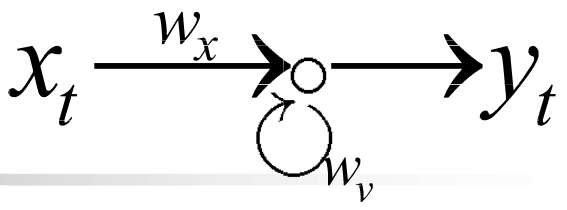
Recurrent Neural Networks(RNN)



$$\frac{\partial \mathrm{E}}{\partial \mathrm{w}_v} = \sum_{k=1}^{t} \frac{\partial \mathrm{E}_t}{\partial y_t} \cdot \frac{\partial y_t}{\partial v_t} \cdot \frac{\partial v_t}{\partial v_k} \cdot \frac{\partial v_k}{\partial \theta}, \qquad \frac{\partial \mathrm{E}_t}{\partial y_t} = \sum_{t=1}^{s} \frac{\partial (d_t - y_t)}{\partial y_t}$$

$$\frac{\partial v_t}{\partial v_k} = \prod_{i=k+1}^{t} \frac{\partial v_i}{\partial v_{i-1}} = \prod_{i=k+1}^{t} \frac{\partial v_i}{\partial y_{i-1}} \cdot \frac{\partial y_{i-1}}{\partial v_{i-1}} = \prod_{i=k+1}^{t} w_v \cdot \phi'(v_t)$$

$$\frac{\partial y_t}{\partial v_t} = \phi'(v_t)$$

- $y_t = \phi(v_t), \;\; v_t = w_v y_{t-1} + w_x x_t$