Day-3 24 Jun 2023

$$f : \mathbb{R}^n \longrightarrow \mathbb{R}$$

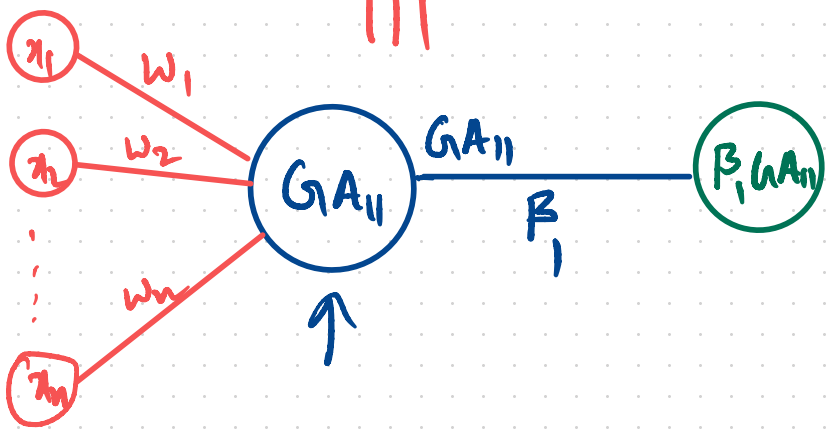
$$f(x) = \sum_{j=1}^{m} \beta_j \prod_{k=1}^{l_j} G(A_{jk}(x))$$

$m = 1, \quad l_1 = 1$

$$f(x) = \sum_{j=1}^{1} \beta_j \prod_{k=1}^{l_j} G(A_{jk}(x))$$

$$f(x) = \beta_1 \left(G(A_{11}(x)) \right)$$

$$\Downarrow\Downarrow\Downarrow$$



$m=1, \quad l_1=2$

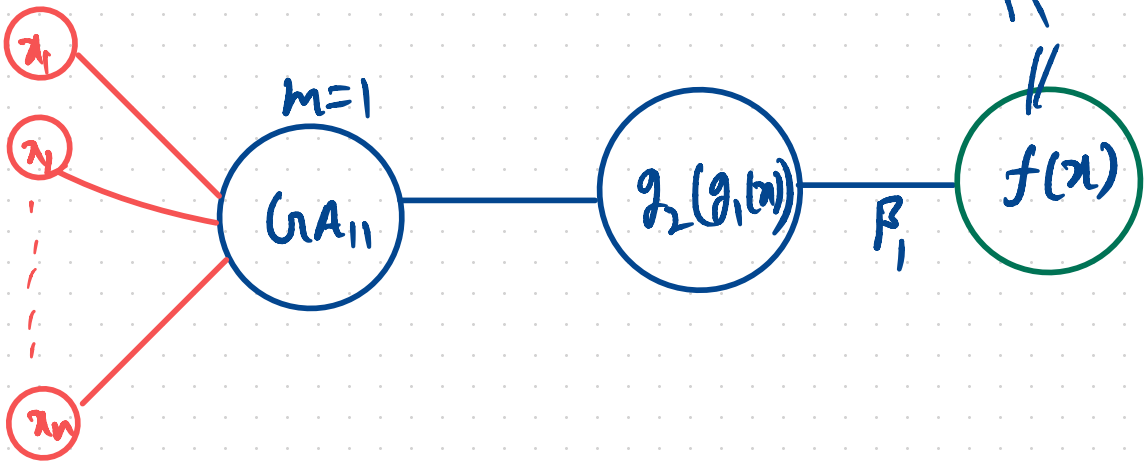
$$f(x) = \sum_{j=1}^{1} \beta_j \prod_{k=1}^{2} \sigma\left(A_{jk}(x)\right)$$

