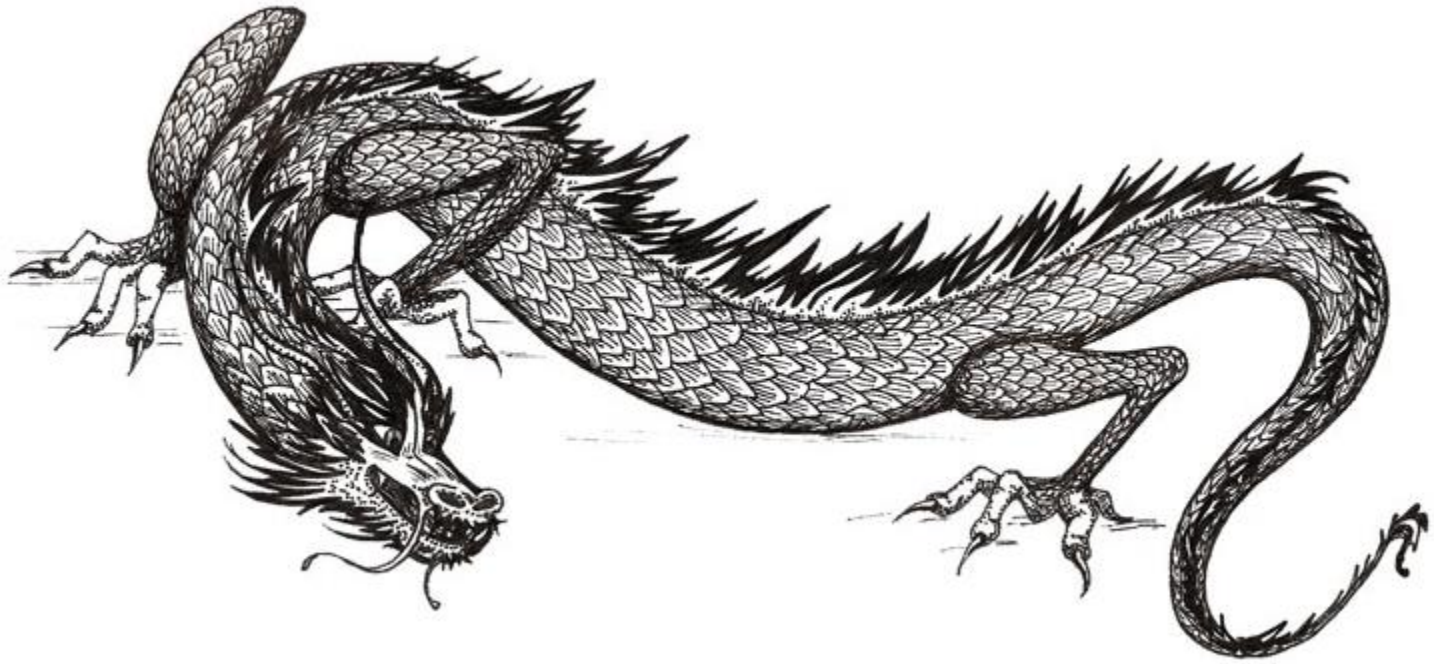
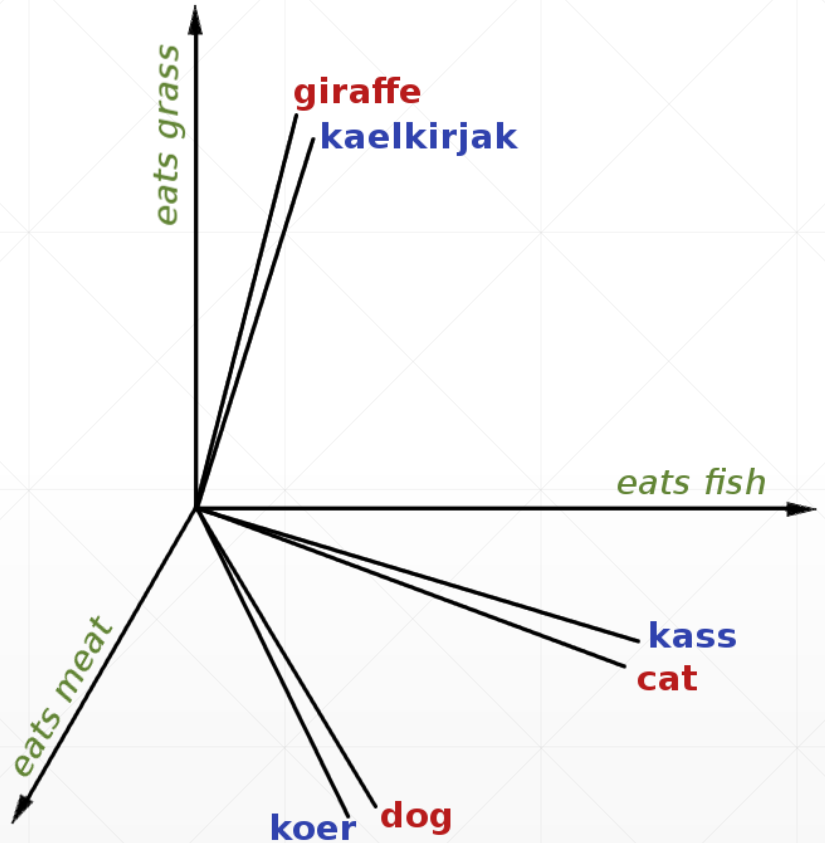


