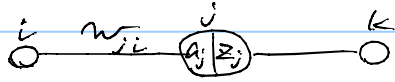


(復習)

逆伝播の導出 5.3.1章

 $\frac{\partial E}{\partial w_{ji}}$ を評価するための

順伝播

$$\left. \begin{aligned} a_j &= \sum_i w_{ji} z_i \\ z_j &= h(a_j) \end{aligned} \right\}$$

逆伝播

$$\frac{\partial E}{\partial w_{ji}} = \frac{\partial E}{\partial a_j} \frac{\partial a_j}{\partial w_{ji}} = \delta_j z_i$$

$$\frac{\partial a_j}{\partial w_{ji}} = \frac{\partial}{\partial w_{ji}} \sum_i w_{ji} z_i = z_i$$

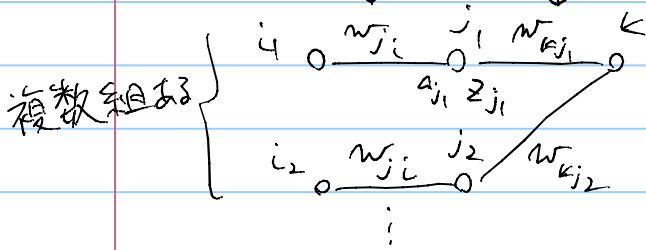
$$\delta_j \equiv \frac{\partial E}{\partial a_j} = \sum_k \frac{\partial E}{\partial a_k} \frac{\partial a_k}{\partial a_j}$$

$$\frac{\partial a_k}{\partial a_j} = \frac{\partial}{\partial a_j} \sum_l w_{kl} z_l = \frac{\partial}{\partial a_j} \sum_l w_{kl} h(a_l) = w_{kj} h'(a_j)$$

$$\therefore \delta_j = \sum_k \delta_k w_{kj} h'(a_j) = h'(a_j) \sum_k \delta_k w_{kj}$$

重み共有してこえ

この層は共有のみ この層は独立



$$\frac{\partial a_k}{\partial a_{j_l}} = \frac{\partial}{\partial a_{j_l}} \sum_m w_{km} z_m = \frac{\partial}{\partial a_{j_l}} \sum_m w_{km} h(a_m) = w_{kj_l} h'(a_{j_l})$$

順伝播

$$a_{j_l} = \sum_i w_{ji} z_{i_l}$$

$$z_{i_l} = h(a_{i_l})$$

$$\frac{\partial a_{j_l}}{\partial w_{ji}} = \frac{\partial}{\partial w_{ji}} \sum_i w_{ji} z_{i_l} = z_{i_l}$$

逆伝播

$$\frac{\partial E}{\partial w_{ji}} = \sum_k \frac{\partial E}{\partial a_{j_l}} \frac{\partial a_{j_l}}{\partial w_{ji}} = \sum_k \delta_{j_l} z_{i_l} \quad \dots \textcircled{1}$$

$$\delta_{j_l} \equiv \frac{\partial E}{\partial a_{j_l}} = \sum_k \frac{\partial E}{\partial a_k} \frac{\partial a_k}{\partial a_{j_l}}$$

$$\therefore \frac{\partial a_k}{\partial a_{j_l}} = \frac{\partial}{\partial a_{j_l}} \sum_m w_{km} z_m = \frac{\partial}{\partial a_{j_l}} \sum_m w_{km} h(a_m) = w_{kj_l} h'(a_{j_l})$$

つまり
この層は独立に重み共有

$$\delta_{j_l} = \sum_k \delta_k w_{kj_l} h'(a_{j_l}) \quad \dots \textcircled{2}$$

重み共有のとき逆伝播の式は

組の和



② は 5.3.1 章と同じ、① のみ 5.3.1 章と比べて \sum_k に加えて