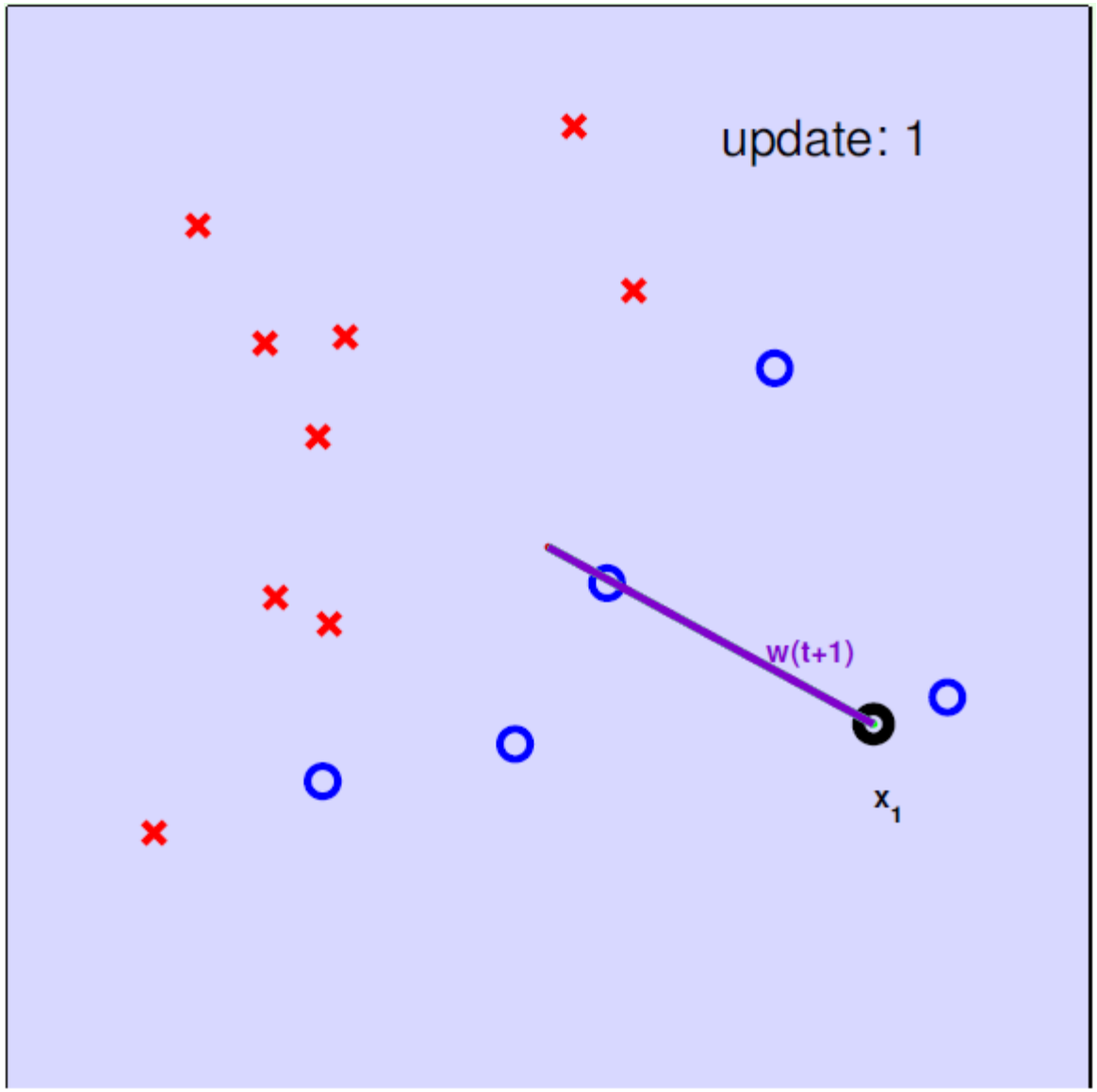

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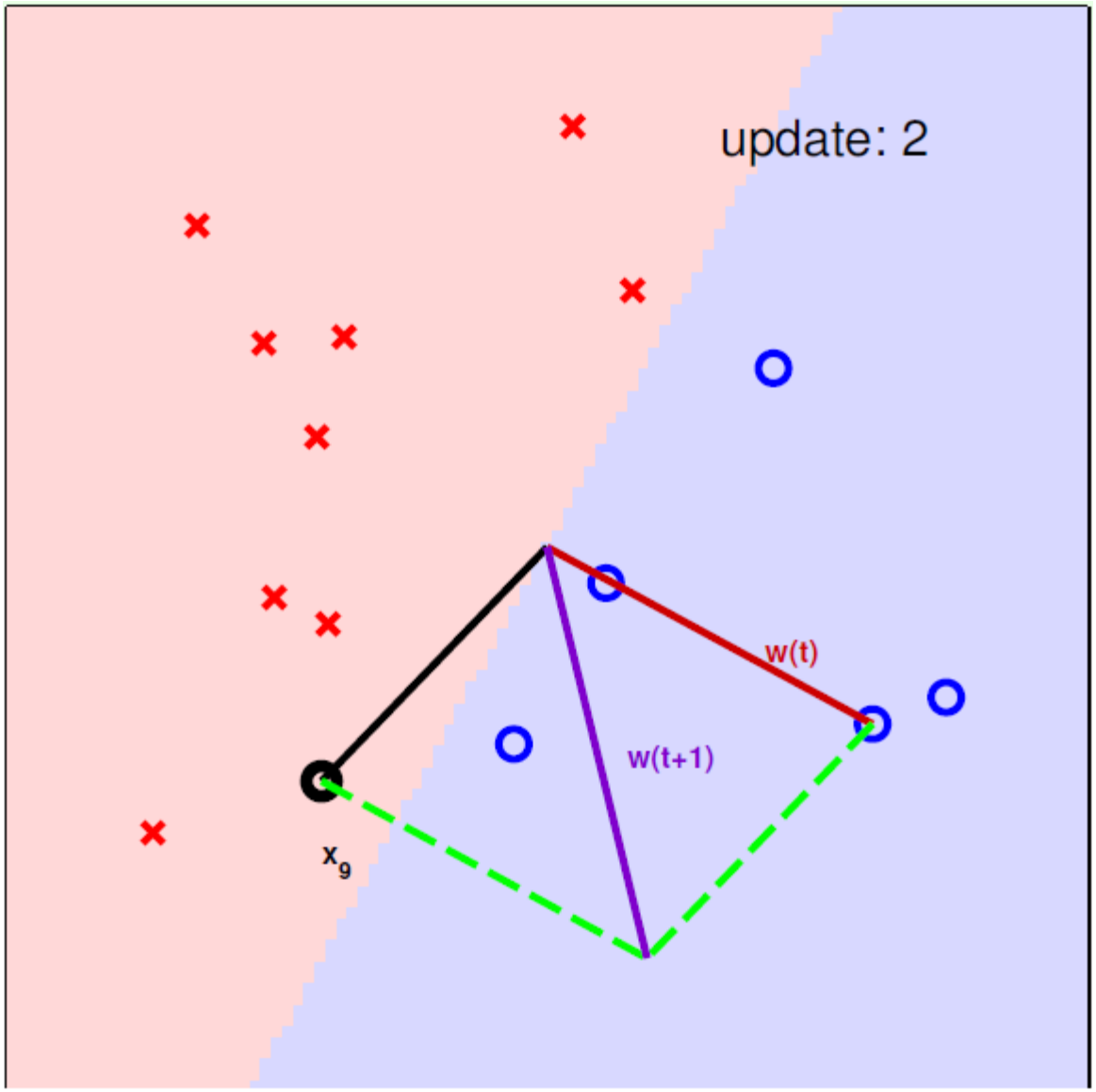

