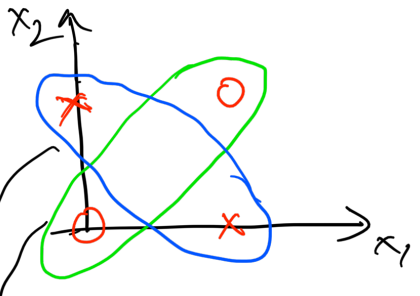
Logic Gates & NN – II:

Problem (4): XOR Gate:

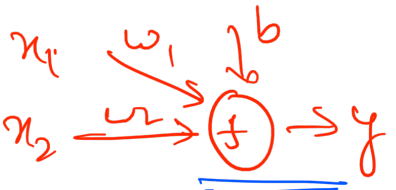


x_1	x_2	y
0	0	0
0	1	1
1	0	1
1	1	0

Q) Can we model this using a single neuron?

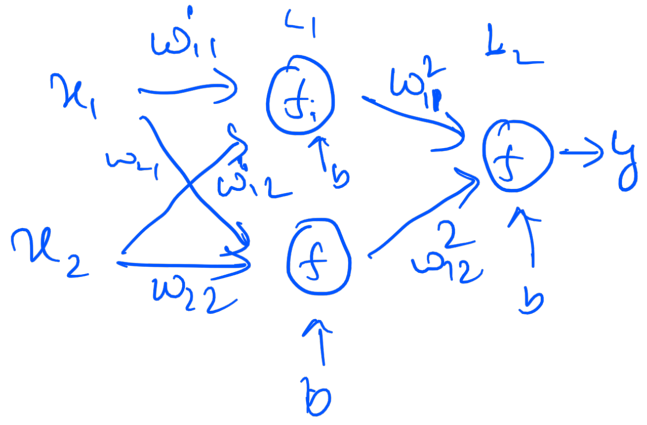
→ Eqn. of ellipse.

↳ $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$



$y = f(x_1 w_1 + x_2 w_2 + b)$

↳ x^2



Say $b = 0$

› Eqn:

$$y = f\left(w_{11}^2 y_{11} + w_{12}^2 y_{12} \right)$$

$$y_{11} = f\left(x_1 w_{11}^1 + x_2 w_{21}^1 \right)$$

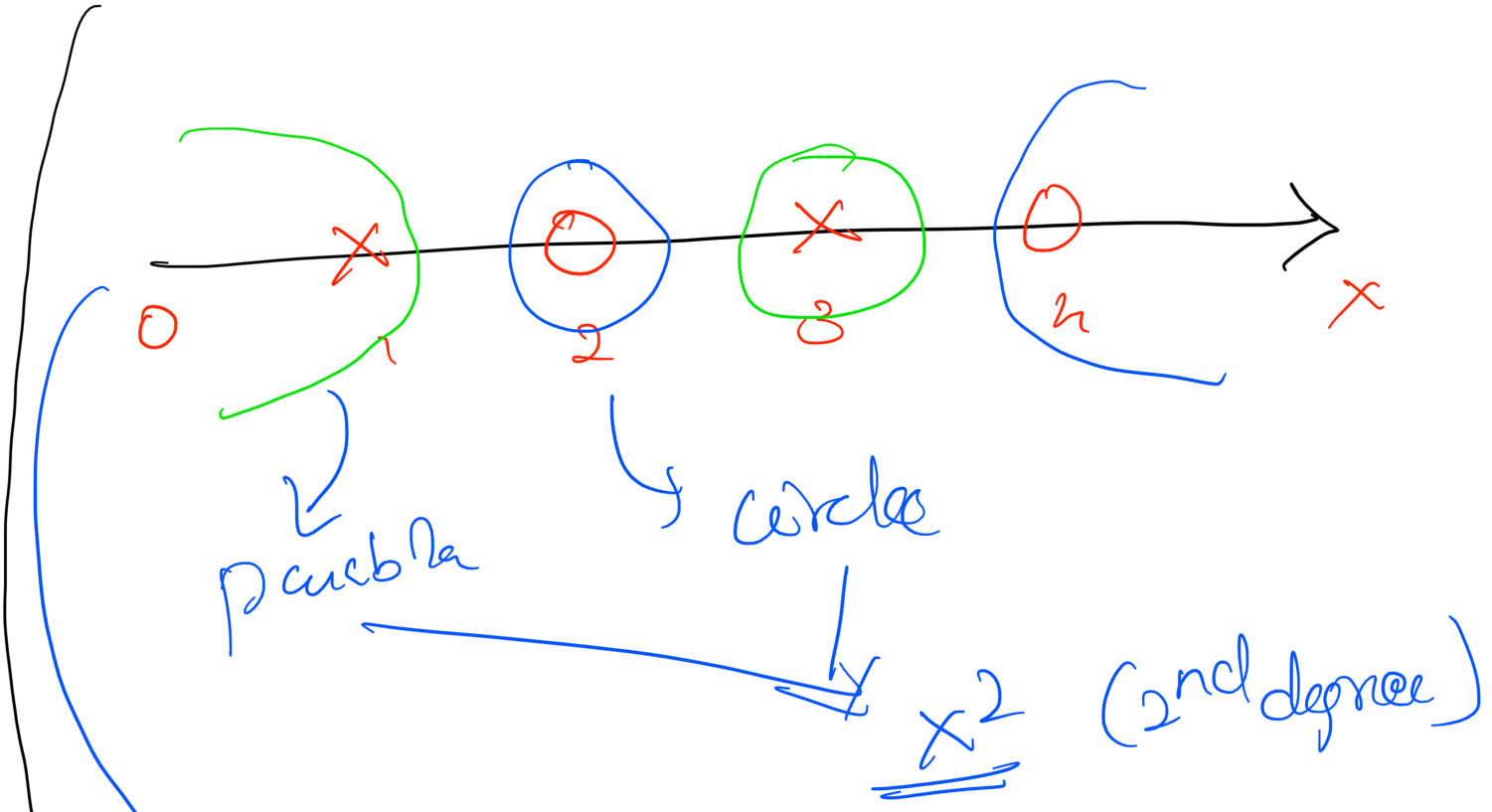
$$y_{12} = f\left(x_1 w_{12}^1 + x_2 w_{22}^1 \right)$$

