- Consider penultimate layers of node.
- Expression for $\frac{\partial E_n(w)}{\partial a_1^{[2]}}$. Use $\delta_1^{[3]}$.

$$\delta_1^{[3]} \equiv \frac{\partial E_n(w)}{\partial a_1^{[3]}}$$

Chain rule:-

$$\frac{\partial E_n(w)}{\partial a_1^{[2]}} = \underbrace{\boxed{\frac{\partial E_n(w)}{\partial a_1^{[3]}}}}_{\delta_1^{[3]}} * \frac{\partial a_1^{[3]}}{\partial a_1^{[2]}}$$

$$\therefore a_1^{(3)} = w_{11}^{(3)} h(a_1^{[2]}) + w_{12}^{[3]} h(a_2^{[2]}) + w_{13}^{[3]} h(a_3^{[2]})$$

$$\frac{\partial a_1^{[3]}}{\partial a_1^{[2]}} = \boxed{w_{11}^{[3]} h'(a_1^{[2]})}$$

$$\boxed{\therefore \frac{\partial E_n(w)}{\partial a_1^{[2]}} = \delta_1^{[3]} w_{11}^{[3]} h'(a_1^{[2]})} \quad \text{—} \ (1)$$

- Use this to calc $\frac{\partial E_n(w)}{\partial w_{11}^{[2]}}$

$$\boxed{\frac{\partial E_n(w)}{\partial w_{11}^{[2]}} = \frac{\partial E_n(w)}{\partial a_1^{[2]}} \times \frac{\partial a_1^{[2]}}{\partial w_{11}^{[2]}}} \quad \text{—} \ (2)$$

$$\therefore a_1^{[2]} = w_{11}^{[2]} h(a_1^{[1]}) + w_{12}^{[2]} h(a_2^{[1]}) + w_{13}^{[2]} h(a_3^{[1]})$$

$$\boxed{\frac{\partial a_1^{[2]}}{\partial w_{11}^{[2]}} = h(a_1^{[1]})} \quad \text{—} \ (3)$$

(1) and (3) in (2)

$$\boxed{\frac{\partial E_n(w)}{\partial w_{11}^{[2]}} = \delta_1^{[3]} w_{11}^{[3]} h'(a_1^{[2]}) h(a_1^{[1]})}$$

X———X