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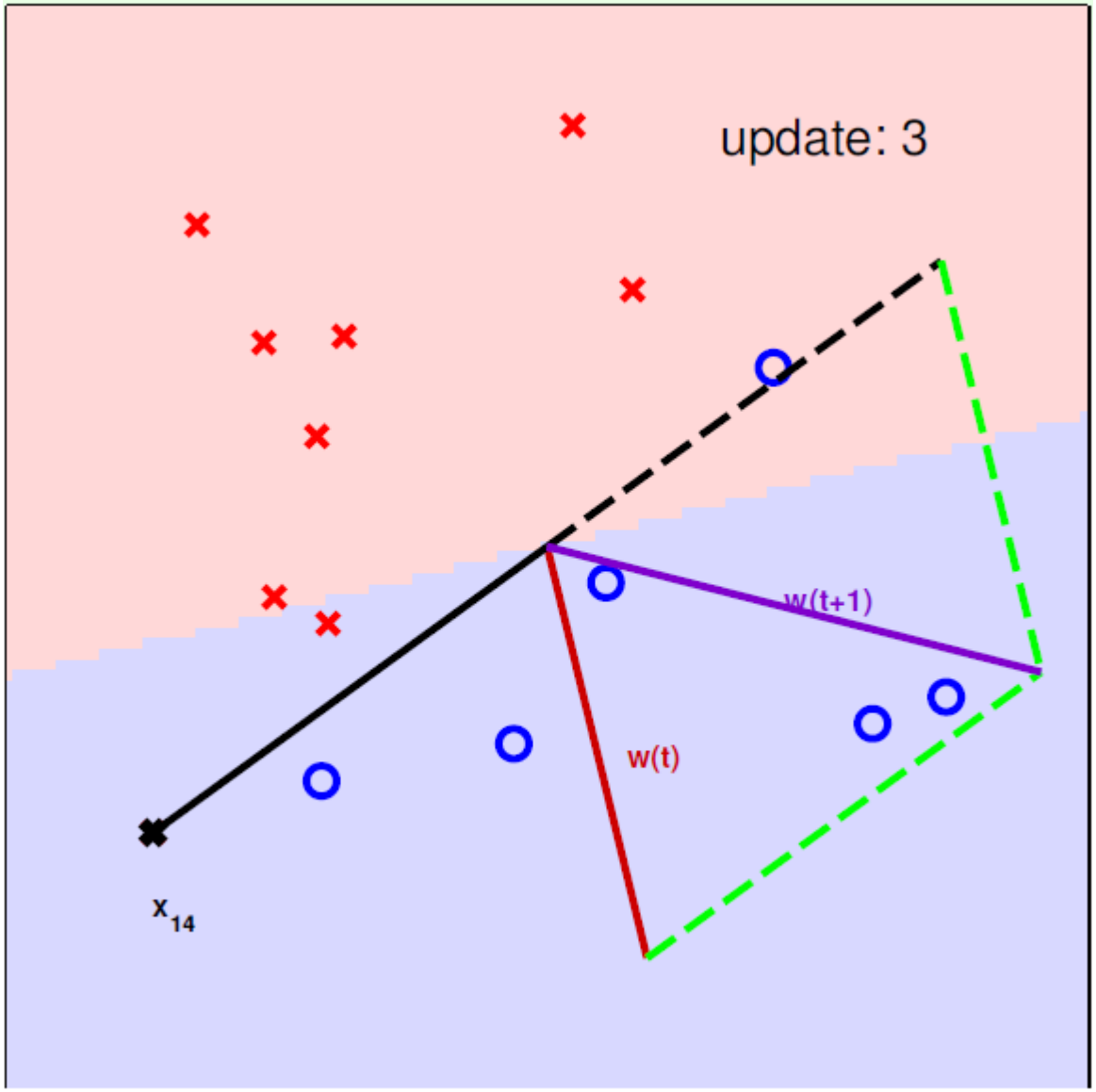

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