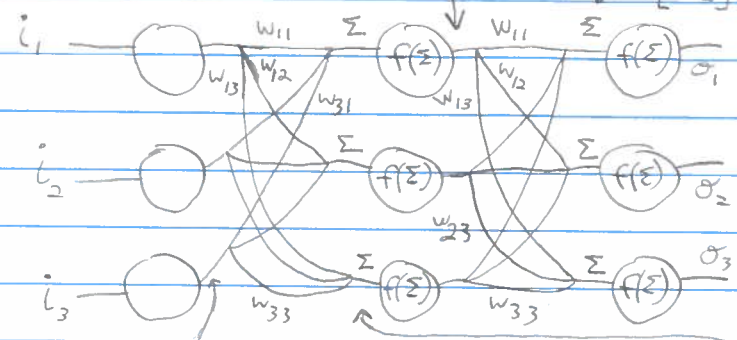
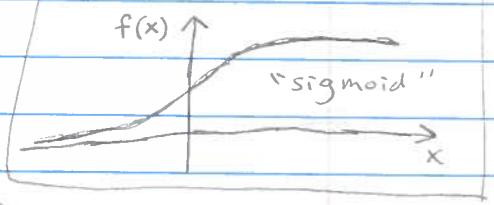
$$[W_2] = \begin{pmatrix} w_{11} & w_{21} & \cdots \\ w_{12} & \vdots & \ddots \\ w_{13} & & \end{pmatrix} \quad * [W_1] \neq [W_2] \text{ in general (bad notation)}$$

$f(\vec{i}_2)$ → $[W_2] f(\vec{i}_2)$



$$\vec{o} = f([W_2] f(\vec{i}_2))$$

$$f(x) = \frac{1}{1+e^{-x}}$$



$$\vec{i}_1 = \begin{pmatrix} i_1 \\ i_2 \\ i_3 \end{pmatrix} \qquad [W_1] = \begin{pmatrix} w_{11} & w_{21} & w_{31} \\ w_{12} & w_{22} & w_{32} \\ w_{13} & w_{23} & w_{33} \end{pmatrix}$$

$$\vec{i}_2 = [W_1] \vec{i}_1$$

* input layer doesn't do anything

* note opposite subscript convention

* no special relationship between weights (e.g. $\sum_i w_{ij}$ needn't = 1

Error

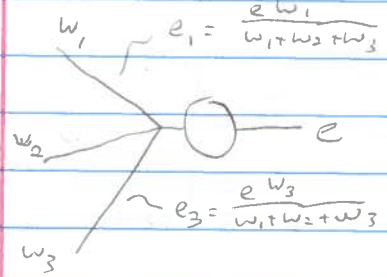
error at output layer: $\vec{e} = \vec{t} - \vec{o}$

↑ known correct answer from training data

error is backpropagated and redistributed based on weights of links (sigmoid is ignored)

e.g. $\vec{e}_{output} = \begin{pmatrix} e_1 \\ e_2 \\ \vdots \end{pmatrix}$

$$\vec{e}_{\text{last hidden layer}} = \begin{pmatrix} \frac{w_{11}}{w_{11}+w_{21}+\cdots} & \frac{w_{12}}{w_{12}+w_{22}+\cdots} & \cdots \\ \frac{w_{21}}{w_{11}+w_{21}+\cdots} & \frac{w_{22}}{w_{12}+w_{22}+\cdots} & \\ \vdots & & \ddots \end{pmatrix} \cdot \vec{e}_{output}$$



$$\approx \begin{pmatrix} w_{11} & w_{12} & \cdots \\ w_{21} & w_{22} & \\ \vdots & & \ddots \end{pmatrix} = [W]^T$$

$$\Rightarrow \boxed{\vec{e}_{n-1} \approx [W_n]^T \vec{e}_n} \; *$$