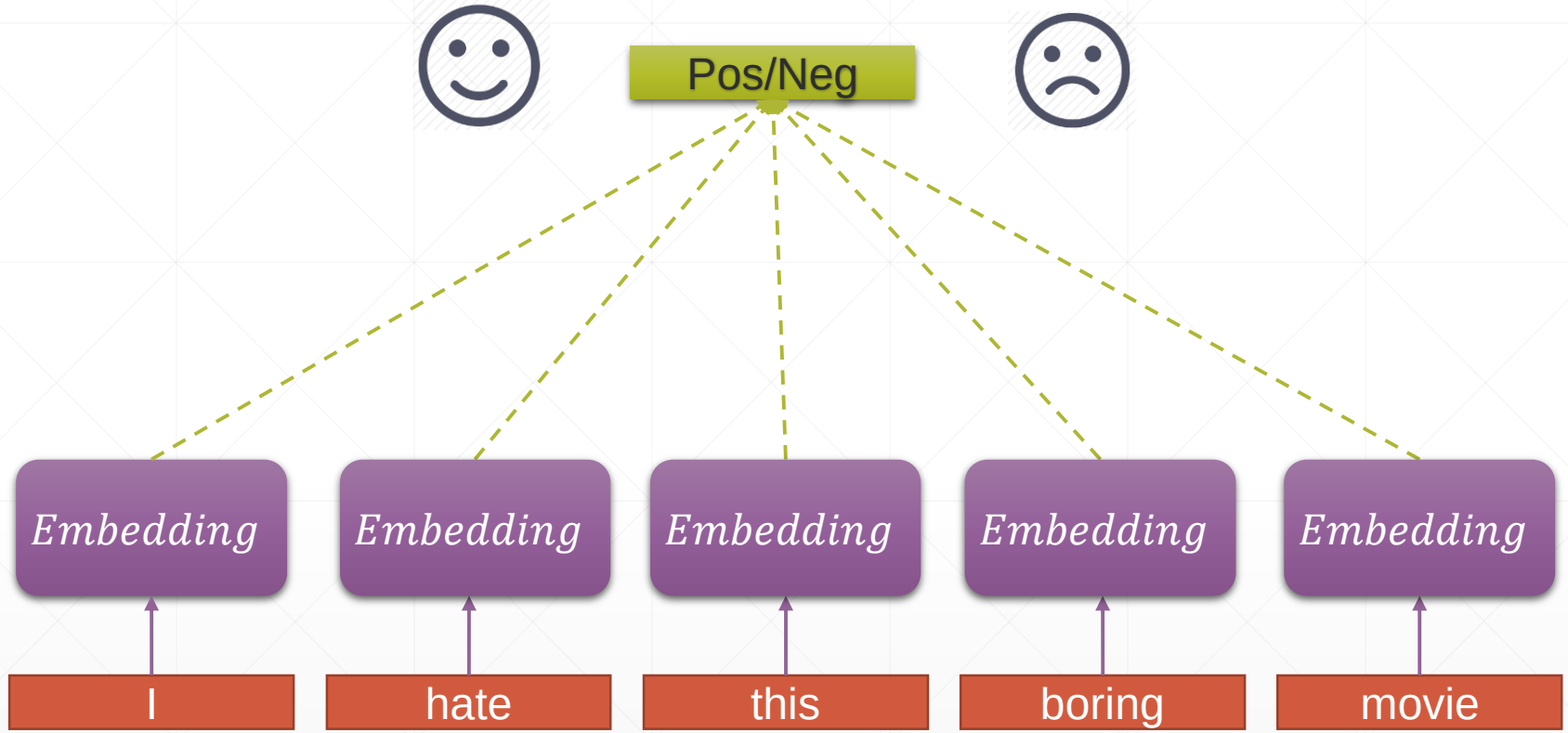
循环神经网络

主讲：龙良曲

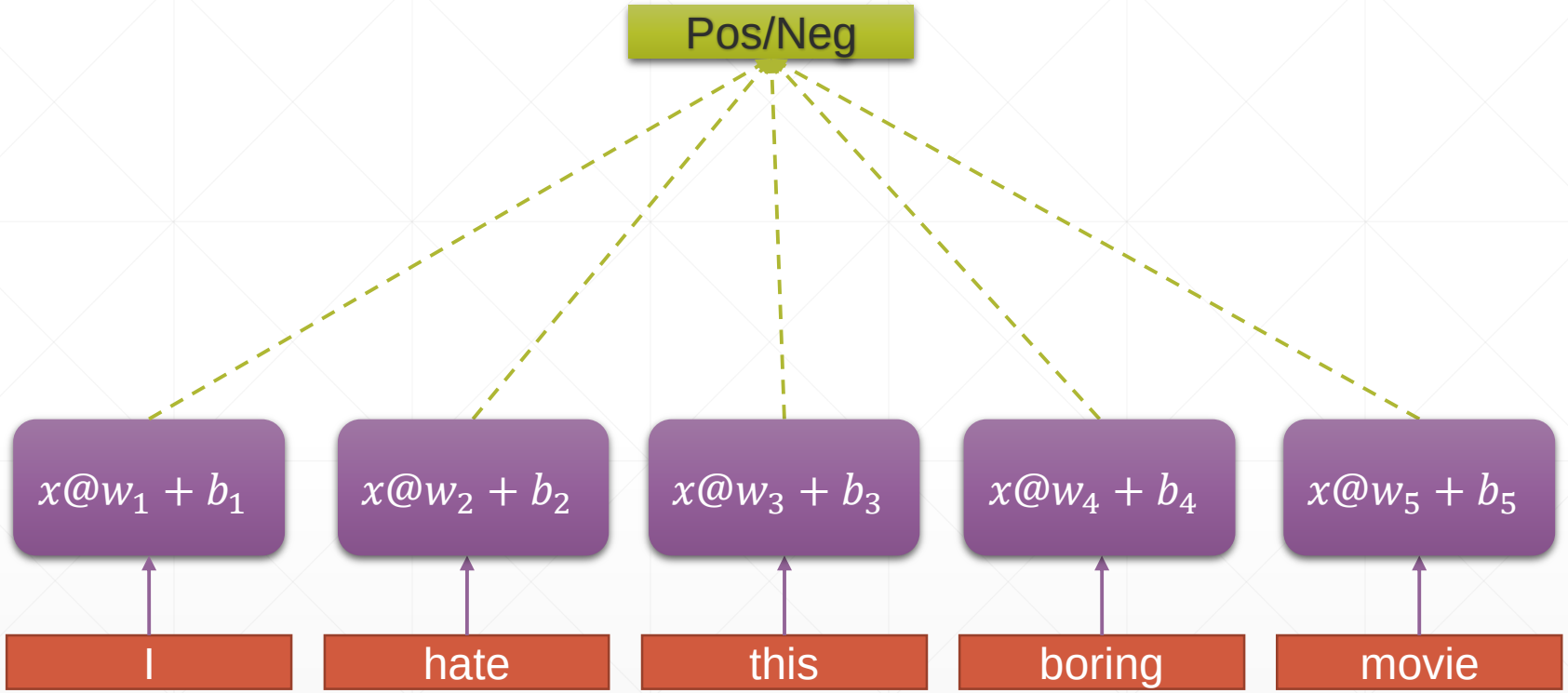
Recap


eats grass
giraffe
kaelkirjak
eats fish
kass
cat
eats meat
koer
dog

