



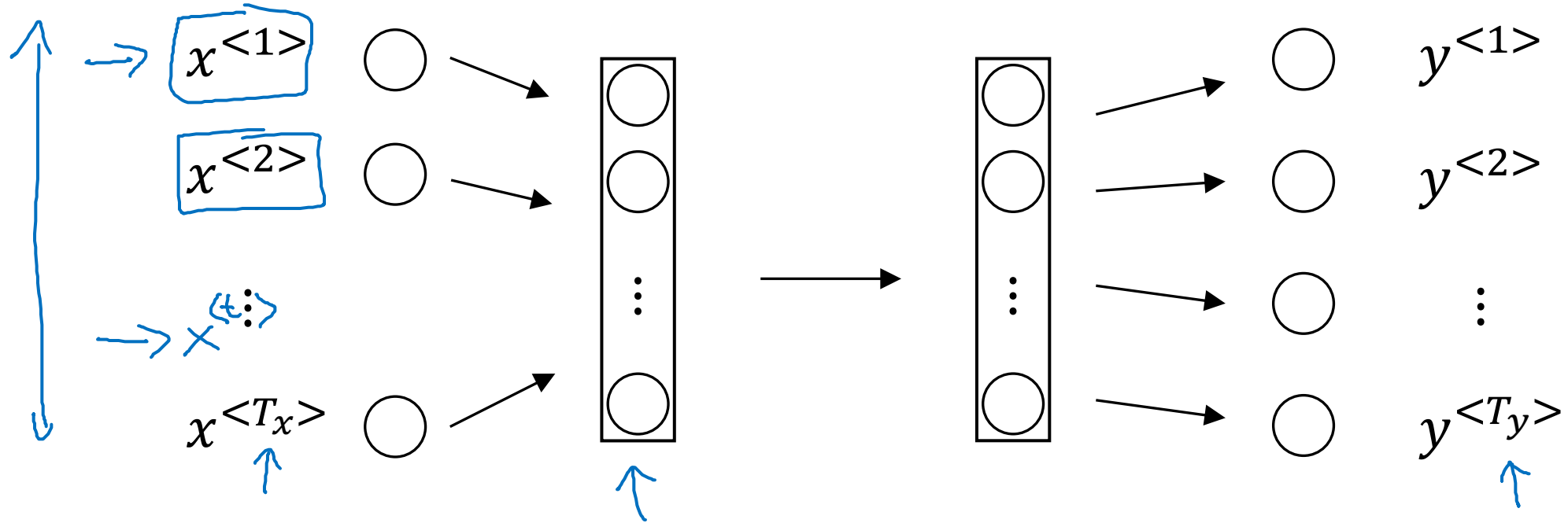
deeplearning.ai

# Recurrent Neural Networks

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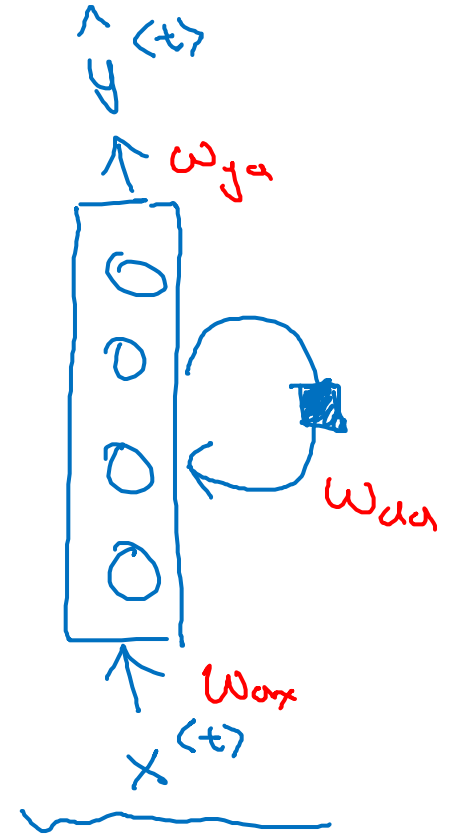
## Recurrent Neural Network Model

