神经网络&深度学习
TENSORFLOW
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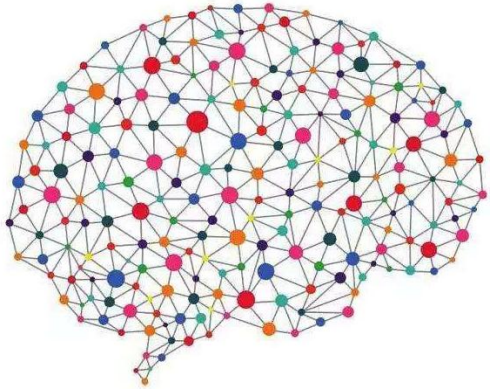

12 人工神经网络

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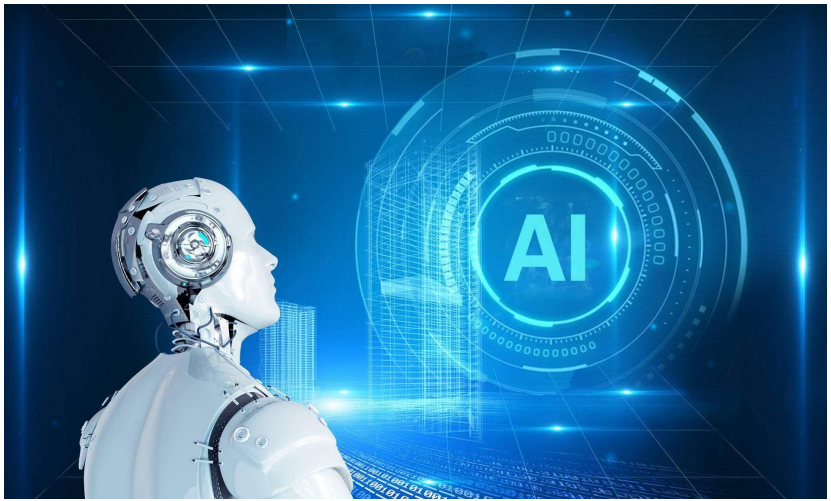
tensorflow / tensorflow
TensorFlow: Open sou
Clone this repo:
git clone https://tensor
Branches
master