Sentiment Analysis



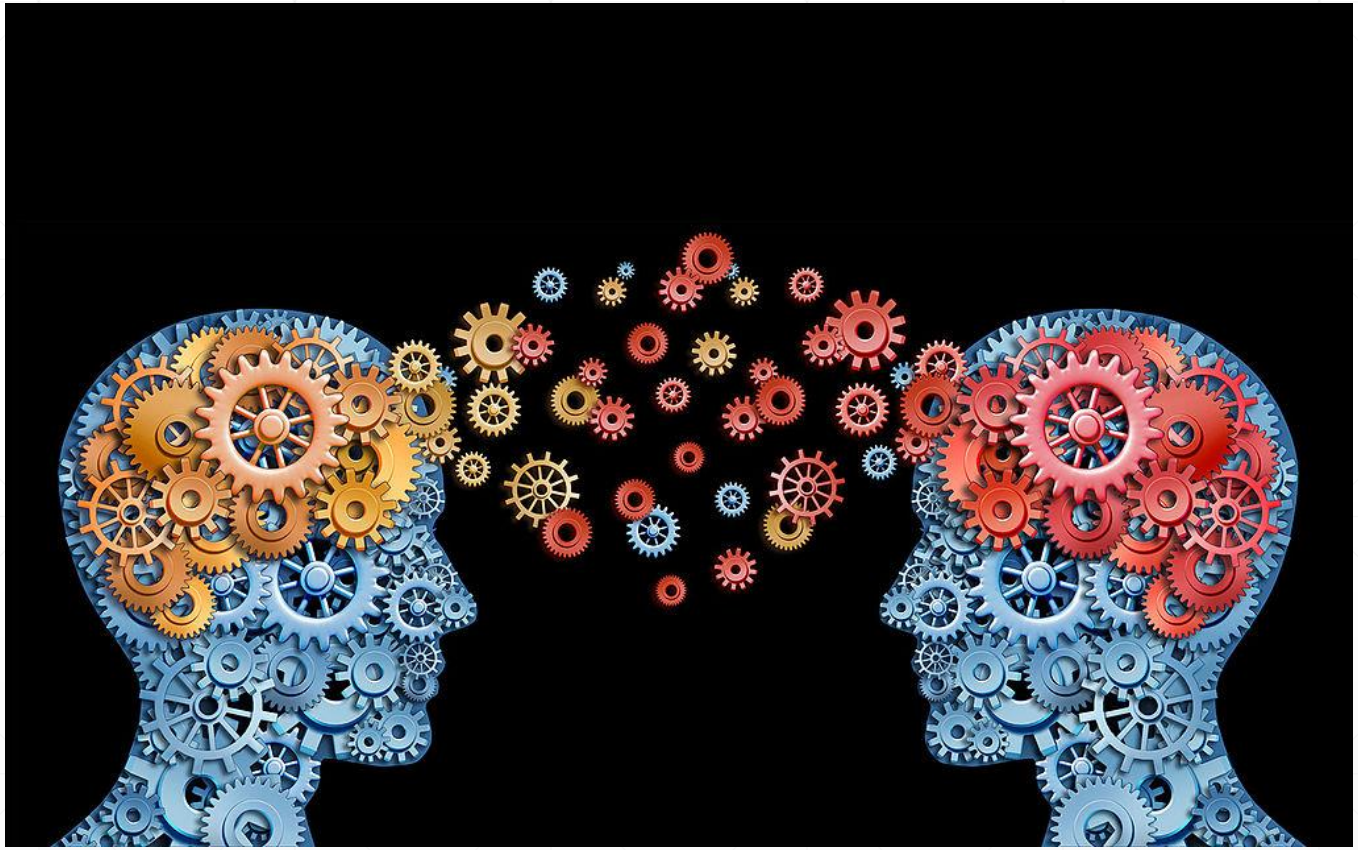
Proposal


Pos/Neg
$x@w_1 + b_1$
$x@w_2 + b_2$
$x@w_3 + b_3$
$x@w_4 + b_4$
$x@w_5 + b_5$
I
hate
this
boring
