Forward Propagation in MLP (ANN)

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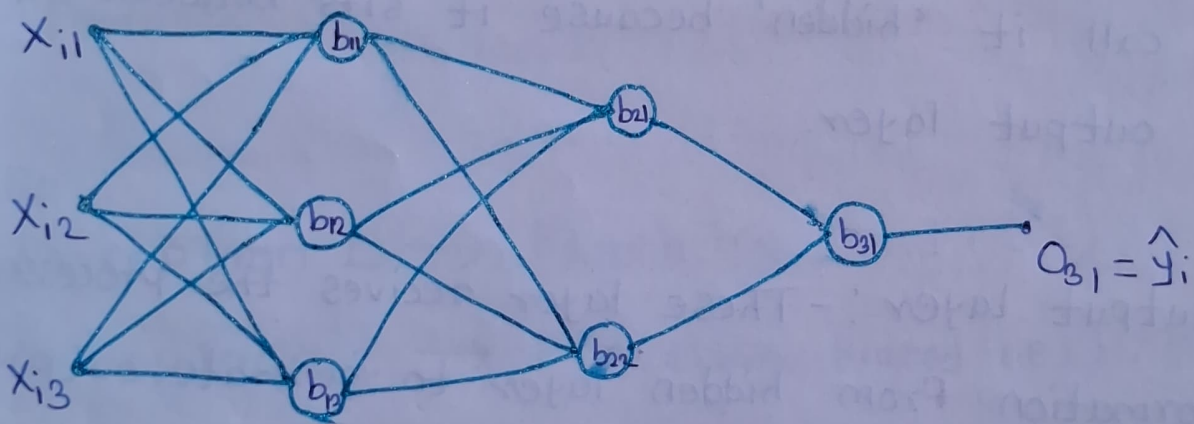## * Forward Propagation :-

Forward Propagation is the entire process of model from taking inputs throug input layer, processing it in hidden layers and making the prediction.

In this process the calculations happens through dot product of matrix.

Layer 1

$$\begin{bmatrix} W'_{11} & W'_{12} & W'_{13} \\ W'_{21} & W'_{22} & W'_{23} \\ W'_{31} & W'_{32} & W'_{33} \end{bmatrix}^{T} \begin{bmatrix} X_{i1} \\ X_{i2} \\ X_{i3} \end{bmatrix} + \begin{bmatrix} b_{11} \\ b_{12} \\ b_{13} \end{bmatrix}$$

3×3

$$\begin{bmatrix} W'_{11}X_{11} + W'_{12}X_{12} + W'_{13}X_{13} \\ W'_{21}X_{11} + W'_{22}X_{12} + W'_{23}X_{13} \\ W'_{31}X_{11} + W'_{32}X_{12} + W'_{33}X_{13} \end{bmatrix} + \begin{bmatrix} b_{11} \\ b_{12} \\ b_{13} \end{bmatrix} = \begin{bmatrix} O_{11} \\ O_{12} \\ O_{13} \end{bmatrix}$$

Layer 2

$$\begin{bmatrix} W^2_{11} & W^2_{12} & W^2_{13} \\ W^2_{21} & W^2_{22} & W^2_{23} \end{bmatrix}^T \underset{2\times 3}{} \begin{bmatrix} O_{11} \\ O_{12} \\ O_{13} \end{bmatrix}_{3\times 1} + \begin{bmatrix} b_{21} \\ b_{22} \end{bmatrix}$$

$$\begin{bmatrix} W_{11}O_{11} + W_{12}O_{12} + W_{13}O_{13} \\ W_{21}O_{11} + W_{22}O_{12} + W_{23}O_{13} \end{bmatrix}_{1\times 2} + \begin{bmatrix} b_{21} \\ b_{22} \end{bmatrix}_{2\times 2} = \begin{bmatrix} O_{31} \end{bmatrix}$$

$$= \hat{y}_i$$