Activation Funⁿ

Drawback - if Activation funⁿ are not there, then, entire neural Network graph will be just a linear relⁿship.

Key role of Activation funⁿ is to introduce Non-linearity in your relⁿ ships

3 Most used Activation funⁿ :-

1) sigmoid = $\frac{1}{1+e^{-z}}$

2) tanh = $\frac{e^{z}-e^{-z}}{e^{z}+e^{-z}}$

3) relu = max $(0, z)$

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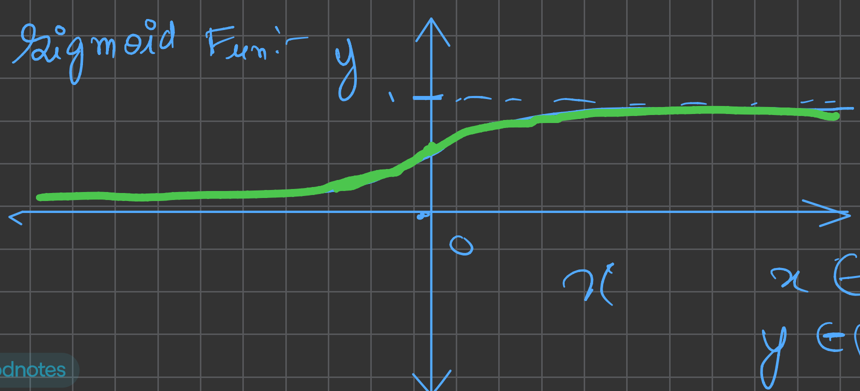
1) Sigmoid Funⁿ :-



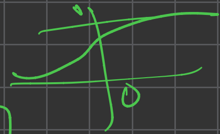
$x \in R$

$y \in (0,1)$

Derivation

we need to prove,

$$\sigma(z) = \frac{1}{1+e^{-x}}$$??



$$\text{Probability} = \frac{\#\text{ of outcomes for a event}}{\text{total }\#\text{ of outcomes}}$$

(How likely is the event)

$H = 20, T = 30$, $P(H) = 20/50$

$P(T) = 30/50$

$P(H) = 1 - P(T)$

$H = 50, T = 50$

Q How much more likely Head will come compare to Tail?

A $\Rightarrow$ $\frac{H}{T} = \frac{50}{50} = 1$

if Tail comes once, then head also will occur once.

Equally likely H & T to occur.

$H = 80$, $T = 20$

Q How much more likely head will come from Tail?

Ans $\frac{H}{T} = \frac{80}{20} = 4$

if Tail comes once, then H will come 4x more

Q How much more like Tail will come from Head?

A = $\frac{T}{H} = \frac{20}{80} = \frac{1}{4} = 0.25$

if H comes, 4x times, then Tail comes 1x time, or,

if H comes 1x time, then tail comes 0.25x time

So, in conclusion, there is a event which is happening & which is not happening

$$\boxed{\text{odds} = H/T \;\&\; T/H}$$

$$\boxed{\text{odds} = \frac{\text{\# of time of event happening}}{\text{\# of time of event not happening}}}$$

(Dividing by total outcome)

$$\text{odds} = \frac{P(\text{event happening})}{P(\text{event not happening})}$$

$$\boxed{\text{odds} = \frac{P}{1-P}}$$ ✱✱

$P(0,1)$

$P=0$, odds $=0$

$P=1$, odds $=\infty$

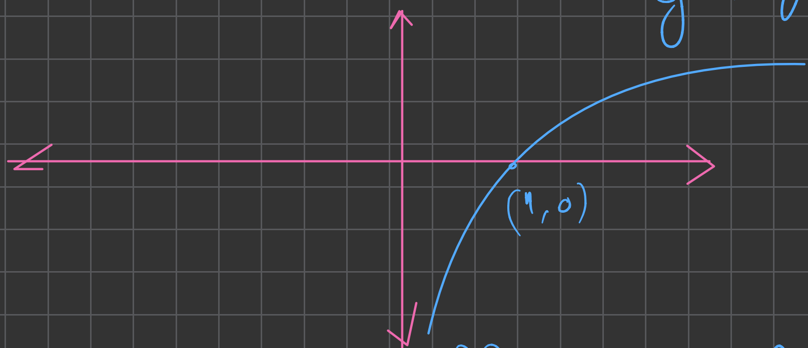
$(0,1) \rightarrow (0,\infty)$

map

understanding log (x) significance?

$x \in (0, \infty)$ $\quad$ $y \in (-\infty, \infty)$

$y = \log(x)$



even for $10^{32} \rightarrow$ No. $\rightarrow$ log $\rightarrow 32$

$10^{-32} \rightarrow$ No. $\rightarrow$ log $\rightarrow -32$

So, log is introduced for squashing in neural network

$$\text{odds} = \frac{p}{1-p}$$

(taking log on both side)

$$\log\left(\frac{p}{1-p}\right) = z \qquad \frac{1}{1+e^{-z}} = f(z)$$

$$\frac{p}{1-p} = e^{z}$$

$$\frac{p}{1-p} = e^{z} \Rightarrow p = (1-p)\cdot e^{z}$$

$$p = e^{z} - pe^{z} \Rightarrow p = \frac{e^{z}}{1+e^{z}}$$

$$p = \frac{e^{z}}{1+e^{z}} \approx \frac{1}{1+e^{-z}}$$

$$\left(\frac{\cancel{e^{z}}}{(1+e^{z})} * \frac{e^{z}}{\cancel{e^{z}}}\right)$$

$$\rightarrow \frac{1}{\frac{(1+e^{z})}{e^{z}}}$$

$$\downarrow$$

$$\frac{1}{\left(\frac{1}{e^{z}} + 1\right)}$$

$$\downarrow$$

$$\frac{1}{1+e^{-z}}$$

$$\boxed{\sigma(z) = \frac{1}{1+e^{-z}}}$$