Find function:

$$y = z_1 \text{ (or) } z_2$$

The truth table for function y

$$y_{in} = z_1 v_1 + z_2 v_2$$

Assume the weight are initialized to

$$v_1 = v_2 = 1$$

x_1	x_2	Y	z_1	z_2
0	0	0	0	0
0	1	1	0	1
1	0	1	1	0
1	1	0	0	0

Calculate the net inputs

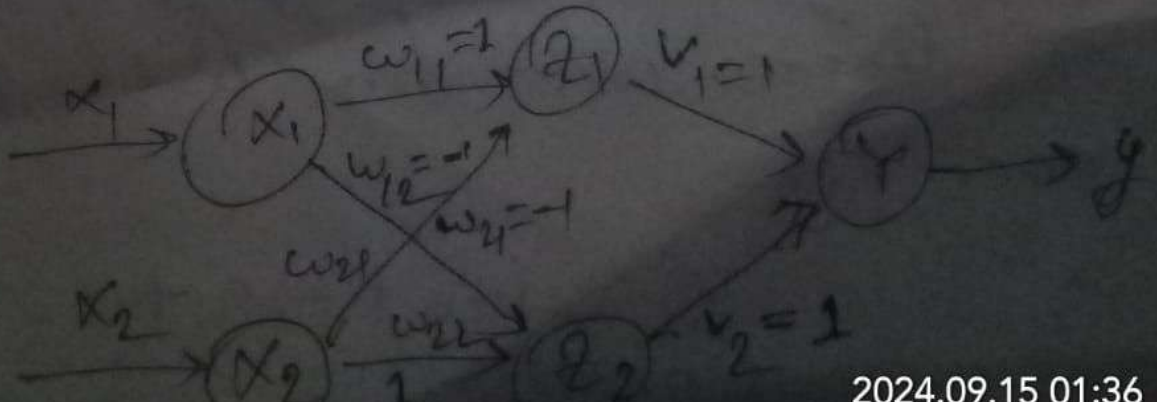
(0,0) $y_{in} = 0 \times 1 + 0 \times 1 = 0$

(0,1) $y_{in} = 0 \times 0 + 1 \times 1 = 1$

(1,0) $y_{in} = 1 \times 1 + 0 \times 1 = 1$

(1,1) $y_{in} = 1 \times 1 + 0 \times 1 = 0$

if $f(y_{in}) = \begin{cases} 1 & \text{if } y_{in} \geq 0 \\ 0 & \text{if } y_{in} < 0 \end{cases}$



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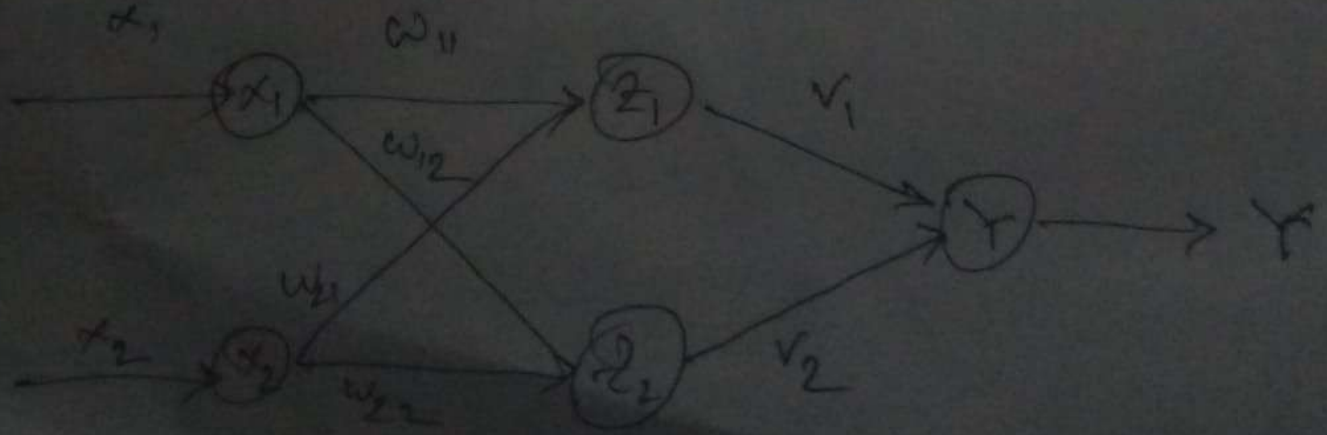
lab-2 Implement XOR function using Mccullock-pits neuron.