movie

Downsides

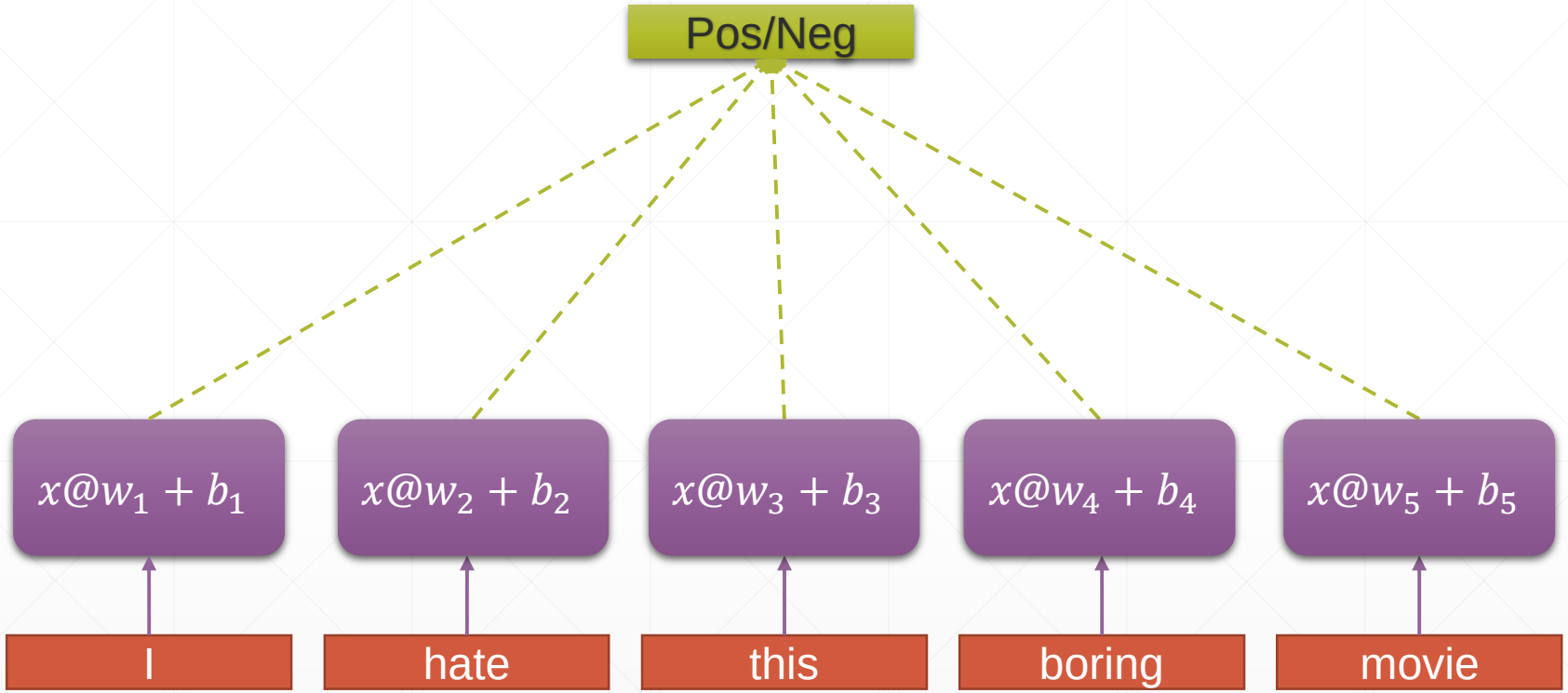
- Long sentence
  - 100+ words
  - too much parameters $[w_N, b_N]$
- No context information
  - consistent tensor

