PR EndSem

N. KAUSIK
COE17B010

21.

Supervised	Unsupervised
Bayes Classifier	PCA
SVM	Mixture of Gaussian Clustering
Multi layer Perceptron	
KNN	

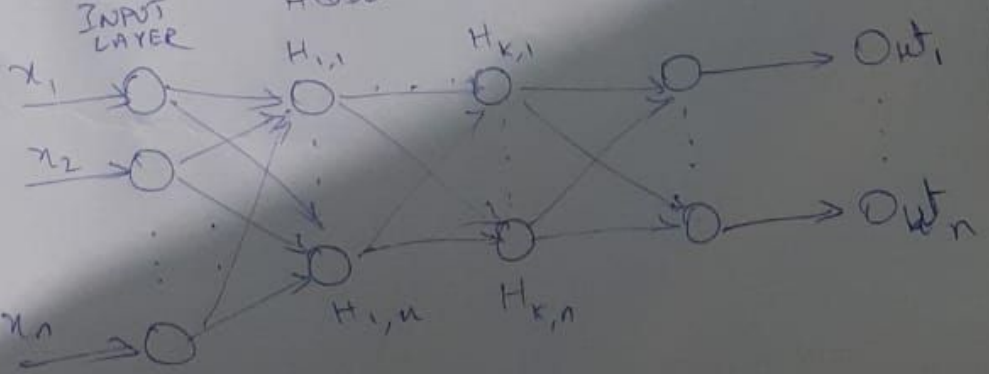
22.

1 neuron is needed as it is linearly separable and only 2 classes.

Generally for neural networks in output layer SOFTMAX act fn is used.

As it is linearly separable, we can use threshold-based act fn (step function) for output layer.

23.



For output layer, generally SOFTMAX act fn is used.

24. a) As A has fewer units, it is easier to implement and run

b) As B has a middle layer, it has fewer connections than A. So, it is less likely to overfit.

25. As each input can be 0 or 1 only,
no of input patterns for diagram = $2^3 = 8$
for 4 inputs, $2^4 = 16$
For n inputs, 2^n possibilities

26. $v = w_1x_1 + w_2x_2 + w_3x_3$

$$y = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{else} \end{cases}$$

P_1) $v = 2\times1 - 4\times0 + 1\times0 = 2 \Rightarrow 2>0 \Rightarrow y = 1$

P_2) $v = 2\times0 - 4\times1 + 1\times1 = -3 \Rightarrow -3<0 \Rightarrow y = 0$

P_3) $v = 2\times1 - 4\times0 + 1\times1 = 3 \Rightarrow 3>0 \Rightarrow y = 1$

P_4) $v = 2\times1 - 4\times1 + 1\times1 = -1 \Rightarrow -1<0 \Rightarrow y = 0$

27. Hidden layer,

$v_3 = w_{13}x_1 + w_{23}x_2 \qquad v_4 = w_{14}x_1 + w_{24}x_2$

$y_3 = \varphi(v_3)$, $y_4 = \varphi(v_4)$

output,

$v_5 = w_{35}y_3 + w_{45}y_4 \qquad v_6 = w_{56}y_5 + w_{46}y_4$

$y_5 = \varphi(v_5)$, $y_6 = \varphi(v_6)$

P1) (0,0)

$v_3 = -2\times0 + 3\times0 = 0 \Rightarrow y_3 = 1$

$v_4 = 4\times0 - 1\times0 = 0 \Rightarrow y_4 = 1$

$v_5 = 1\times1 - 1\times1 = 0 \Rightarrow y_5 = \boxed{1}$

$v_6 = -1\times1 + 1\times1 = 0 \Rightarrow y_6 = \boxed{1}$ ⇒ output is (1,1)

P2) (1,0)

$v_3 = -2\times1 + 3\times0 = -2 \Rightarrow y_3 = 0$

$v_4 = 4\times1 - 1\times0 = 4 \Rightarrow y_4 = 1$

$v_5 = 1\times0 - 1\times1 = -1 \Rightarrow y_5 = \boxed{0}$

$v_6 = -1\times0 + 1\times1 = 1 \Rightarrow y_6 = \boxed{1}$ ⇒ output is (0,1)

P3) (0,1)

$v_3 = -2\times0 + 3\times1 = 3 \Rightarrow y_3 = 1$

$v_4 = 4\times0 - 1\times1 = -1 \Rightarrow y_4 = 0$

$v_5 = 1\times1 - 1\times0 = 1 \Rightarrow y_5 = \boxed{1}$

$v_6 = -1\times1 + 1\times0 = -1 \Rightarrow y_6 = \boxed{0}$ ⇒ output is (1,0)

P4) (1,1)

$v_3 = -2\times1 - 3\times1 = 1 \Rightarrow y_3 = 1$

$v_4 = 4\times1 - 1\times1 = 3 \Rightarrow y_4 = 1$

$v_5 = 1\times1 - 1\times1 = 0 \Rightarrow y_5 = \boxed{1}$

$v_6 = -1\times1 + 1\times1 = 0 \Rightarrow y_6 = \boxed{1}$ ⇒ output is (1,1)

28.

$h_1 = 1 \times 0.3 + 0.1 \times 0.1 + 0.2 \times 0.2 = 0.35$

Sigmoid $(h_1) = 0.59$

$h_2 = 1 \times 0.2 + 0.1 \times 0.1 + 0.2 \times 0.2 = 0.25$

Sigmoid $(h_2) = 0.56$

$O_1 = 1 \times 0.5 + 0.59 \times 0.1 + 0.56 \times 0.2 = 0.671$

Sigmoid $(O_1) = 0.662$

$O_2 = 1 \times 0.4 + 0.59 \times 0.1 + 0.56 \times 0.2 = 0.571$

Sigmoid $(O_2) = 0.639$

$y_1 = 0.662 \qquad y_2 = 0.639$

$\delta_1^2 = (0.662 - 0.4) \times 0.662 \times (1 - 0.662) = 0.0586$

$\delta_2^2 = (0.639 - 0.3) \times 0.639 \times (1 - 0.639) = 0.0782$

$\frac{\partial E}{\partial \omega_{01}^2} = 0.0586, \quad \frac{\partial E}{\partial \omega_{02}^2} = 0.0782, \quad \frac{\partial E}{\partial \omega_{11}^2} = 0.036$

$= 0.0586 \times 0.4$

$\frac{\partial E}{\partial \omega_{12}^2} = 0.0782 \times 0.586 = 0.0458$

$\frac{\partial E}{\partial \omega_{21}^2} = 0.0586 \times 0.562 = 0.032$

$\frac{\partial E}{\partial \omega_{22}^2} = 0.0782 \times 0.562 = 0.0439$