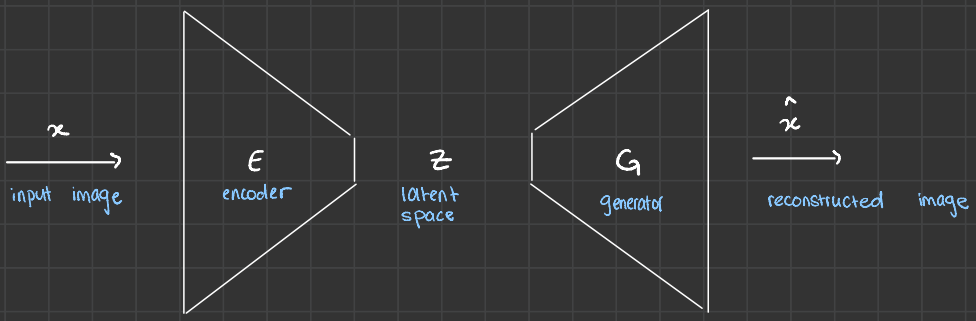
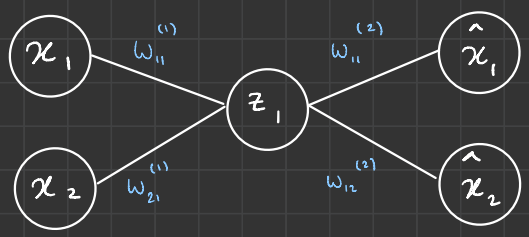
autoencoders



backpropagation example



update any weight w : $w - \alpha \frac{dL}{dw}$

$$L(x_i, \hat{x}_i) = \frac{1}{2}(x_i - \hat{x}_i)^2$$

$\hat{x}_1 = f(w_{11}^{(2)} z_1)$ and $z_1 = f(w_{11}^{(1)} x_1 + w_{21}^{(1)} x_2)$

let's start with layer 2 : for one weight $w_{11}^{(2)}$

$$w_{11}^{(2)} := w_{11}^{(2)} - \alpha \frac{dL}{dw_{11}^{(2)}}$$

$$\frac{dL}{dw_{11}^{(2)}} = \frac{dL}{d\hat{x}_1} \cdot \frac{d\hat{x}_1}{dw_{11}^{(2)}}$$

$$\boxed{\frac{dL}{dw_{11}^{(2)}} = (-\hat{x}_1) \cdot f'(w_{11}^{(2)} z_1) \cdot z_1}$$

let's do layer 1 : for one weight $w_{11}^{(1)}$

$$\frac{dL}{w_{11}^{(1)}} = \frac{dL}{d\hat{x}_1} \cdot \frac{d\hat{x}_1}{z_1} \cdot \frac{dz_1}{dw_{11}^{(1)}}$$

$$\frac{dL}{w_{11}^{(1)}} = (-\hat{x}_1) \cdot f'\left(w_{11}^{(2)} \cdot z_1\right) \cdot w_{11}^{(2)} \cdot f'\left(w_{11}^{(1)} x_1 + w_{21}^{(1)} x_2\right) \cdot x_1$$

$w_{11}^{(2)}$: new value