$$= \beta_1 \prod_{k=1}^{2} \sigma\left(A_{1k}(x)\right)$$

$\sigma(A_{11}(x)) = g_1(x)$

$\sigma(A_{12}(x)) = g_2(x)$

$$= \beta_1 \left(g_2\left(g_1(x)\right)\right)$$



$n=2, \quad l_1=1, \quad l_2=1$

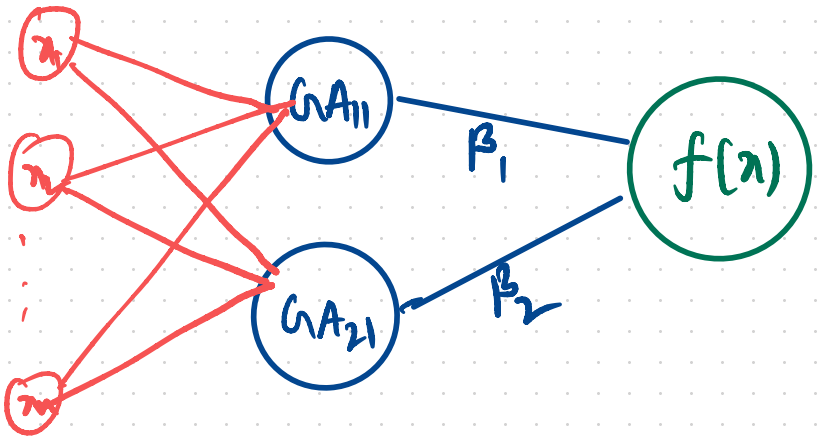
$$f(x) = \sum_{j=1}^{2} \beta_j \prod_{k=1}^{l_j} G_1(A_{jk}(x))$$

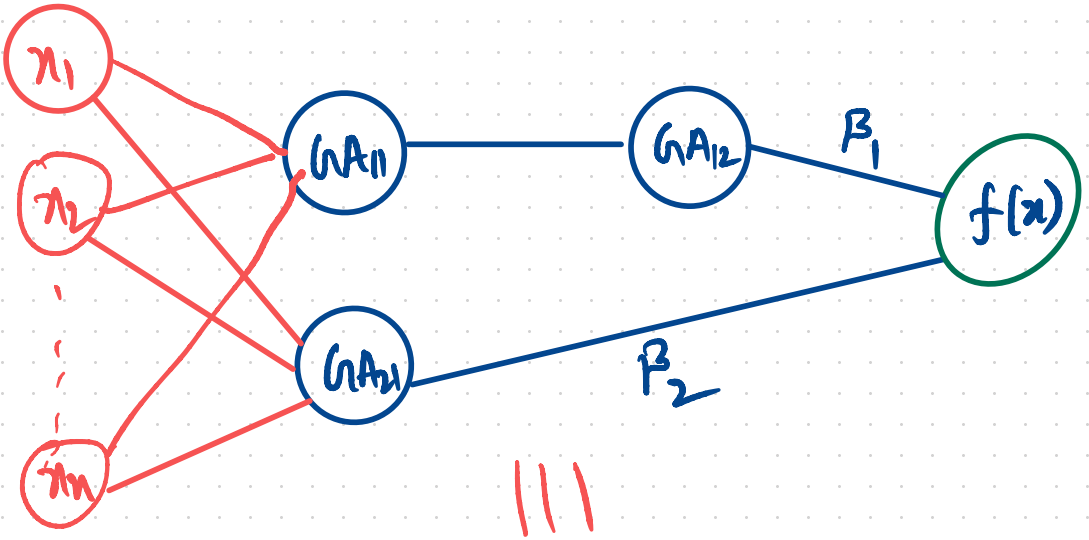
$$= \beta_1 \left[\prod_{k=1}^{1} G_1(A_{1k}(x)) \right] + \beta_2 \left[\prod_{k=1}^{1} G_1(A_{2k}(x)) \right]$$

$$G_1(A_{11}(x)) = g_1^1(x)$$

$$G_1(A_{21}(x)) = g_1^2(x)$$

$$f(x) = \beta_1 (g_1^1(x)) + \beta_2 (g_1^2(x))$$





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$$f(x) = \sum_{j=1}^{2} \beta_j \prod_{k=1}^{\lambda_j} G(A_{jk}(x))$$