Say $\Rightarrow f = I(\cdot)$

$$y = w_{11}^2 \left(x_1 w_{11}^1 + x_2 w_{21}^1 \right) + w_{12}^2 \left(x_1 w_{12}^1 + x_2 w_{22}^1 \right)$$

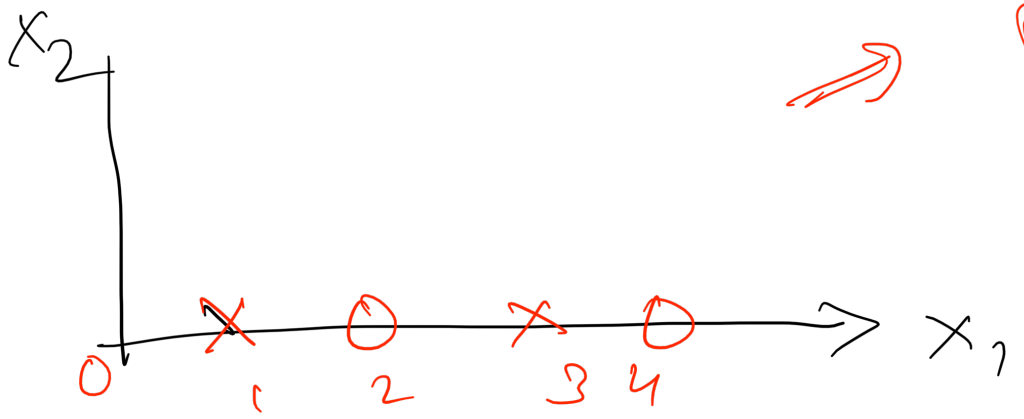
$$y = x_1 w_{11}^1 \cdot w_{11}^2 + x_2 w_{21}^1 w_{11}^2 + w_{12}^2 w_{12}^1 x_1 + x_2 w_{22}^1 w_{12}^2$$

1D Eqv. of XOR problem:



data ⇒ 1D

Expanding to 2D:

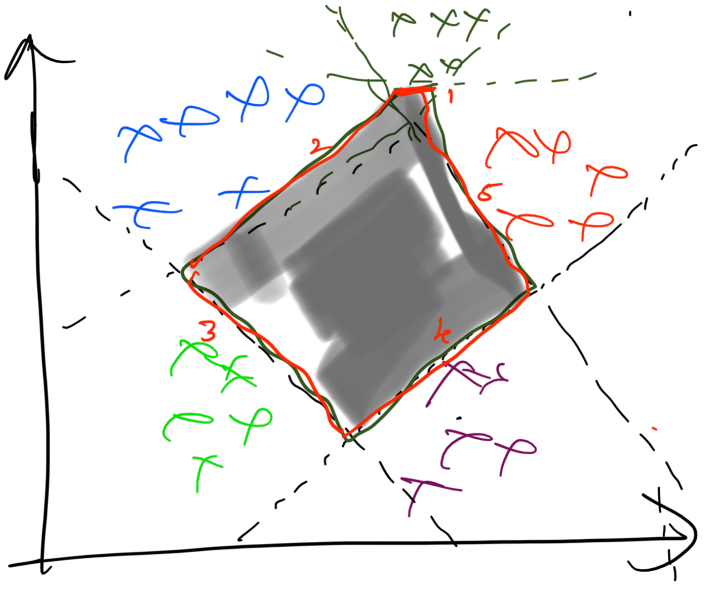


possible to solve

Decision boundary :

	Space
line / curve	2D
plane / surface	3D
Hyper surface of dim N	N+1

⇒ We can either make our NN more complex or transform our data to find a proper DB.



5 class classification problem.

Q) Can we solve this problem using SVMs?

↳ 1 Vs ALL method.

↳ piece wise linear approximation.

Q) Can NNs also solve this using PWLA?

Fourier Transform?

Q) Can NNs approximate any function?

if Yes → How?

if No → why?