- Consider the truth table for XOR function
- the M-P neuron has no particular training algorithm.
- In M-P neuron, only analysis is being performed
- XOR function cannot be representation by simple and single logic function: it is represented as

$$y = x_1\bar{x}_2 + \bar{x}_1 x_2$$

$$y = z_1 + z_2 \quad \left| \begin{array}{l} z_1 = x_1\bar{x}_2 \\ z_2 = \bar{x}_1 x_2 \end{array} \right.$$

$$= z_1 \text{ OR } z_2$$



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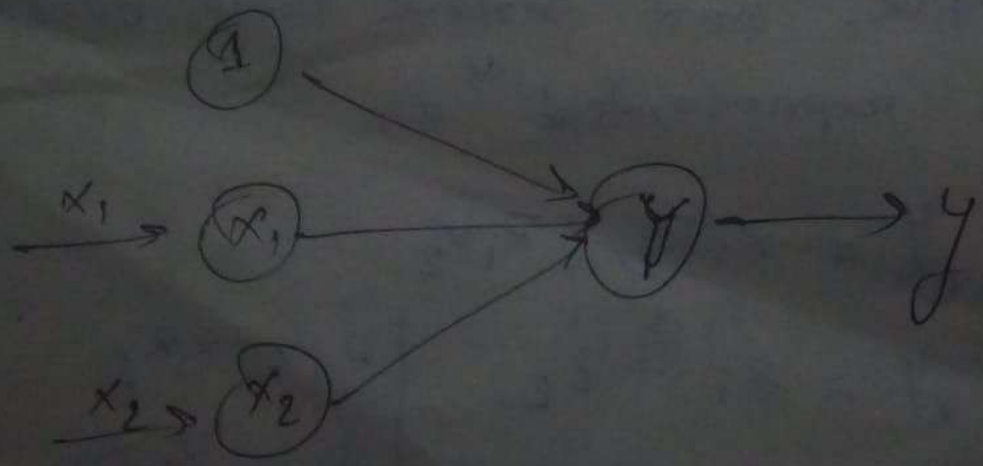
Epoch # 2

x_1	x_2	t	y_{in}	y	Δw_1	Δw_2	b	w_1	w_2	w_3
1	1	1	1	1	0	0	0	1	1	-1
1	-1	-1	-1	-1	0	0	0	1	1	-1
-1	1	-1	-1	-1	0	0	0	1	1	-1
-1	-1	-1	-3	-1	0	0	0	1	1	-1



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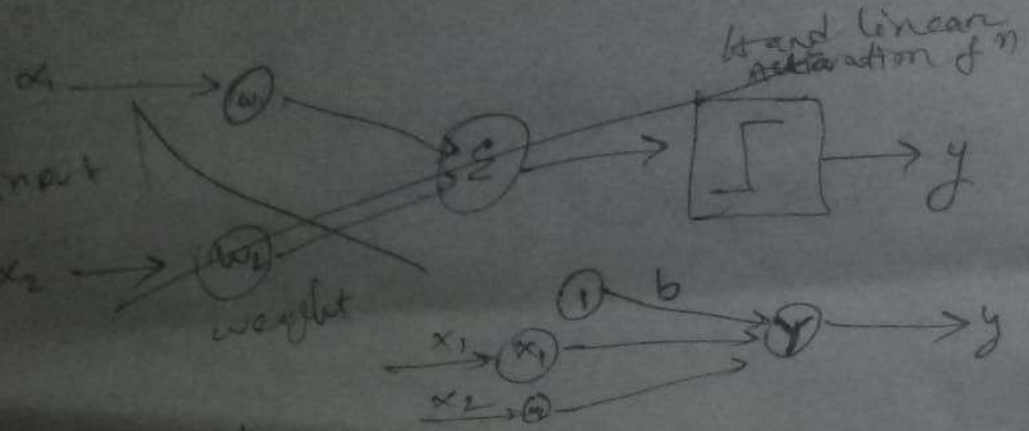