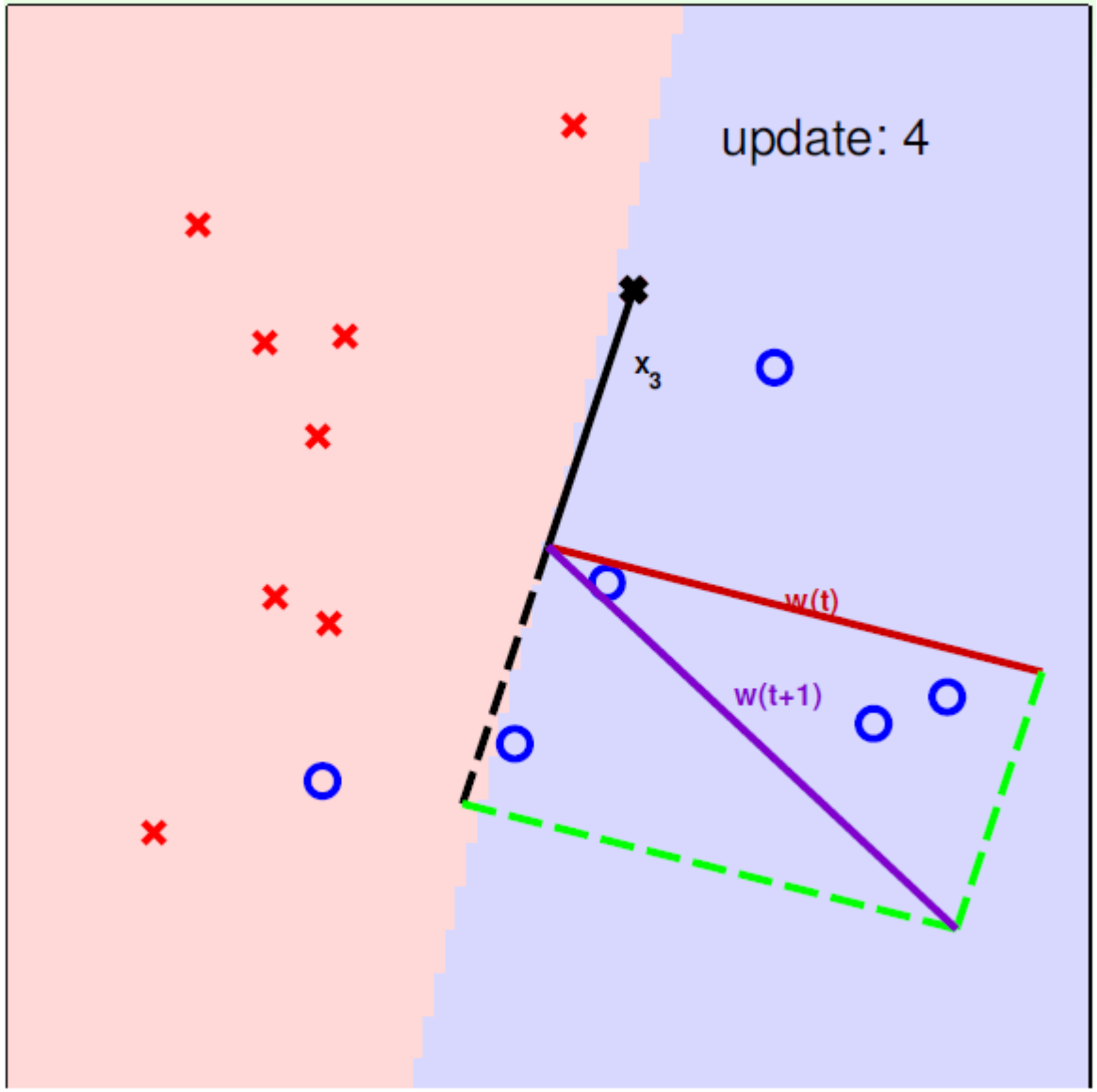

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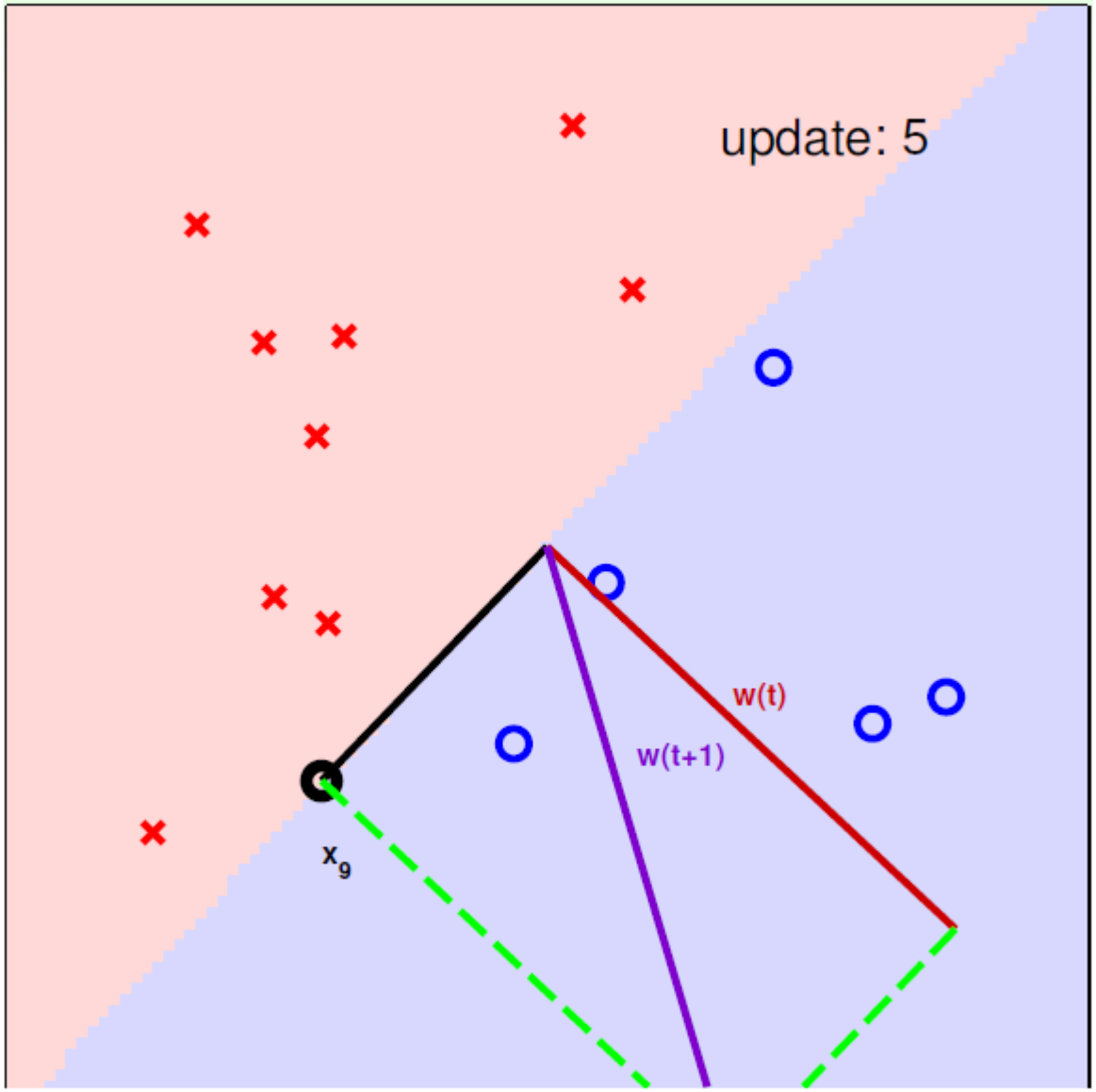

