

A super crash course in *Artificial Neural Networks*

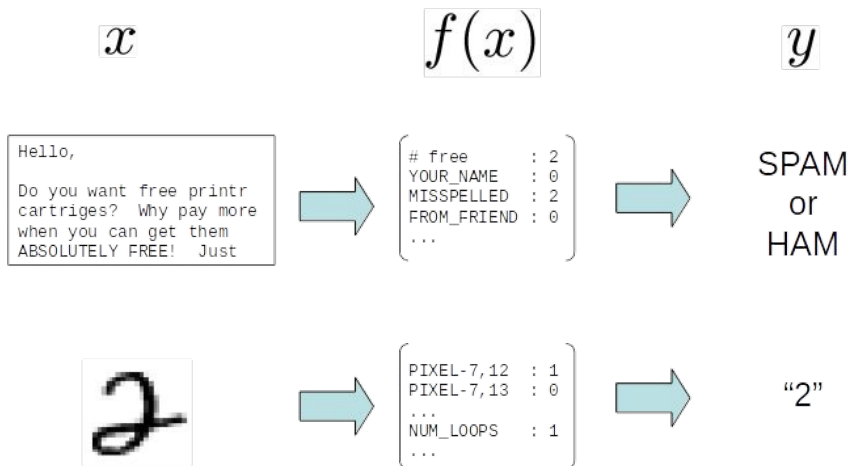
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Artificial Neural Networks

Example: Predicting SPAM email

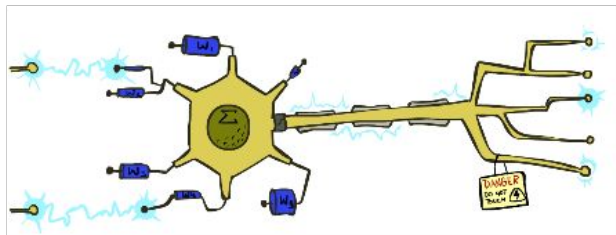
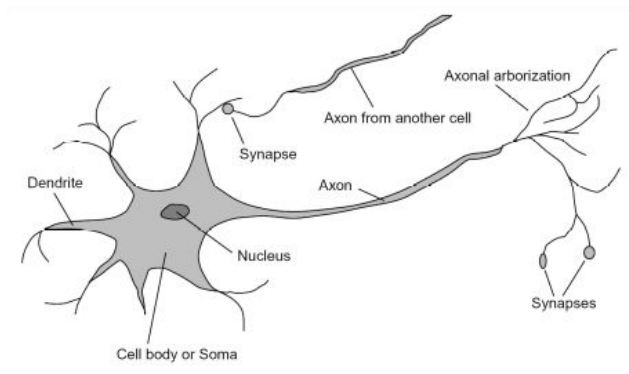
Feature Vectors



Artificial Neural Networks

Some (Simplified) Biology

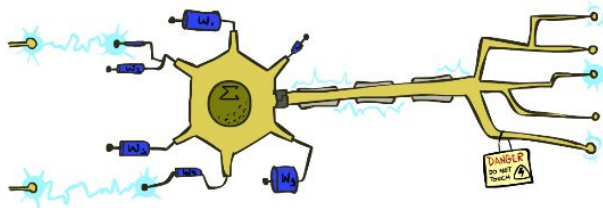
- Very loose inspiration: human neurons



Artificial Neural Networks

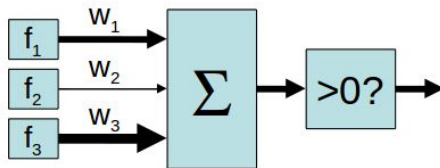
Linear Classifier

- Inputs are **feature values**
- Each feature has a **weight**
- Sum is the **activation**



$$\text{activation}_w(x) = \sum_i w_i \cdot f_i(x) = w \cdot f(x)$$

- If the activation is:
 - Positive, output +1
 - Negative, output -1

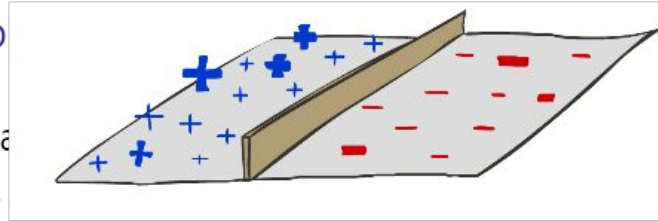


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Binary Decision Rule

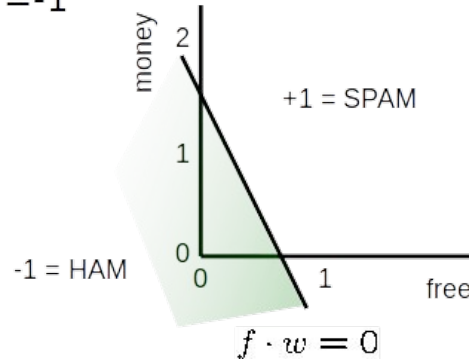
- In the space of feature vectors

- Examples are points
- Any weight vector is a hyperplane
- One side corresponds to $Y=+1$
- Other corresponds to $Y=-1$



w

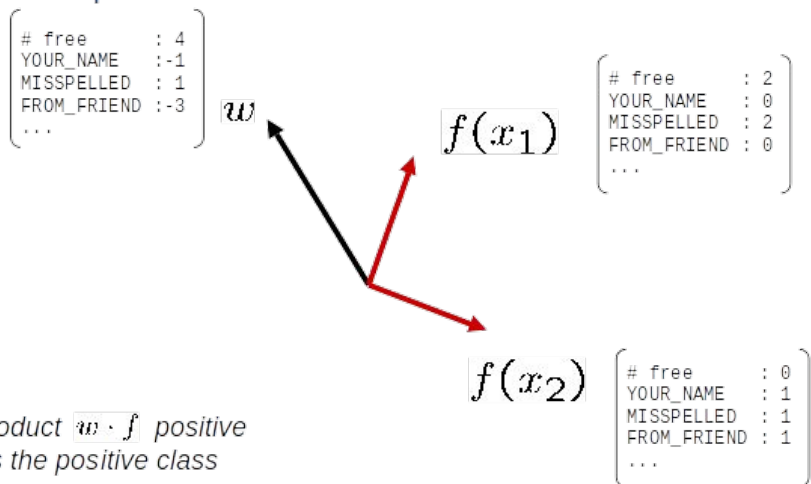
BIAS	:	-3
free	:	4
money	:	2
...	:	



Artificial Neural Networks

Weights

- Binary case: compare features to a weight vector
- Learning: figure out the weight vector from examples

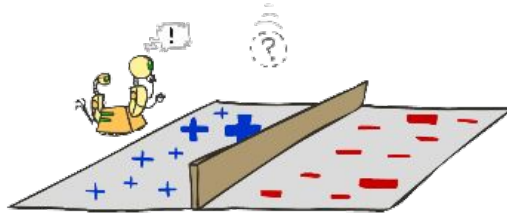


Dot product $w \cdot f$ positive
means the positive class

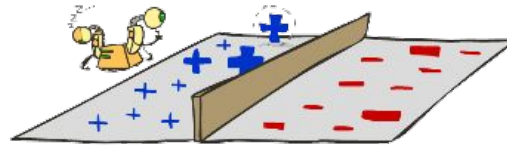
Artificial Neural Networks

Learning: Binary Perceptron

- Start with weights = 0
- For each training instance:
 - Classify with current weights



- If correct (i.e., $y=y^*$), no change!



- If wrong: adjust the weight vector