S1.Weight sharing

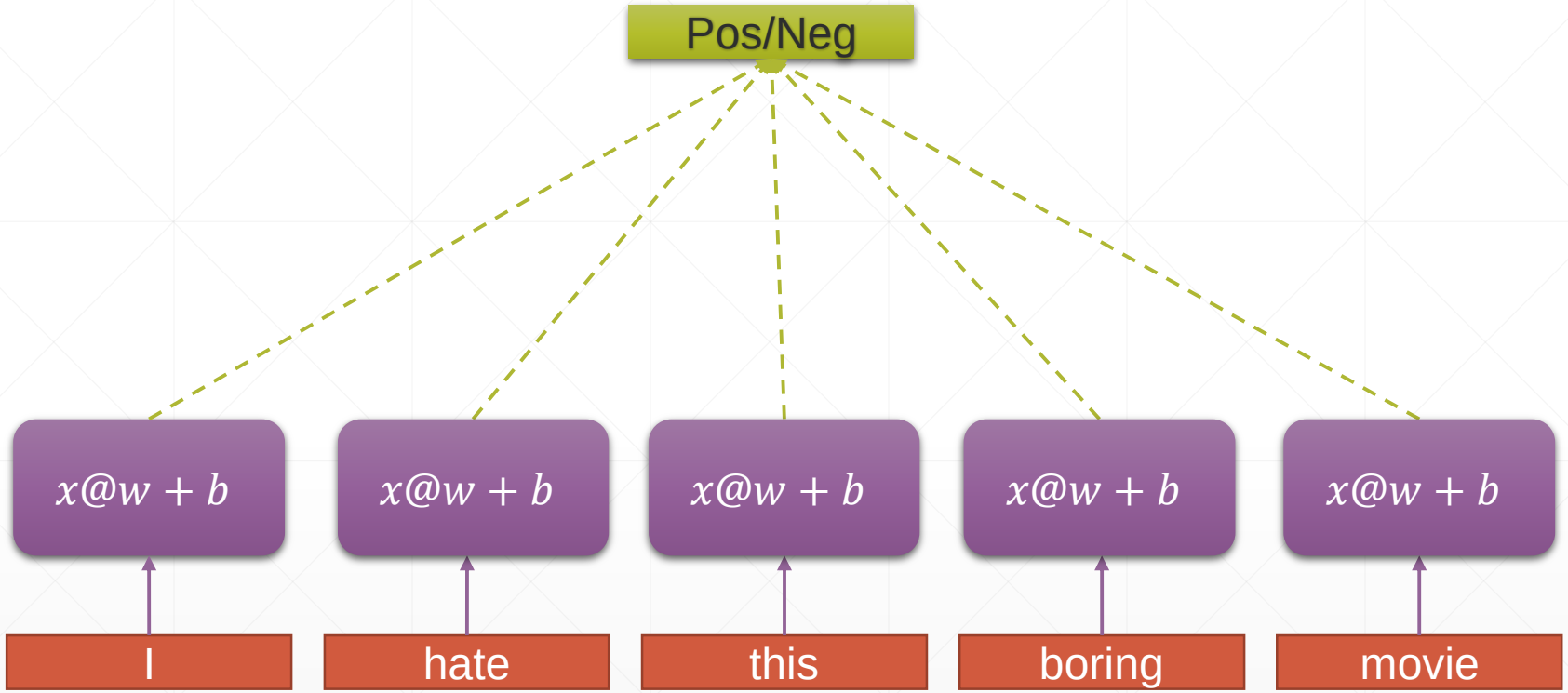


https://kasperspiro.com/2016/10/27/sharing-your-knowledge-whats-in-it-for-you/

Naïve version