12.1 神经元与感知机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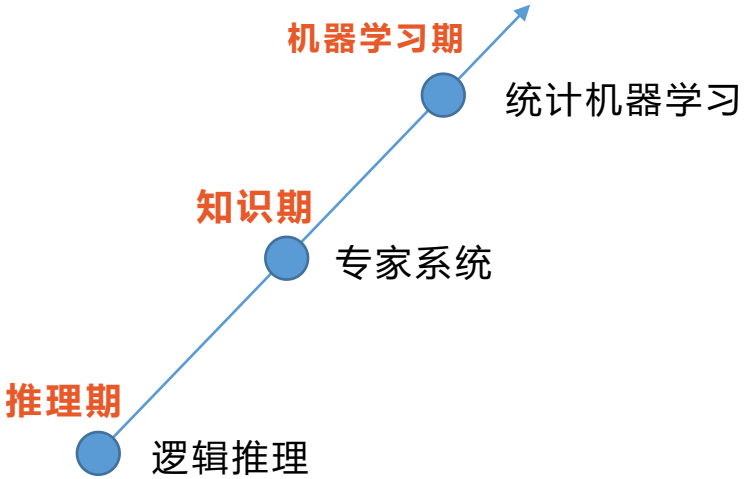
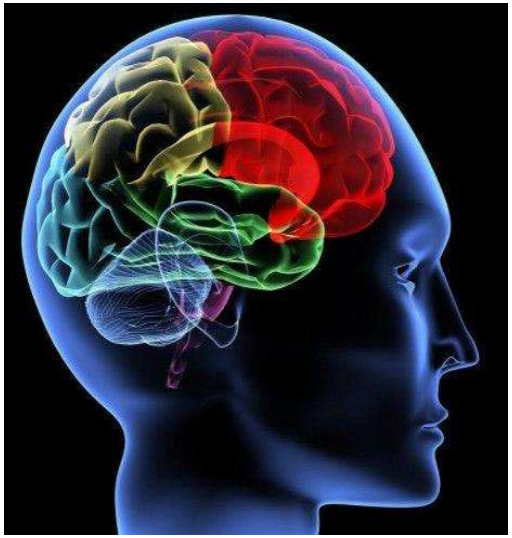
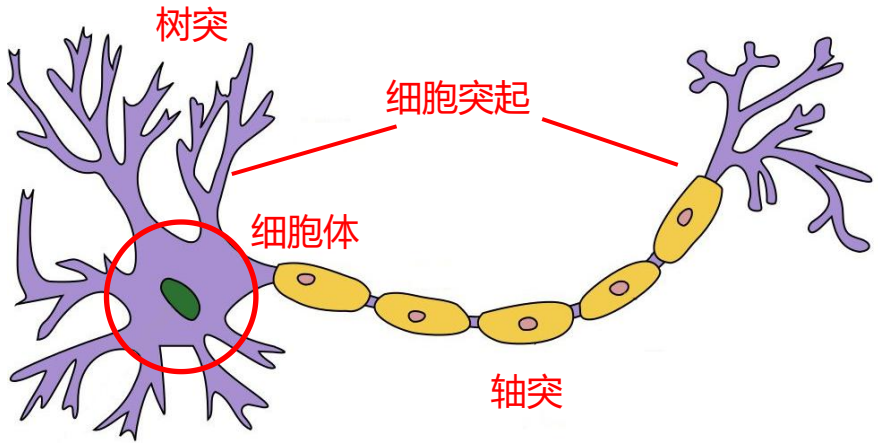
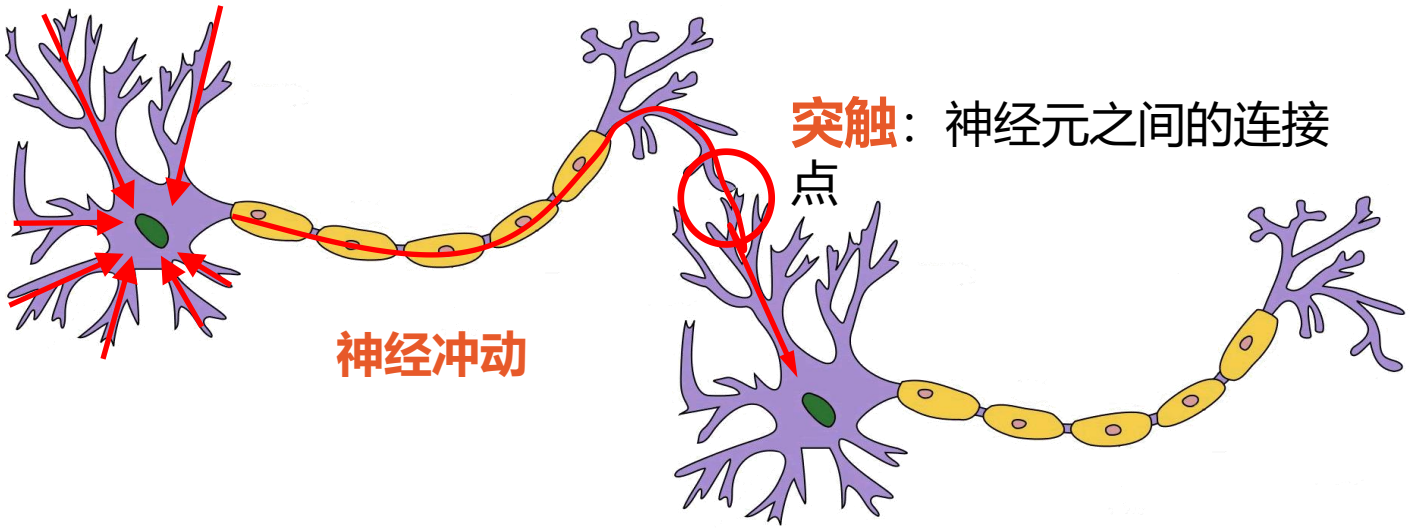

