# RNN - Presentation (1 hour)

1) RNN Classification
   - ONE to ONE
   - ...
   - MANY to MANY

2) Simple NN cell vs RNN cell

3) Meaning of hidden units in NN & RNN

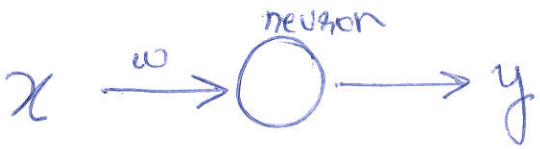
4) Multilayer in NN & RNN

5) Capturing long term dependencies by:
   - Bidirectional RNNs
   - LSTMs
   - GRUs

6) Running Example (Simplest RNN Architecture) → LANGUAGE Model
   - Forward Prop imputes loss
   - Backprop imputes gradients of loss w.r.t model params

# Simple Neural Net Cell:

(BINARY classes)



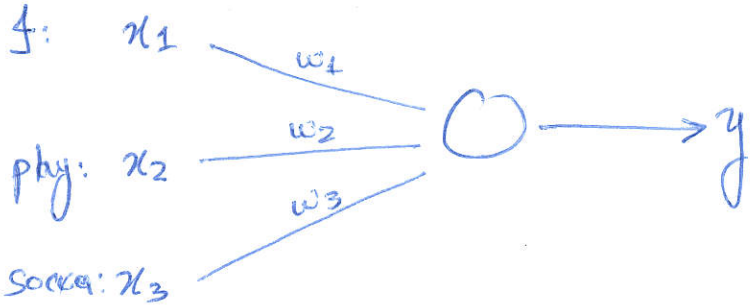

$$y = \sigma(w \cdot x + b)$$

$\sigma$ : sigmoid function

With three inputs:

$x = [\text{I}, \text{Play}, \text{soccer}]$

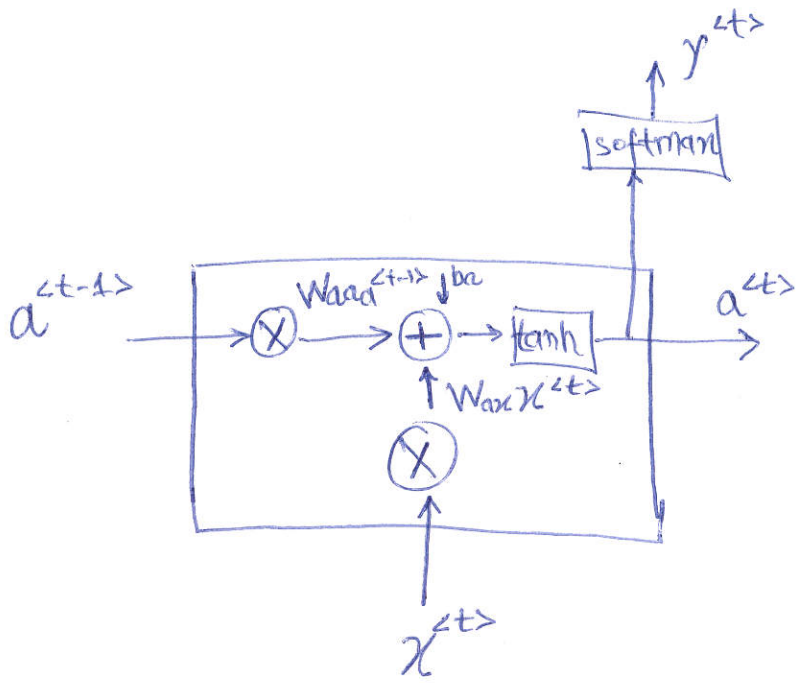
$y = [\text{game}, \text{nogame}]$




$$y = \sigma(w_1 x_1 + w_2 x_2 + w_3 x_3 + b)$$

# RNN Cell:

(Andrew Ng's lectures)