And Gate. Perceptron

Bias

$y_{in} = b + x_1 w_1 + x_2 w_2$

$$y = f(y_{in}) = \begin{cases} 1 & \text{if } y_{in} > 0 \\ 0 & \text{if } y_{in} = 0 \\ -1 & \text{if } y_{in} < 0 \end{cases}$$

$\Delta w_1 = \alpha t x_1$ (learning, input, target)

$\Delta w_2 = \alpha t x_2$

$\Delta b = \alpha t$

$\alpha = 1$

$$y_{in} = b + \sum_{i=1}^{n} x_i w_i$$

if $y \neq t$, then

$w(new) = w(old) + \alpha t x$

else $w(new) = w(old)$

input		target	Net input (y_{in})	Calculated output (y)	Weight changes			Weights		
x_1	x_2				Δw_1	Δw_2	Δb	w_1	w_2	b
								0	0	0
1	1	1	0	0	1	1	1	1	1	1
1	-1	-1	1	1	-1	1	-1	0	2	0
-1	1	-1	2	1	1	-1	-1	1	1	-1
-1	-1	-1	-3	-1	0	0	0	1	1	-1

If the $\theta = 2$, then the neuron fires

Hence $w_{11} = 1$ $w_{21} = -1$

x_1	x_2	z_2
0	0	0
0	1	1
1	0	0
1	1	0

for - $z_2 = \bar{x}_1 x_2$

consider $w_{12} = w_{22} = 1$

calculate the net inputs

$(0,0)$ $z_{in} = 0 \times 1 + 0 \times 1 = 0$

$(0,1)$ $z_{in} = 0 \times 1 + 1 \times 1 = 1$

$(1,0)$ $z_{in} = 1 \times 1 + 0 \times 1 = 1$

$(1,1)$ $z_{in} = 1 \times 1 + 1 \times 1 = 2$

$$f(y_{in}) = \begin{cases} 1 & \text{if } y_{in} \geq \theta \\ 0 & y_{in} < \theta \end{cases}$$

Hence, it is not possible to obtain function z_2 using these weights

so we update the weight

$w_{12} = -1$, $w_{22} = 1$

calculate the net inputs

$(0,0)$ $z_{in} = (0 \times -1) + 0 \times 1 = 0$

$(0,1)$ $z_{in} = (0 \times -1) + 1 \times 1 = 1$

$(1,0)$ $z_{in} = -1 + 0 = -1$

$(1,1)$ $z_{in} = -1 + 1 = 0$

Hence

$w_{12} = -1$,

$w_{22} = 1$

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Our target values are 0.01 and 0.99 our Y_1 and Y_2 value is not matched with our target values T_1 and T_2. So find the error

