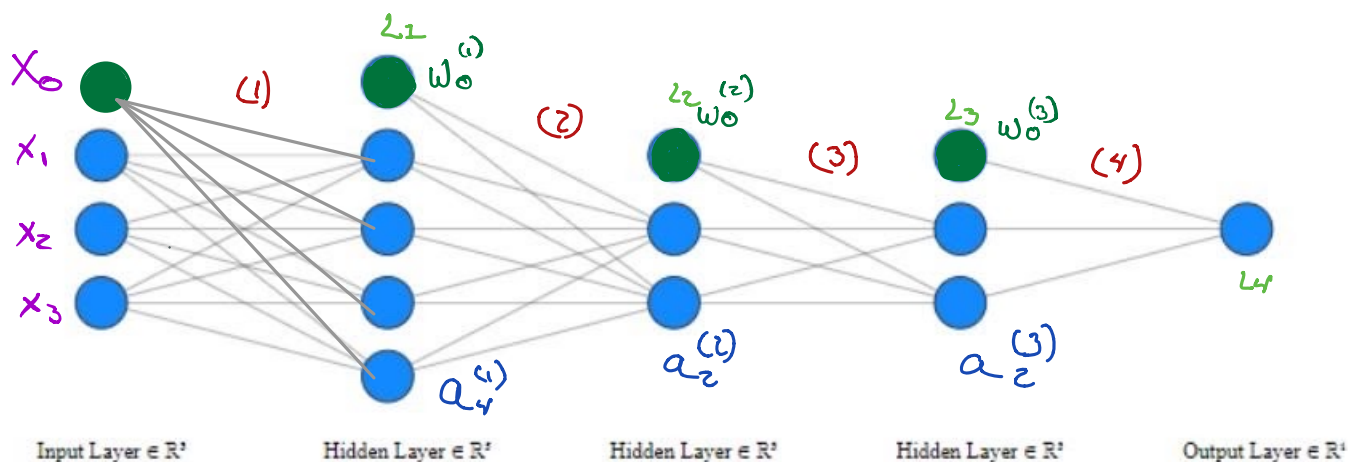


Tarea 1: Deep Learning

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1.- Dibujar Red Neuronal de regresión con $M=3, L=4, L=2, L=2, tn=\mathbb{R}$



2.- Contar el número total de pesos $W^{(1)}, W^{(2)}, W^{(3)}$

$$\begin{array}{l} \text{LAYER} \\ L_1 = 3 \times 4 = 12 \\ L_2 = 4 \times 2 = 8 \\ L_3 = 2 \times 2 = 4 \\ \text{Out} = 2 \times 1 = 2 \\ \hline 26 \end{array}$$

$$\begin{array}{l} \text{PESOS} \\ w_0^{(1)} = 2 \\ w_0^{(2)} = 2 \\ w_0^{(3)} = 1 \\ x_0 = 4 \\ \hline 9 \end{array}$$

26 PESOS CONSIDERANDO SOLO AQUELLOS DE LAS CAPAS 1 35
EN TOTAL SI CONSIDERAMOS EL BIAS

3.- Descomponer explícitamente \hat{y}_n en términos de $W^{(1)}, \dots$

$$a_1^{(1)} = f^{(1)}(w_{11}^{(1)}x_1 + w_{12}^{(1)}x_2 + w_{13}^{(1)}x_3 + w_{10}^{(1)}w_0^{(1)})$$

$$a_2^{(1)} = f^{(1)}(w_{21}^{(1)}x_1 + w_{22}^{(1)}x_2 + w_{23}^{(1)}x_3 + w_{20}^{(1)}w_0^{(1)})$$

$$a_3^{(1)} = f^{(1)}(w_{31}^{(1)}x_1 + w_{32}^{(1)}x_2 + w_{33}^{(1)}x_3 + w_{30}^{(1)}w_0^{(1)})$$

$$a_4^{(1)} = f^{(1)}(w_{41}^{(1)} x_1 + w_{42}^{(1)} x_2 + w_{43}^{(1)} x_3 + w_{40}^{(1)} w_0^{(1)})$$