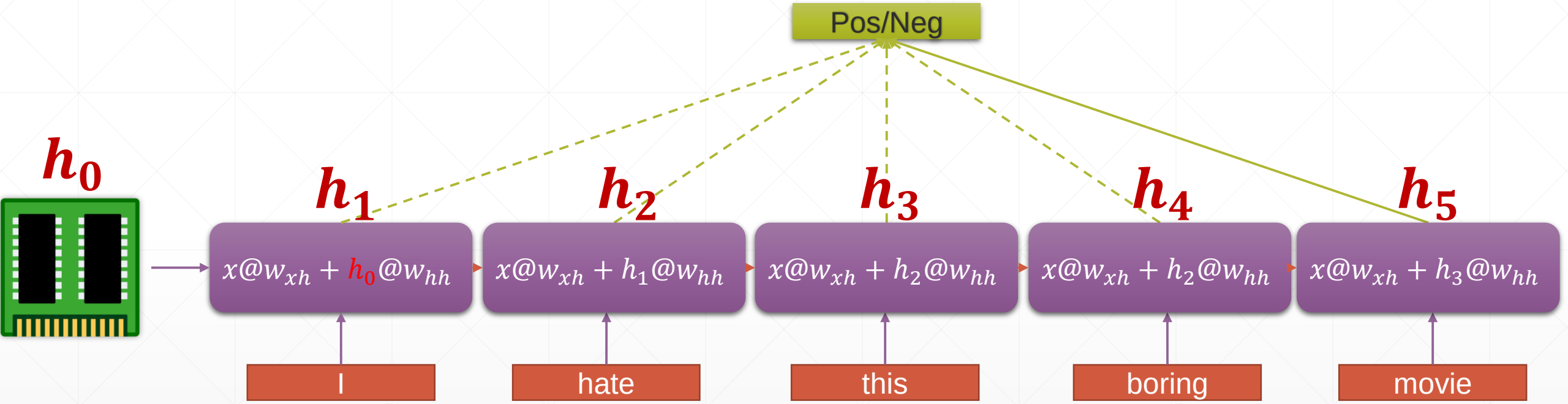


Weight sharing

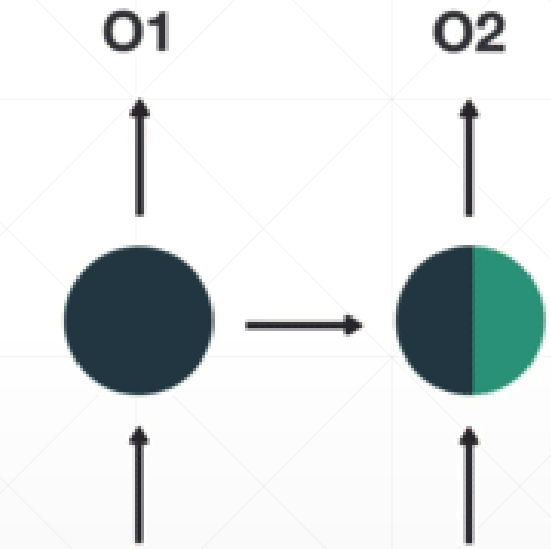


S2.Consistent memory

Consistent memory

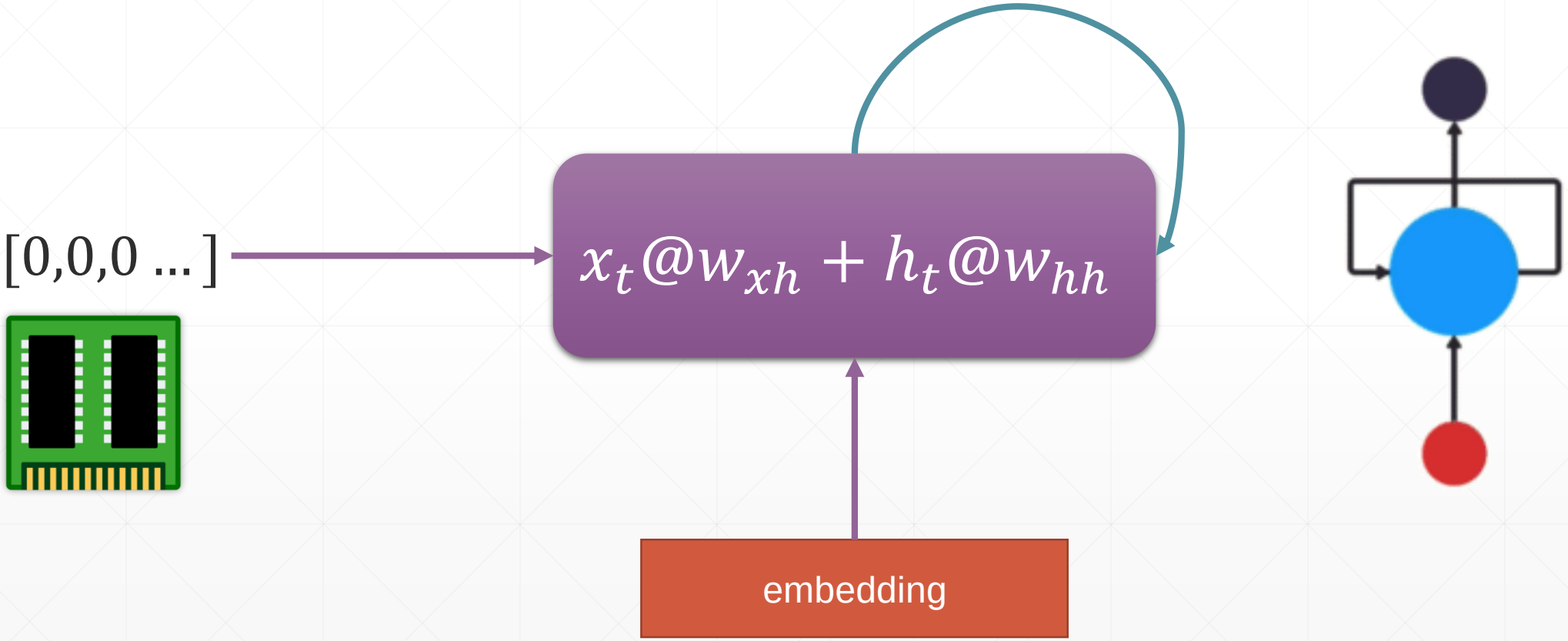


Unfolded model



