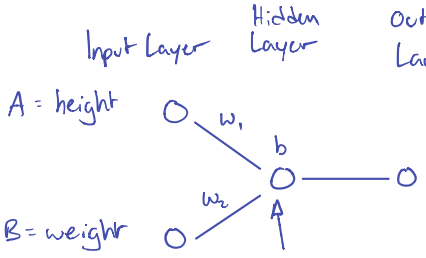
Flow of neural network: inputs → arithmatic → outputs
↑
N.N.



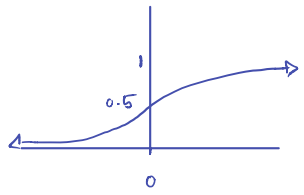
raw value = $w_1 A + w_2 B + b$

output value = sigmoid (raw value)

$0 < x < 1$

(discuss other network shapes)

sigmoid



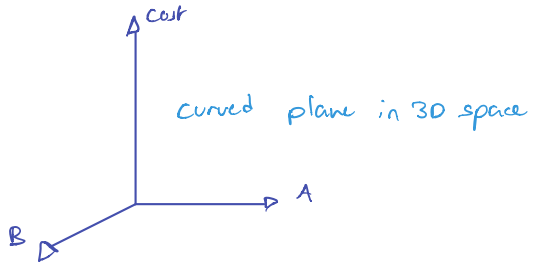
$f(x) = \frac{1}{1+e^{-x}}$ called "activation function"

we made a prediction! $x > 0.5$ = elephant

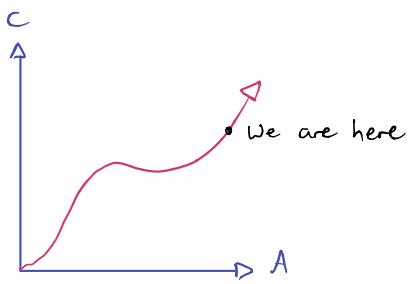
$x < 0.5$ = dog

What if our prediction is wrong, or not confident? Find "cost"

Our cost function: $C = (\text{prediction} - \text{target})^2$



Isolate 1 variable:



Does the weight need to be greater or smaller?

→ SIGN OF DERRIVATIVE says it needs to be smaller

→ Steepness says it needs to be much smaller

constant t

$C = (\text{prediction} - \text{target})^2$

Goal: $\frac{dc}{dw_1} = \frac{dc}{dp} \cdot \frac{dp}{dRV} \cdot \frac{dRV}{dw_1}$

① $\frac{dc}{dp} = 2(p - t)$ ✓

② Derr. of sigmoid: $s = \frac{1}{1+e^{-x}} = (1+e^{-x})^{-1}$

$s' = -1(1+e^{-x})^{-2}(-e^{-x})$

$= \frac{e^{-x}}{(1+e^{-x})^2} = \frac{1}{(1+e^{-x})} \cdot \frac{e^{-x}+1-1}{(1+e^{-x})}$

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

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

$$= s \cdot (1-s) \quad \checkmark$$

③ Recall $RV = w_1 A + w_2 B + b$

$$\frac{dRV}{dw_1} = A$$

$$\therefore \quad \frac{dc}{dw_1} = 2(p-t) \times \left[s(RV) \cdot (1-s(RV)) \right] \times A$$

$$\frac{dc}{dw_1} = \text{same} \times B$$

$$\frac{dc}{db} = \text{same} \times 1$$

Updates: $w_1 \mathrel{+}= LR \times \frac{dc}{dw_1}$ $\quad w_2 \mathrel{+}= LR \times \frac{dc}{dw_2}$ $\quad b \mathrel{+}= LR \times \frac{dc}{db}$