$$a_1^{(2)} = f^{(2)}(w_{11}^{(2)} a_1^{(1)} + w_{12}^{(2)} a_2^{(1)} + w_{13}^{(2)} a_3^{(1)} + w_{14}^{(2)} a_4^{(1)} + w_{10}^{(2)} w_0^{(2)})$$

$$a_2^{(2)} = f^{(2)}(w_{21}^{(2)} a_1^{(1)} + w_{22}^{(2)} a_2^{(1)} + w_{23}^{(2)} a_3^{(1)} + w_{24}^{(2)} a_4^{(1)} + w_{20}^{(2)} w_0^{(2)})$$

$$a_1^{(3)} = f^{(3)}(w_{11}^{(3)} a_1^{(2)} + w_{12}^{(3)} a_2^{(2)} + w_{10}^{(3)} w_0^{(3)})$$

$$a_2^{(3)} = f^{(3)}(w_{21}^{(3)} a_1^{(2)} + w_{22}^{(3)} a_2^{(2)} + w_{20}^{(3)} w_0^{(3)})$$

$$a^{(4)} = f^{(4)}(w_{11}^{(4)} a_1^{(3)} + w_{12}^{(4)} a_2^{(3)} + w_{10}^{(4)} w_0^{(4)})$$

$$\hat{y} = a^{(4)}$$

EL SIGUIENTE PASO SERIA REEMPLAZAR EN $a^{(4)}$ CADA UNO DE LOS VALORES DE $a^{(3)}$.

$$a^{(4)} = f^{(4)}(w_{11}^{(4)} \cdot f^{(3)}(w_{11}^{(3)} a_1^{(2)} + w_{12}^{(3)} a_2^{(2)} + w_{10}^{(3)} w_0^{(3)}) + w_{12}^{(4)} \cdot f^{(3)}(w_{21}^{(3)} a_1^{(2)} + w_{22}^{(3)} a_2^{(2)} + w_{20}^{(3)} w_0^{(3)}) + w_{10}^{(4)} w_0^{(4)}).$$

$$= f^{(4)}(w_{11}^{(4)} f^{(3)}(w_{11}^{(3)} f^{(2)}(w_{11}^{(2)} a_1^{(1)} + w_{12}^{(2)} a_2^{(1)} + w_{13}^{(2)} a_3^{(1)} + w_{14}^{(2)} a_4^{(1)} + w_{10}^{(2)} w_0^{(2)}) + w_{12}^{(3)} f^{(2)}(w_{21}^{(2)} a_1^{(1)} + w_{22}^{(2)} a_2^{(1)} + w_{23}^{(2)} a_3^{(1)} + w_{24}^{(2)} a_4^{(1)} + w_{20}^{(2)} w_0^{(2)}) + w_{10}^{(3)} w_0^{(3)}) + w_{12}^{(4)} f^{(3)}(w_{21}^{(3)} f^{(2)}(w_{11}^{(2)} a_1^{(1)} + w_{12}^{(2)} a_2^{(1)} + w_{13}^{(2)} a_3^{(1)} + w_{14}^{(2)} a_4^{(1)} + w_{10}^{(2)} w_0^{(2)}) + w_{22}^{(3)} f^{(2)}(w_{21}^{(2)} a_1^{(1)} + w_{22}^{(2)} a_2^{(1)} + w_{23}^{(2)} a_3^{(1)} + w_{24}^{(2)} a_4^{(1)} + w_{20}^{(2)} w_0^{(2)}) + w_{20}^{(3)} w_0^{(3)}) + w_{10}^{(4)} w_0^{(4)})$$

$$= f^{(4)}(w_{11}^{(4)} f^{(3)}(w_{11}^{(3)} f^{(2)}(w_{11}^{(2)} f^{(1)}(w_{11}^{(1)} x_1 + w_{12}^{(1)} x_2 + w_{13}^{(1)} x_3 + w_{10}^{(1)} w_0^{(1)}) + w_{12}^{(2)} f^{(1)}(w_{21}^{(1)} x_1 + w_{22}^{(1)} x_2 + w_{23}^{(1)} x_3 + w_{20}^{(1)} w_0^{(1)}) + w_{10}^{(2)} f^{(1)}(w_{31}^{(1)} x_1 + w_{32}^{(1)} x_2 + w_{33}^{(1)} x_3 + w_{30}^{(1)} w_0^{(1)}) + w_{14}^{(2)} w_0^{(2)}).$$