机器学习期
统计机器学习
知识期
专家系统
推理期
逻辑推理



神经网络：人脑智慧的物质基础

神经元/神经细胞：生物神经系统的基本单元

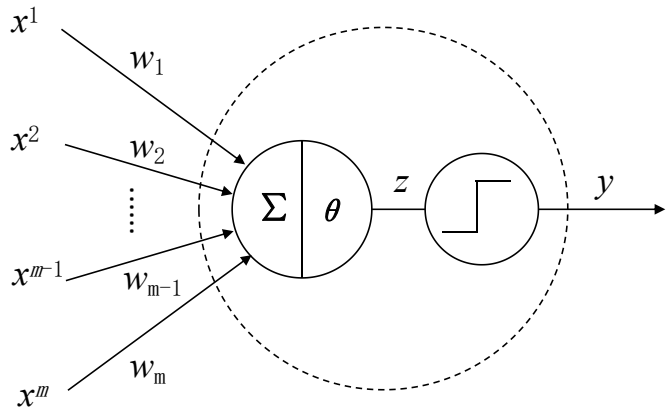




突触：神经元之间的连接点

抑制状态 → 兴奋状态

M-P神经元：1943，McCulloch，Pitts



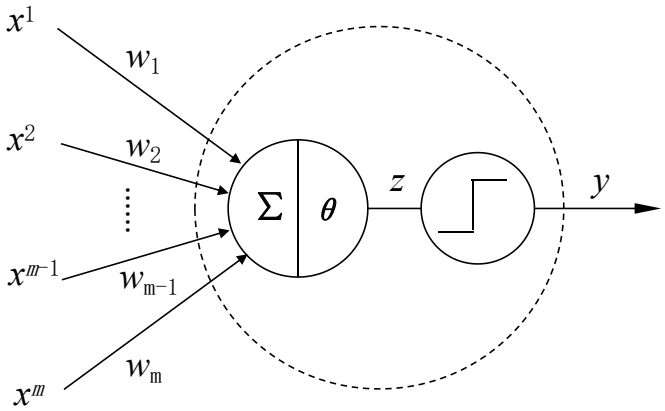
$$z = \sum_{j=1}^{m} w_j x^j - \theta$$

激活函数/激励函数 (activation function)

$$y = step(z)$$

$$step(z) = \begin{cases} 1 & , \quad z \geq 0 \\ 0 & , \quad z < 0 \end{cases}$$