$$E_{Total} = \sum \frac{1}{2}(target - output)^2$$

$$= \frac{1}{2}(0.01 - 0.7513)^2 + \frac{1}{2}(0.99 - 0.7729)^2$$

$$= 0.2983711$$

Backpass the output layer

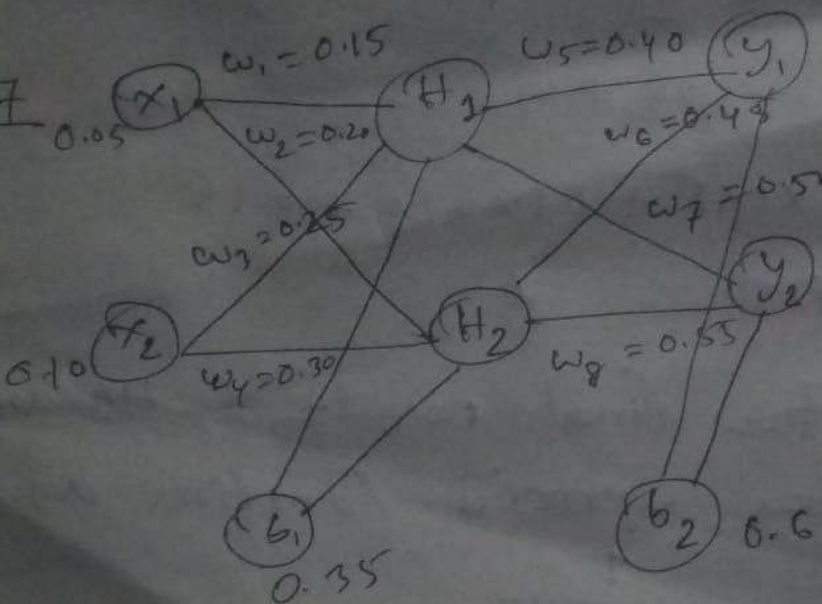
$$Error = \frac{\partial E_{Total}}{\partial w}$$

- We perform backword process so first Consider the last weight w_5

Although there are many ways to defined this error, one common measure is

$$E(\vec{w}) = \frac{1}{2} \sum_{d \in D} (t_d - o_d)^2$$

CMB-7



Here: Input values

$x_1 = 0.05$ $x_2 = 0.10$

initial weight

$w_1 = 0.15$ $w_5 = 0.40$

$w_2 = 0.20$ $w_6 = 0.45$

$w_3 = 0.25$ $w_7 = 0.50$

$w_4 = 0.30$ $w_8 = 0.55$

Bias values → $T_1 = 0.01$

$T_2 = 0.99$

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বাংলাদেশ উন্মুক্ত বিশ্ববিদ্যালয় 2073611

অতিরিক্ত খাতা

পরীক্ষার্থী কর্তৃক পূরণীয়

কক্ষ পরিদর্শকের স্বাক্ষর ও তারিখ

১। পরীক্ষা ..... সাল

২। বিষয়/কোর্সের নাম : Md. Omar Faruk

৩। সেমিস্টার/বর্ষ :

৪। প্রশ্নপত্র কোড / বিষয় কোড :

৫। পরীক্ষার তারিখ : ..... সকাল/বিকাল

(এ স্থান হতে উত্তর লেখা আরম্ভ করতে হবে)

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lab → 4

	Area	bedrooms	Price
1	260	3	550000
2	3000	4	565000
3	3200	3	610000
4	3600	3	595000
5	4000	5	760000
6	4100	6	810000

