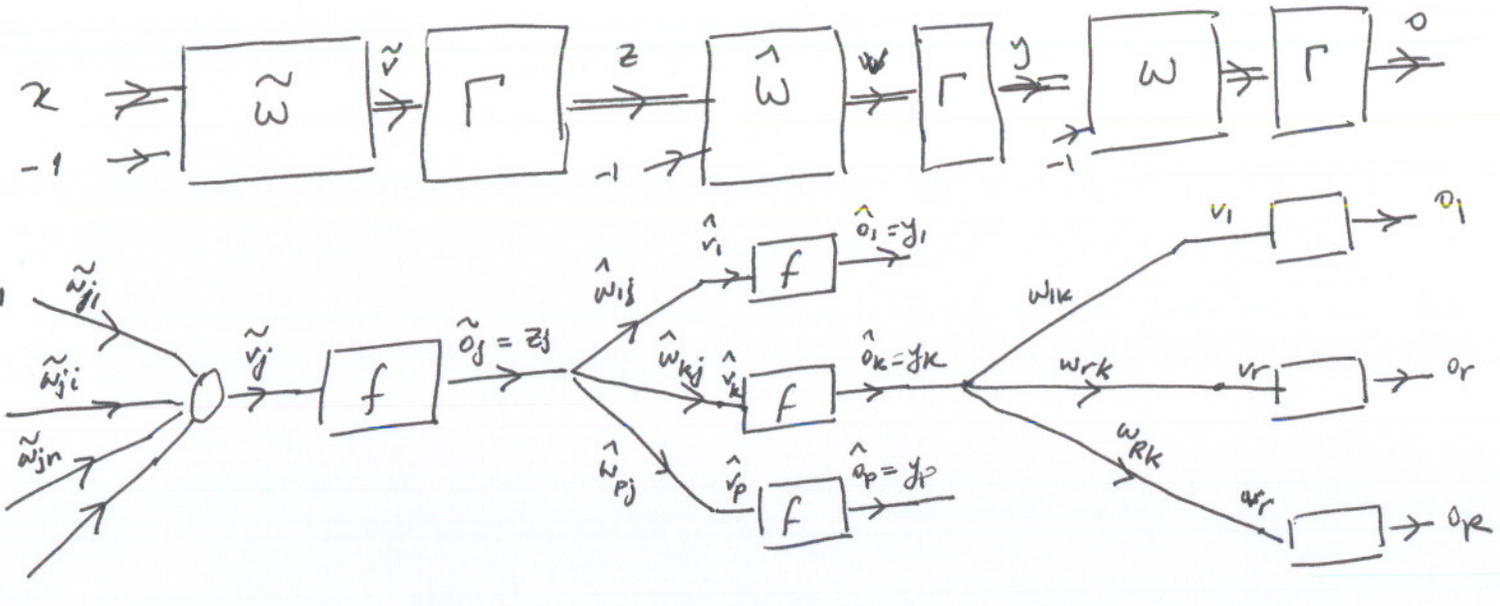


$$\frac{\partial E(n)}{\partial \tilde{w}_{ji}} = \sum_{k=1}^{P} \sum_{r=1}^{R} \underbrace{\frac{\partial E(n)}{\partial e_r}}_{e_r} \cdot \underbrace{\frac{\partial e_r}{\partial o_r}}_{-1} \cdot \underbrace{\frac{\partial o_r}{\partial v_r}}_{f'(v_r)} \cdot \underbrace{\frac{\partial v_r}{\partial y_k}}_{w_{rk}} \cdot \underbrace{\frac{\partial y_k}{\partial \hat{v}_k}}_{f'(\hat{v}_k)} \cdot \underbrace{\frac{\partial \hat{v}_k}{\partial \tilde{o}_j}}_{\hat{w}_{kj}} \cdot \underbrace{\frac{\partial \tilde{o}_j}{\partial \tilde{v}_j}}_{f'(\tilde{v}_j)} \cdot \underbrace{\frac{\partial \tilde{v}_j}{\partial w_{ji}}}_{x_i}$$

$$= -f'(\tilde{v}_j) \left[ \sum_{k=1}^{P} f'(\hat{v}_k) \left( \sum_{r=1}^{R} \underbrace{f'(v_r)\, e_r}_{\delta_r} w_{rk} \right) \hat{w}_{kj} \right] x_i$$

$$= -f'(\tilde{v}_j) \left[ \sum_{k=1}^{P} \underbrace{f'(\hat{v}_k) \left( \sum_{r=1}^{R} \delta_r \cdot w_{rk} \right)}_{\hat{\delta}_k} \hat{w}_{kj} \right] x_i = \underbrace{-f'(\tilde{v}_j) \left( \sum_{k=1}^{P} \hat{\delta}_k \hat{w}_{kj} \right)}_{\tilde{\delta}_j} x_i$$