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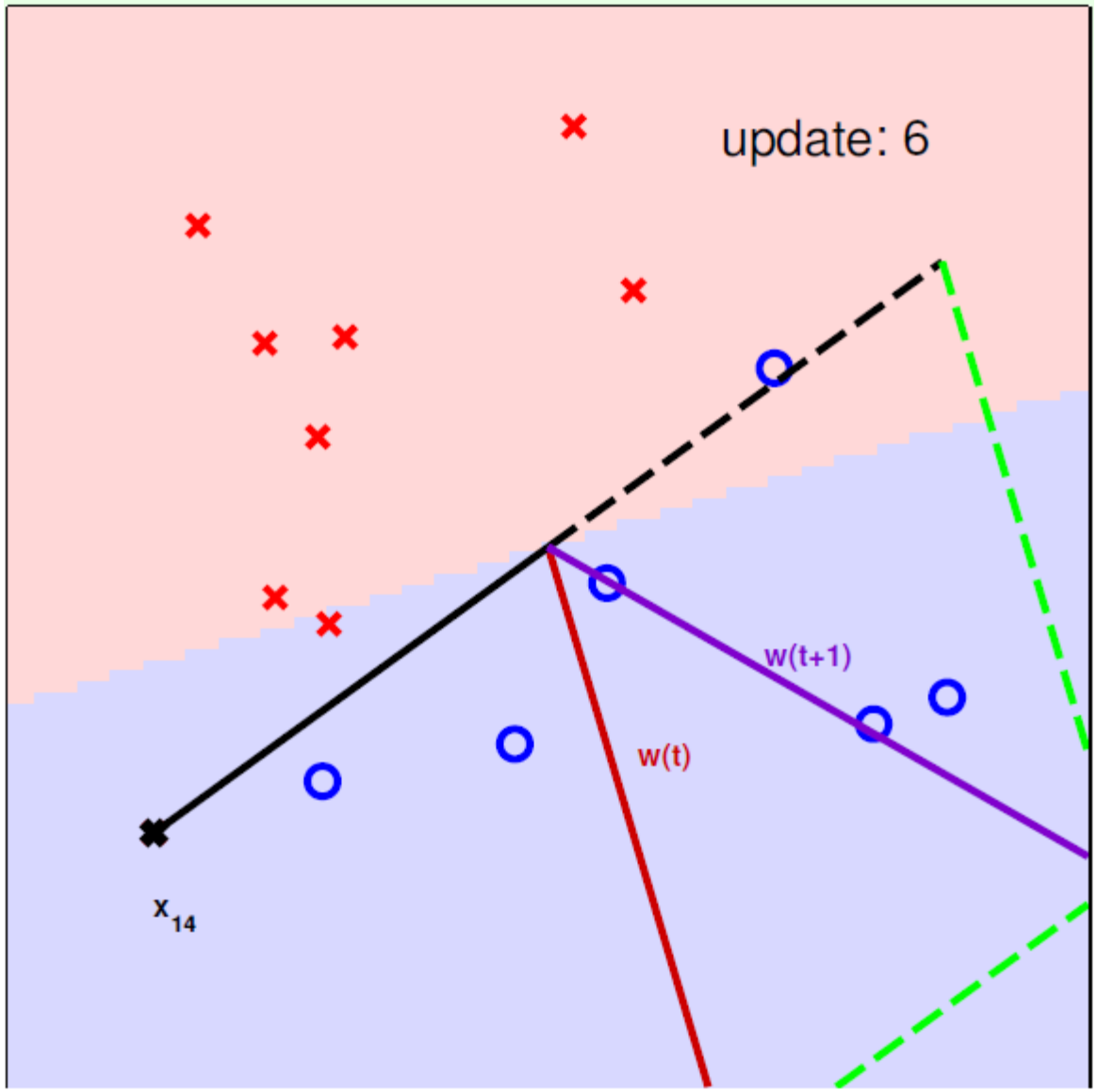

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