machine learning model

$= w_1 \times area + w_2 * bedrooms + bias$

$w_1 = w_2 = b = 1$

for first : Price $= 1 \times 260 + 3 \times 1 + 1$

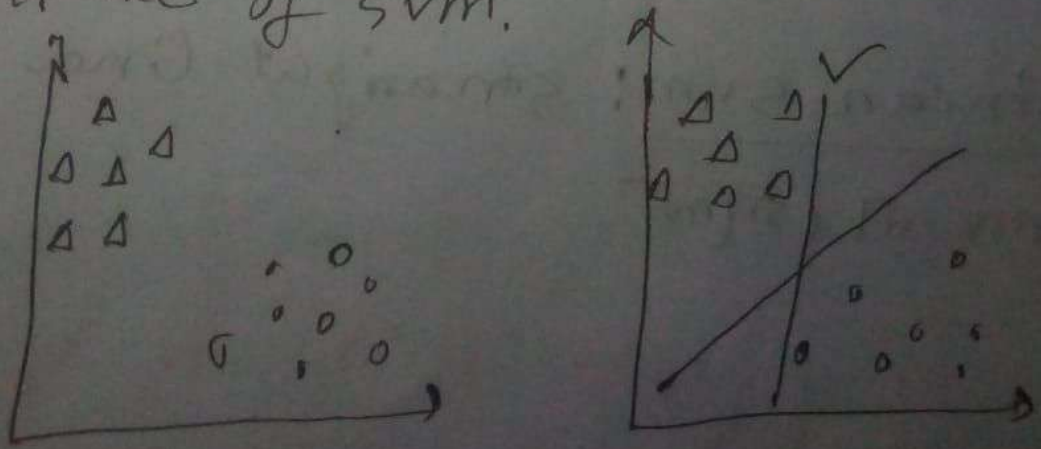
$= 2604$

predit value is = 550000

error = (Price - Predit) = (2604 -

Support Vector machine:- Support Vector machine or SVM is one of the most popular supervised learning algorithms, which is used for classification as well as Regration & problems

- However, primarily, it is used for classification problems in ML.
- The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future.
- The best boundary is known as the hyperplane of SVM.



- first function $z_1 = x_1 \bar{x}_2$
- The fourth table for function z_1

Assume the weights are initialized to

$$w_{11} = w_{21} = 1$$

calculate the net inputs

$(0,0)\ z_{in} = 0 \times 1 + 0 \times 1 = 0$

$(0,1)\ z_{in} = 0 \times 1 + 1 \times 1 = 1$

$(1,0)\ z_{in} = 1 \times 1 + 0 \times 1 = 1$

$(1,1)\ z_{in} = 1 \times 1 + 1 \times 1 = 2$

if $f(y_{in}) = \begin{cases} 1 & \text{if } y_{in} \geq \theta \\ 0 & \text{if } y_{in} \leq \theta \end{cases}$ Activation function

Hence, it is not possible to obtain function z_1 using ~~those~~ these weight

x_2	x_1	z_1
0	0	0
0	1	0
1	0	1
1	1	0

we assain a new weight

$$w_{11} = 1 \ ; \ w_{21} = -1$$

Calculate the net inputs

$(0,0)\ z_{in} = 0 \times 1 + 0 \times (-1) = 0$

$(0,1)\ z_{in} = 0 \times 1 + 1 \times (-1) = -1$

$(1,0)\ z_{in} = 1 \times 1 + 0 \times (-1) = 1$

$(1,1)\ z_{in} = 1 \times 1 + 1 \times (-1) = 0$

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Forward pass:: Now, we first calculate the values H_1 and H_2 by a forward pass.

To find the value of H1 we first multiply the input value from the weight as

$$H_1 = x_1 w_1 + x_2 w_2 + b_1$$
$$= 0.05 \times 0.15 + 0.1 \times 0.20 + 0.35$$
$$= 0.3775$$

To calculate the final result of H1, we performed the sigmoid function as

$$H1 \text{ final} = \frac{1}{1 + \frac{1}{e^{H_1}}}$$
$$= 0.593269992$$

We will calculate the value of H_2 in the same way as H1

$$H_2 = x_1 w_3 + x_2 w_4 + b_1$$
$$= 0.395$$

To calculate the final result of H2, we performed the sigmoid function

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matched with our

So

total error = error1 + error2 + ... + error6

Mean squard Error = $\frac{\text{Total Error}}{6}$

$error_2 = (3005 - 56000)^2 = 3.15838838 \times 10^{11}$

$error_3 = (3204 - 610000)^2 = 3.68201898 \times 10^{11}$

$error_4 = (3604 - 59500)^2 = 3.49749228 8 \times 10^{11}$

$error_5 = (4006 - 760000)^2 = 5.71526928 \times 10^{11}$

$error_6 = (4107 - 810000)^2 = 6.49463579 \times 10^{9}$

Mean squard Error = (MSE) = $\frac{\text{Total error}}{6}$

$= 3.75796575 \times 10^{11}$

$w_1 = w_1 - \text{learning rate} * \frac{\partial (MSE)}{\partial w_1} = 1 - (-50) = 51$