M-P神经元：1943，McCulloch，Pitts



$$y = step(\sum_{j=1}^{m} w_j x^j - \theta) \qquad (j = 1,2,...,m)$$

令 $w_0 = -\theta$，$x^0 = 1$

$$y = step(w_0 x^0 + w_1 x^1 + w_2 x^2 + ... + w_m x^m)$$

$$y = step(W^T X)$$

$$W = (w_0, w_1, ..., w_m)^T$$

$$X = (x_0, x_1, x_2, ..., x_m)^T$$

权值向量W无法自动学习和更新，**不具备学习的能力**

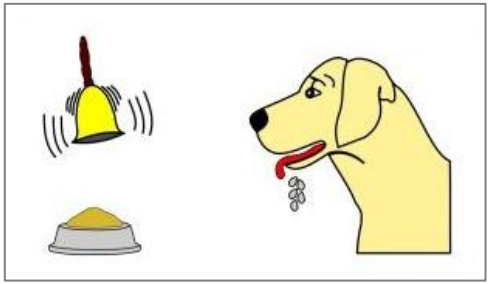
Donald Hebb，1949，神经心理学

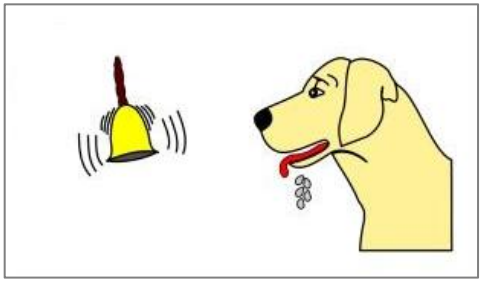
在**同一时间被激发**的神经元间的**联系会被强化**

如果两个神经元总是不能同步激发，它们之间的联系将会越来越弱，甚至消失

神经网络的**学习**过程是发生在神经元之间的**突触**部位

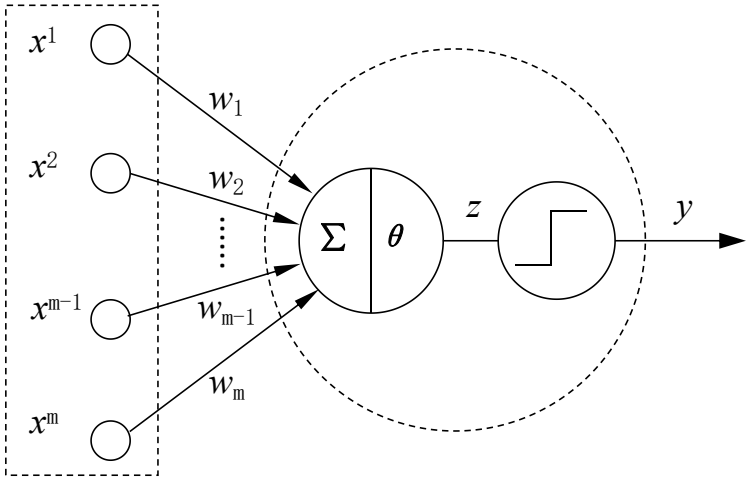
突触的**联结强度**与突触连接的两个神经元的**活性之和**成正比

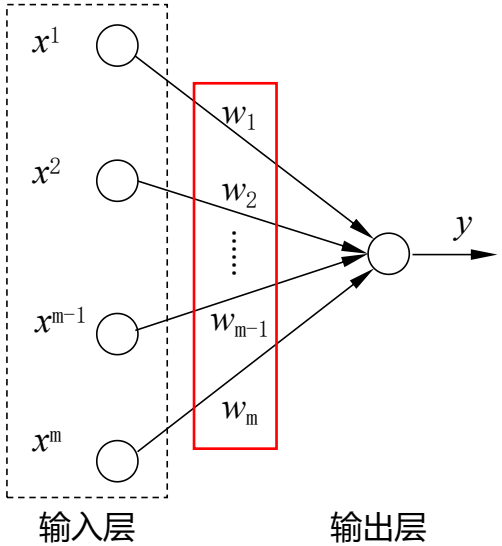




人工神经网络：通过**算法**调整神经元中的**权值**，模拟人类神经网络的学习能力

感知机：1957，Frank Rosenblatt





感知机训练法则 (Perceptron Training Rule)

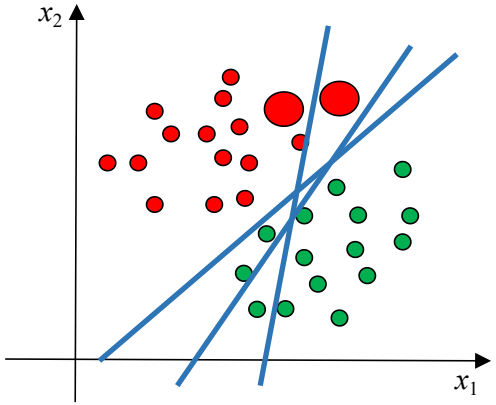
$$w_i^{(k+1)} = w_i^{(k)} + \Delta w_i$$

$$\Delta w_i = \eta (y - \hat{y}) x_i$$

y：训练样例的标记

$\hat{y}$：感知机的输出

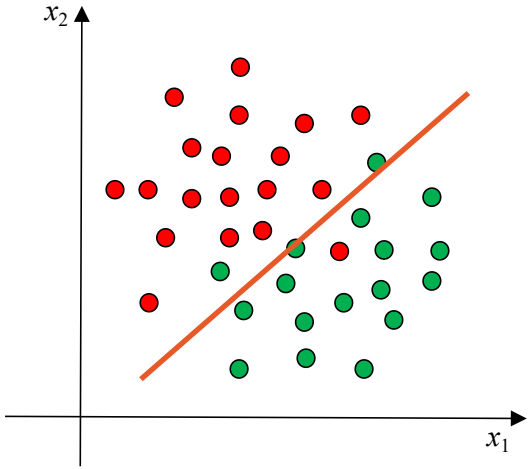
$\eta \in (0,1)$：学习率



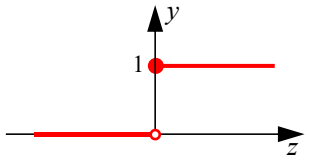
$$y = step(W^T X)$$

- 自动调整权值，具备**学习能力**
- 第一个用算法来精确定义的神经网络模型
- **线性二分类**的分类器
- 感知机算法存在**多个解**，受到**权值向量初始值**，**错误样本顺序**的影响
- 对于**非线性可分**的数据集，感知机训练法则**无法收敛**

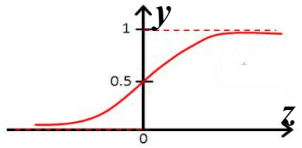
Delta法则：使用**梯度下降法**，找到能够**最佳拟合**训练样本集的的权向量



$$y = step\,(W^T X)$$

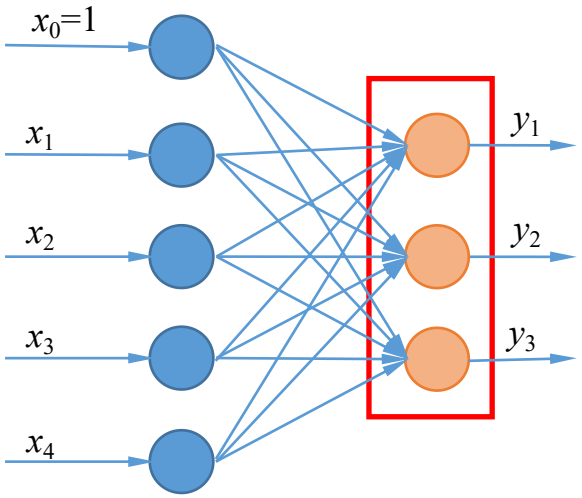


$$y = sigmoid\,(W^T X)$$



逻辑回归可以看做**单层神经网络**

多分类问题：设置多个输出节点



$$y = soft\max(W^T X)$$