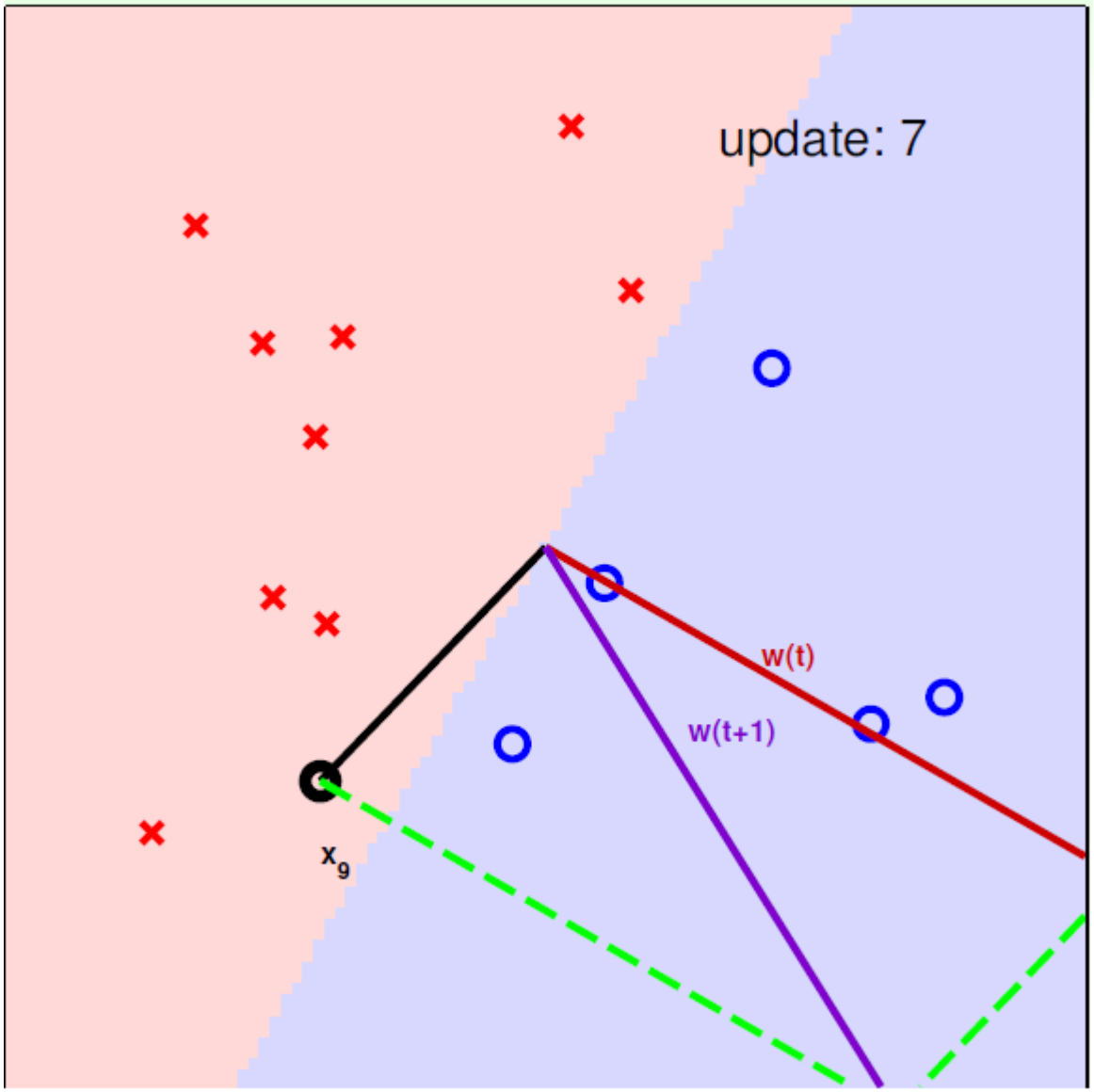

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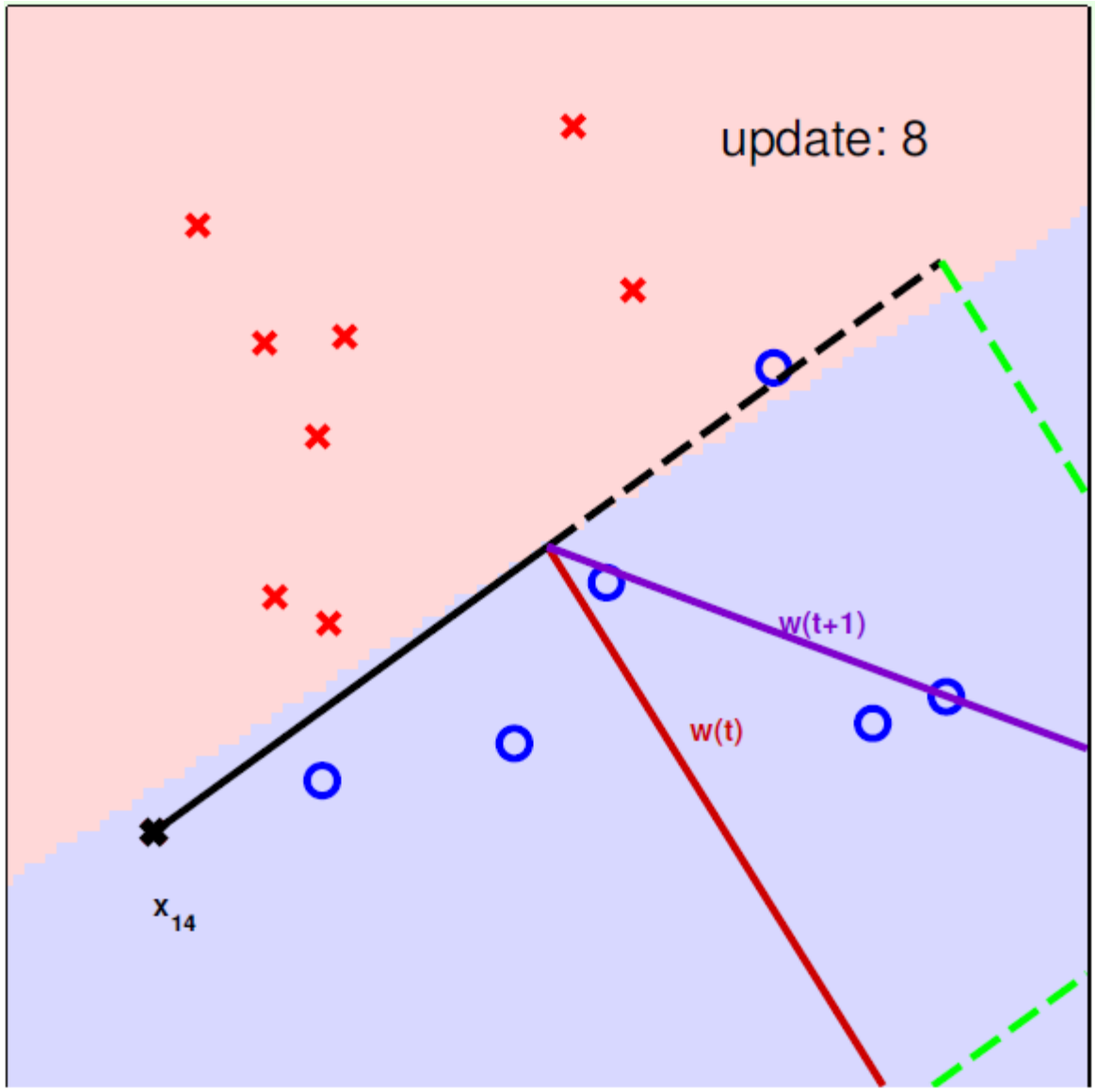

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