$\lambda_1 = 2, \lambda_2 = 1$

$$f(x) \in \sum \Pi^n(G)$$

$$\sum^{n}(G) \quad , \quad \sum \Pi^{n}(G)$$

$$f : \mathbb{R}^n \longrightarrow \mathbb{R}$$

$$f : \mathbb{R}^n \longrightarrow \mathbb{R}^s$$

$$\sum^{n,s}(G)$$

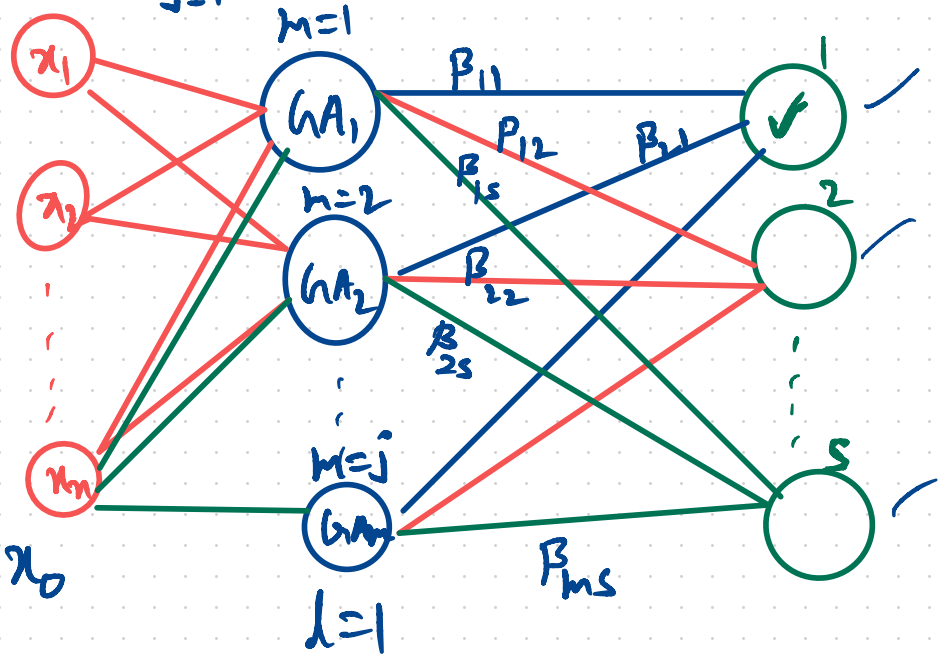
$$f(x) = \sum_{j=1}^{m} \bar{\beta}_j \, G(A_j(x))$$

$$\bar{\beta}_j \in \mathbb{R}^{s\times 1} \quad , \quad \bar{\beta}_j = \begin{pmatrix} \beta_{j1} \\ \beta_{j2} \\ \vdots \\ \beta_{js} \end{pmatrix}$$

$$f(x) = \bar{\beta}_1 G(A_1(x)) + \bar{\beta}_2 G(A_2(x)) + \cdots$$
$$\cdots + \bar{\beta}_m G(A_m(x))$$

$$= \begin{bmatrix} \beta_{11} \\ \beta_{12} \\ \vdots \\ \beta_{1s} \end{bmatrix} h(A_1(x)) + \begin{bmatrix} \beta_{21} \\ \beta_{22} \\ \vdots \\ \beta_{2s} \end{bmatrix} h(A_2(x)) + \cdots \begin{bmatrix} \beta_{m1} \\ \vdots \\ \beta_{ms} \end{bmatrix} h(A_m(x))$$

$$f(x) = \begin{bmatrix} \sum_{j=1}^{m} \beta_{j1} h(A_j(x)) \\ \sum_{j=1}^{m} \beta_{j2} h(A_j(x)) \\ \vdots \\ \sum_{j=1}^{m} \beta_{js} h(A_j(x)) \end{bmatrix}$$



"Fully connected sigle hidden layer ANN"

$$\psi = (a_1, a_2, \dots a_k)$$

$$\sum_k^{n,s}(\psi)$$

$$f : \mathbb{R}^n \longrightarrow \mathbb{R}^s$$

$$f(x) = \sum_{\lambda=1}^{k} \left(\sum_{j=1}^{m_\lambda} \beta_{j\lambda} G_\lambda\left(A_{j\lambda}(x_{\lambda-1})\right) \right)$$

$$\sum^n(a), \quad \sum \Pi^n(a),$$

$$\sum^{n,s}(a), \quad \sum_k^{n,s}(\psi)$$

✓