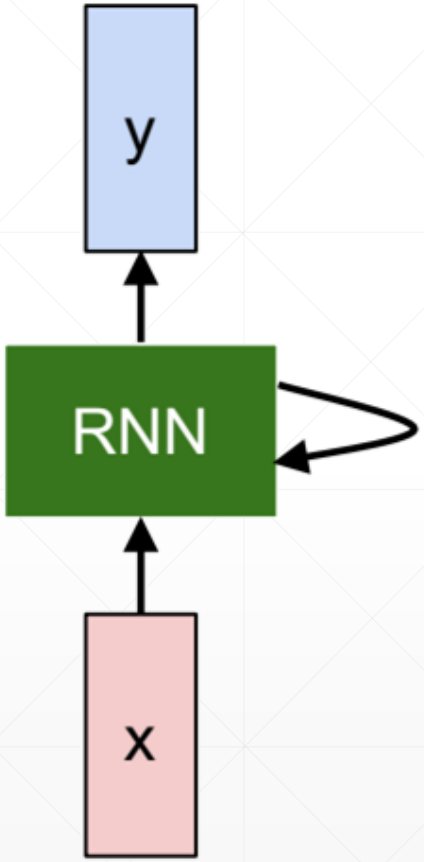
What time is it ?

Folded model



https://towardsdatascience.com/illustrated-guide-to-recurrent-neural-networks-79e5eb8049c9