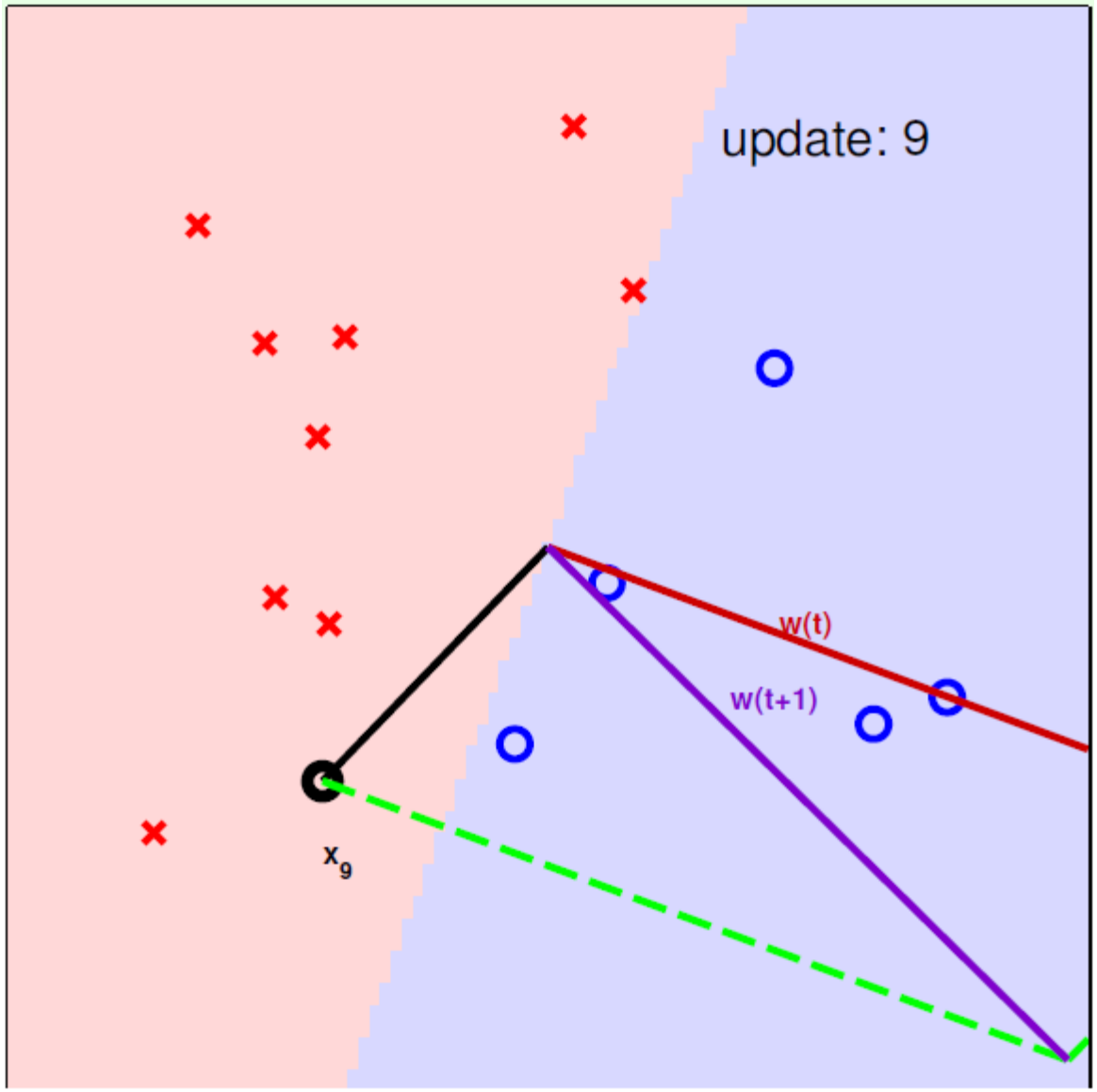

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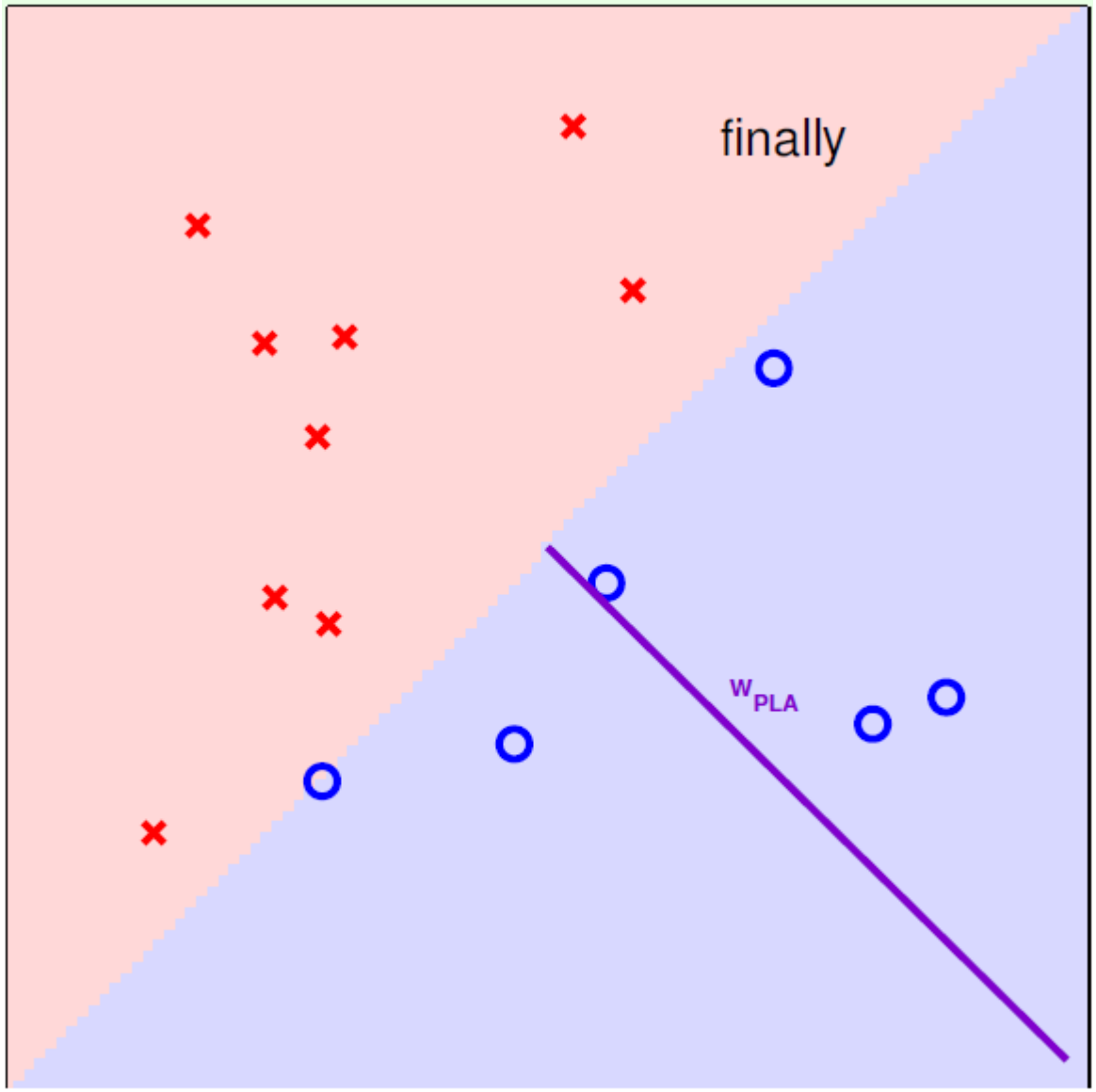