# Why not a standard network?



## Problems:

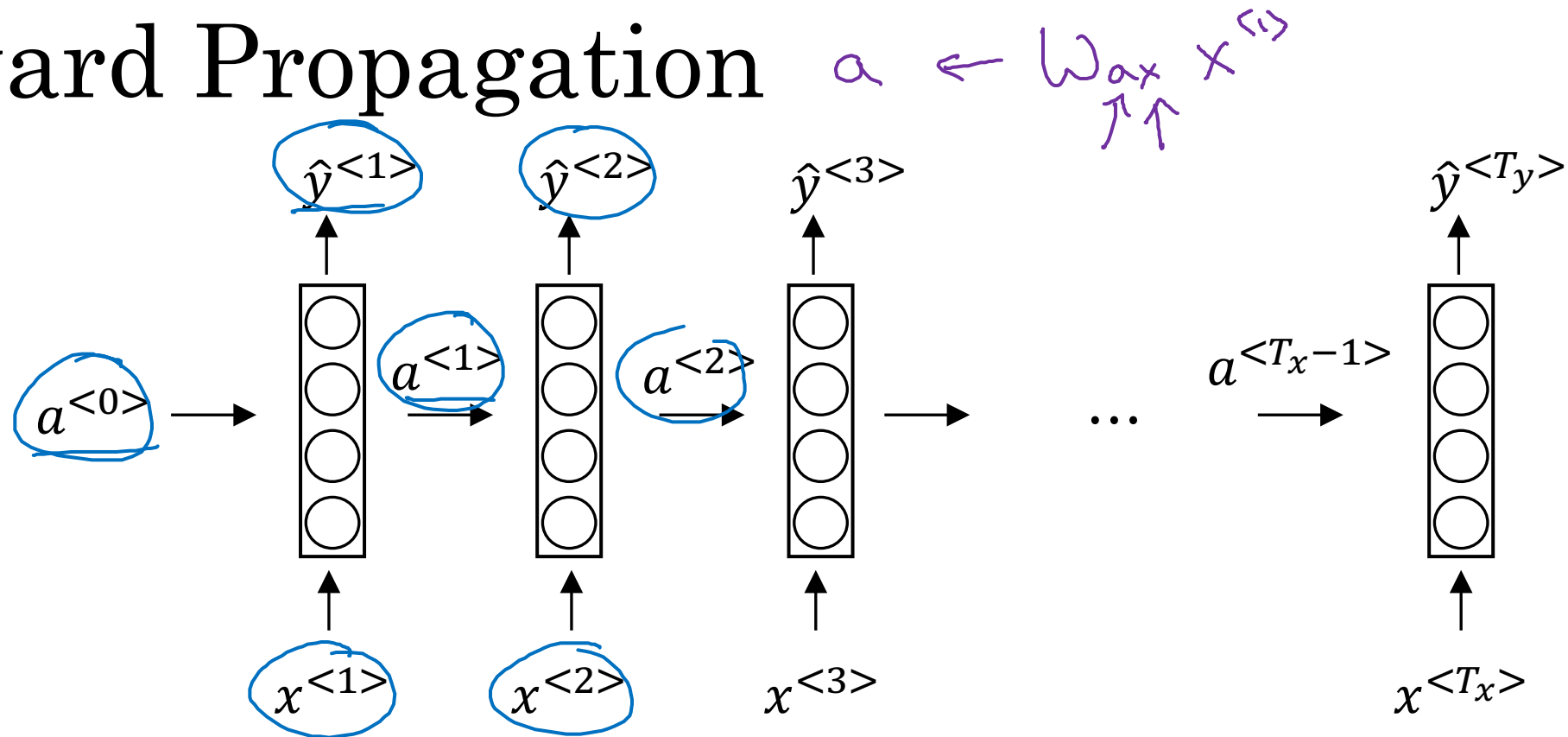
- - Inputs, outputs can be different lengths in different examples.
- - Doesn't share features learned across different positions of text.

$$T_x = T_y$$


He said, “Teddy Roosevelt was a great President.”

He said, "Teddy bears are on sale!"

# Forward Propagation



$$a^{<0>} = \vec{0}.$$

$$\underline{a}^{<1>} = g_1(W_{aa} a^{<0>} + \underline{W_{ax}} x^{<1>} + b_a) \leftarrow \underline{\tanh / \text{Relu}}$$

$$\underline{\hat{y}}^{<1>} = g_2(\underline{W_{ya}} \underline{a}^{<1>} + b_y) \leftarrow \text{Sigmoid}$$

$$\begin{aligned} a^{<t>} &= g(W_{aa} a^{<t-1>} + W_{ax} x^{<t>} + b_a) \\ \hat{y}^{<t>} &= g(W_{ya} a^{<t>} + b_y) \end{aligned}$$

# Simplified RNN notation

$$a^{<t>} = g(\underbrace{W_{aa} a^{<t-1>}}_{\substack{\uparrow \\ (100, 100)}} + \underbrace{W_{ax} x^{<t>}}_{\substack{\uparrow \\ (100, 10,000)}} + b_a)$$

$$\hat{y}^{<t>} = g(W_{ya} a^{<t>} + b_y)$$

$$\hat{y}^{<t>} = g(W_y a^{<t>} + b_y)$$

$$a^{<t>} = g(W_a [a^{<t-1>}, x^{<t>}] + b_a)$$

$$\begin{bmatrix} W_{aa} & W_{ax} \end{bmatrix} = W_a$$

(100, 10100)

$$[a^{<t-1>}, x^{<t>}] = \begin{bmatrix} a^{<t-1>} \\ x^{<t>} \end{bmatrix}$$

100  
10000  
10100

$$\begin{bmatrix} W_{aa} & W_{ax} \end{bmatrix} \begin{bmatrix} a^{<t-1>} \\ x^{<t>} \end{bmatrix} = W_{aa} a^{<t-1>} + W_{ax} x^{<t>}$$