$w_2 = w_2 - \text{learning rate} * \frac{\partial (MSE)}{\partial w_2} = 1 - (-8) = 9$

$b = b - \text{learning rate} * \frac{\partial (MSE)}{\partial b} = 1 - (20000)$

$= 20001$

2nd row -

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জাতীয় বিশ্ববিদ্যালয়

ক্রমিক নং : D242121003

অতিরিক্ত উত্তরপত্র

১। পরীক্ষার নাম : ..... সাল .....

২। বিষয় : .....

৩। কোর্স/পত্র কোড : 100605

৪। বিষয়ের শিরোনাম : .....

৫। তারিখ : .....

৬। ইনভিজিলেটরের স্বাক্ষর ও তারিখ : .....

(এ স্থান হতে উত্তর লেখা আরম্ভ করতে হবে)

Lab-1 ২টি feedforword neural networks, ব্যবহার করে binary classification tasks. এটি ব্যবহার করে we made simple logic function. like AND function.

Perception model :- এক বা তার অধিক input নিয়ে এবং weight for each input, sumation function activation function and simple output.

Explain input :- {(-1, -1), (-1, 1), (1, -1), (1, 1)}

target {-1, -1, -1, 1}

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$$H_2 = \frac{1}{1+e^{-H_2}}$$

$$= 0.59685437$$

Now calculate the values of Y_1 and Y_2 in the same way as we calculate the H1 and H2

$$y_1 = H1 * w_5 + H_2 * w_6 + b_2$$

$$= 1.10590597$$

We will ~~for~~ calculate ~~the~~ value of Y_2 ~~in the same way as Y_1~~

calculate the final value of Y_1

$$Y_1 = \frac{1}{1+e^{-y_1}} = 0.75136507$$

Similarly $y_2 = H1 * Y_7 + H_2 Y_8 + b_2$

$$= 1.2249214$$

$$Y_2 \text{ final} = \frac{1}{1+\frac{1}{e^{y_2}}} = 0.77297894$$

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জাতীয় বিশ্ববিদ্যালয়

ক্রমিক নং ঃ .....

অতিরিক্ত উত্তরপত্র

১। পরীক্ষার নাম ঃ ..... সাল .....

২। বিষয় ঃ .....

৩। কোর্স/পত্র কোড ঃ 10605

৪। বিষয়ের শিরোনাম ঃ .....

৫। তারিখ ঃ .....

৬। ইনভিজিলেটরের স্বাক্ষর ও তারিখ ঃ .....

(এ স্থান হতে উত্তর লেখা আরম্ভ করতে হবে)

Lab-1 2টি feedforward neural networks, ও ব্যবহার হয় binary classification tasks. এই ব্যবহার করে হয় mode simple logic function. like AND function.

Perception model :- এক বা তার অধিক input নিয়ে এরে। weight. for each input, sumation function, activation function and simple output.

Bitplan input :- {(-1, -1), (-1, 1), (1, -1), (1, 1)}

target {-1, -1, -1, 1}

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The dimensions of the hyperplane depend on the features present in the dataset which means if there are 2 features (show in the image) then hyperplane will be a straight line.

- And if there are 3 features, then hyperplane will be a 2-dimension plane

- We always create a hyperplane that has a maximum margin, which means the maximum distance between the data points.

Linear SVM: straight line হলে linear বলে

non-linear SVM: straight line হলে non-linear বলে