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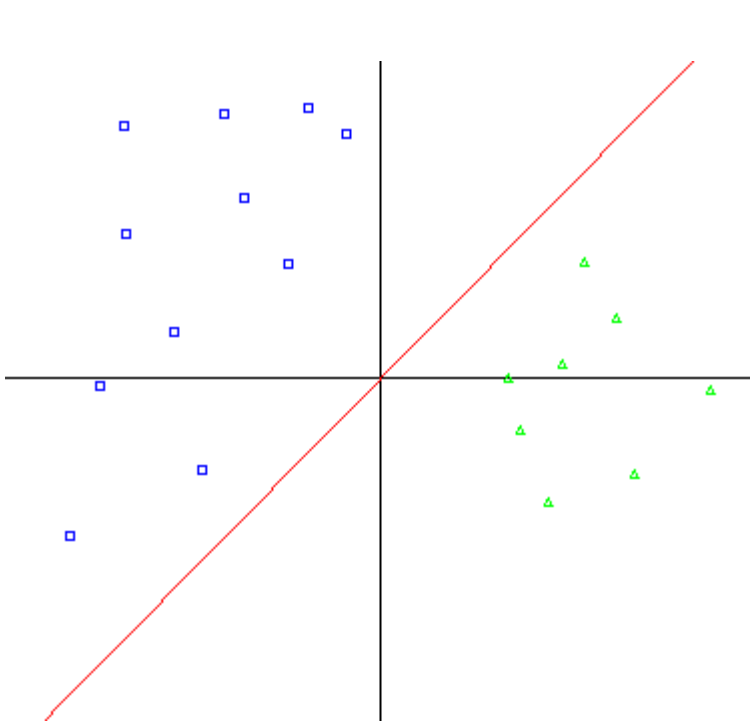

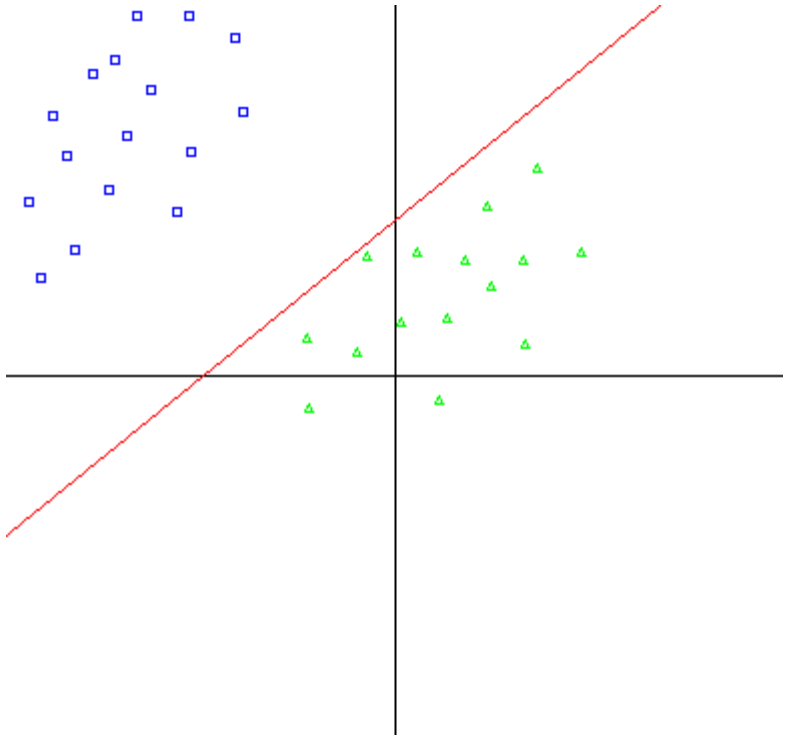

Perceptron Learning Algorithm

- 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。

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