$$\begin{aligned}
&= f^{(1)} (w_{41}^{(1)} x_1 + w_{42}^{(1)} x_2 + w_{43}^{(1)} x_3 + w_{40}^{(1)} w_0^{(1)}) + w_{10}^{(2)} w_0^{(1)} + w_{12}^{(3)} f^{(2)} \\
&\quad (w_{11}^{(2)} f^{(1)} (w_{11}^{(1)} x_1 + w_{12}^{(1)} x_2 + w_{13}^{(1)} x_3 + w_{10}^{(1)} w_0^{(1)}) + w_{22}^{(2)} \\
&\quad f^{(1)} (w_{21}^{(1)} x_1 + w_{22}^{(1)} x_2 + w_{23}^{(1)} x_3 + w_{20}^{(1)} w_0^{(1)}) + w_{23}^{(2)} f^{(1)} (w_{31}^{(1)} x_1 + \\
&\quad w_{32}^{(1)} x_2 + w_{33}^{(1)} x_3 + w_{30}^{(1)} w_0^{(1)}) + w_{24}^{(2)} f^{(1)} (w_{41}^{(1)} x_1 + w_{42}^{(1)} x_2 + w_{43}^{(1)} x_3 \\
&\quad + w_{40}^{(1)} w_0^{(1)}) + w_{20}^{(2)} w_0^{(2)} + w_{10}^{(3)} w_0^{(3)}) + w_{12}^{(4)} f^{(3)} (w_{21}^{(3)} f^{(2)} (w_{11}^{(2)} \\
&\quad f^{(1)} (w_{11}^{(1)} x_1 + w_{12}^{(1)} x_2 + w_{13}^{(1)} x_3 + w_{10}^{(1)} w_0^{(1)}) + w_{12}^{(2)} f^{(1)} (w_{21}^{(1)} x_1 + w_{22}^{(1)} x_2 + \\
&\quad w_{23}^{(1)} x_3 + w_{20}^{(1)} w_0^{(1)}) + w_{13}^{(2)} f^{(1)} (w_{31}^{(1)} x_1 + w_{32}^{(1)} x_2 + w_{33}^{(1)} x_3 + w_{30}^{(1)} w_0^{(1)}) \\
&\quad + w_{14}^{(2)} f^{(1)} (w_{41}^{(1)} x_1 + w_{42}^{(1)} x_2 + w_{43}^{(1)} x_3 + w_{40}^{(1)} w_0^{(1)}) + w_{10}^{(2)} w_0^{(2)}) + \\
&\quad w_{22}^{(3)} f^{(2)} (w_{21}^{(2)} f^{(1)} (w_{11}^{(1)} x_1 + w_{12}^{(1)} x_2 + w_{13}^{(1)} x_3 + w_{10}^{(1)} w_0^{(1)}) + w_{22}^{(2)} \\
&\quad f^{(1)} (w_{21}^{(1)} x_1 + w_{22}^{(1)} x_2 + w_{23}^{(1)} x_3 + w_{20}^{(1)} w_0^{(1)}) + w_{23}^{(2)} f^{(1)} (w_{31}^{(1)} x_1 \\
&\quad + w_{32}^{(1)} x_2 + w_{33}^{(1)} x_3 + w_{30}^{(1)} w_0^{(1)}) + w_{24}^{(2)} f^{(1)} (w_{41}^{(1)} x_1 + w_{42}^{(1)} x_2 \\
&\quad + w_{43}^{(1)} x_3 + w_{40}^{(1)} w_0^{(1)}) + w_{20}^{(2)} w_0^{(2)} + w_{20}^{(3)} w_0^{(3)}) + w_{10}^{(4)} + w_0^{(4)}
\end{aligned}$$