Formulation



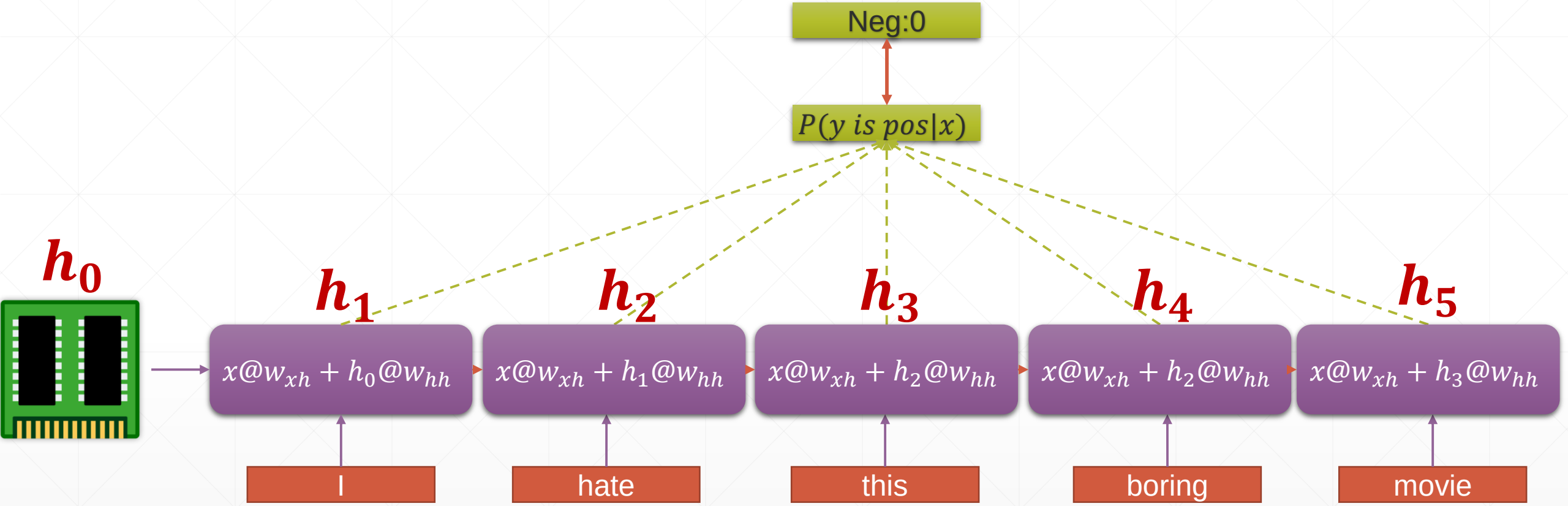
$$h_t = f_W(h_{t-1}, x_t)$$

$$\downarrow$$

$$h_t = \tanh(W_{hh}h_{t-1} + W_{xh}x_t)$$

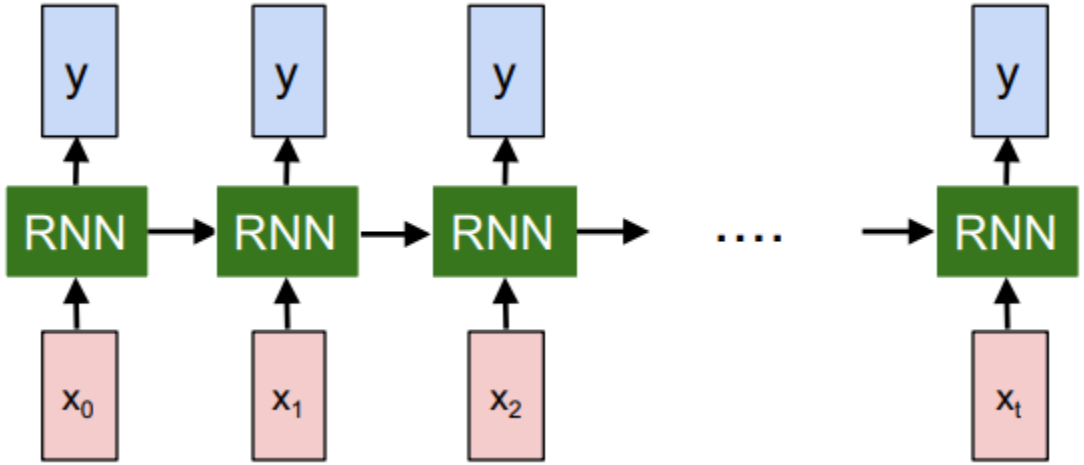
$$y_t = W_{hy}h_t$$

Overall Diagram



One more thing

How To Train?



$$h_t = tanh(W_I x_t + W_R h_{t-1})$$
$$y_t = W_O h_t$$

$$\frac{\partial E_t}{\partial W_R} = \sum_{i=0}^{t} \frac{\partial E_t}{\partial y_t} \frac{\partial y_t}{\partial h_t} \frac{\partial h_t}{\partial h_i} \frac{\partial h_i}{\partial W_R}$$

$$\frac{\partial h_t}{\partial h_i} = \frac{\partial h_t}{\partial h_{t-1}} \frac{\partial h_{t-1}}{\partial h_{t-2}} \cdots \frac{\partial h_{i+1}}{\partial h_i} = \prod_{k=i}^{t-1} \frac{\partial h_{k+1}}{\partial h_k}$$

$$f = tanh(x)$$
$$\frac{\partial h_{k+1}}{\partial h_k} = diag(f'(W_I x_i + W_R h_{i-1}))W_R$$

$$\frac{\partial h_k}{\partial h_1} = \prod_{i}^{k} diag(f'(W_I x_i + W_R h_{i-1}))W_R$$

h_0, w_{ih}, w_{hh}

https://weberna.github.io/blog/2017/11/15/LSTM-Vanishing-Gradients.html

下一课时

RNN Layer使用方法

Thank You.