## Inputs to cell:

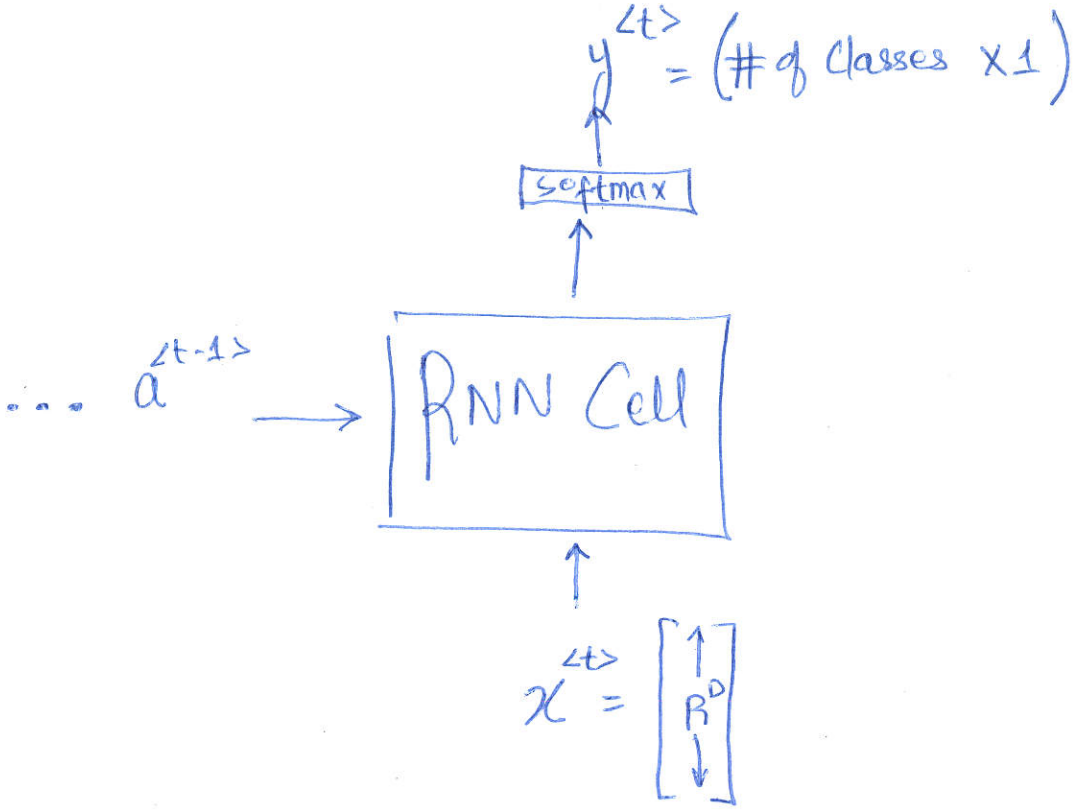
1) $a^{<t-1>}$ (Previous State)
2) $x^{<t>}$ (Current input)

## Output

1) $y^{<t>}$ (Prob vector in general)

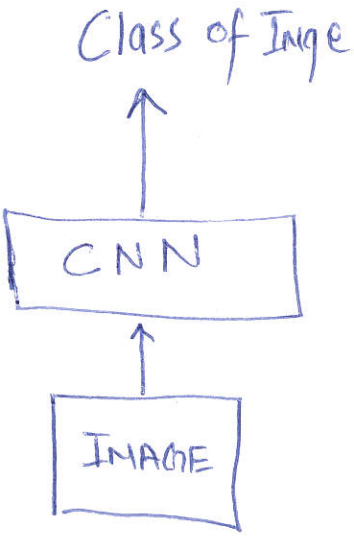
DIMENSION of $a^{<t>}$ Decides hidden units

EXAMPLE (NER)

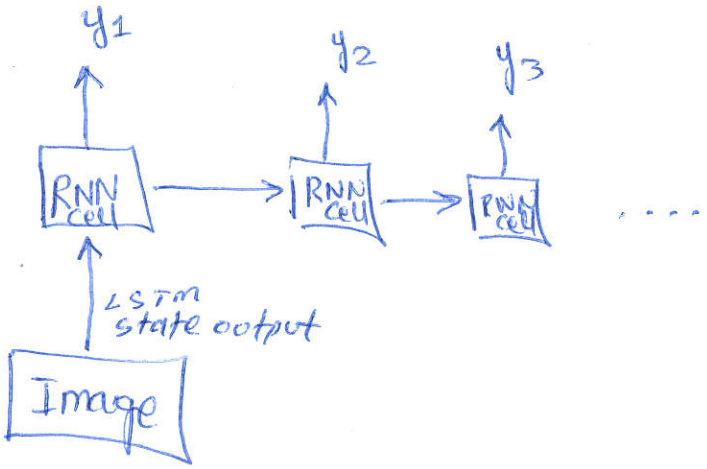

$y^{\langle t \rangle}$ = (# of classes x 1)
softmax
RNN Cell
$a^{\langle t-1 \rangle}$
$x^{\langle t \rangle}$ = $\mathbb{R}^D$

# TYPES of NN (ANDREJ KARPATHY)

1) ONE-to-ONE

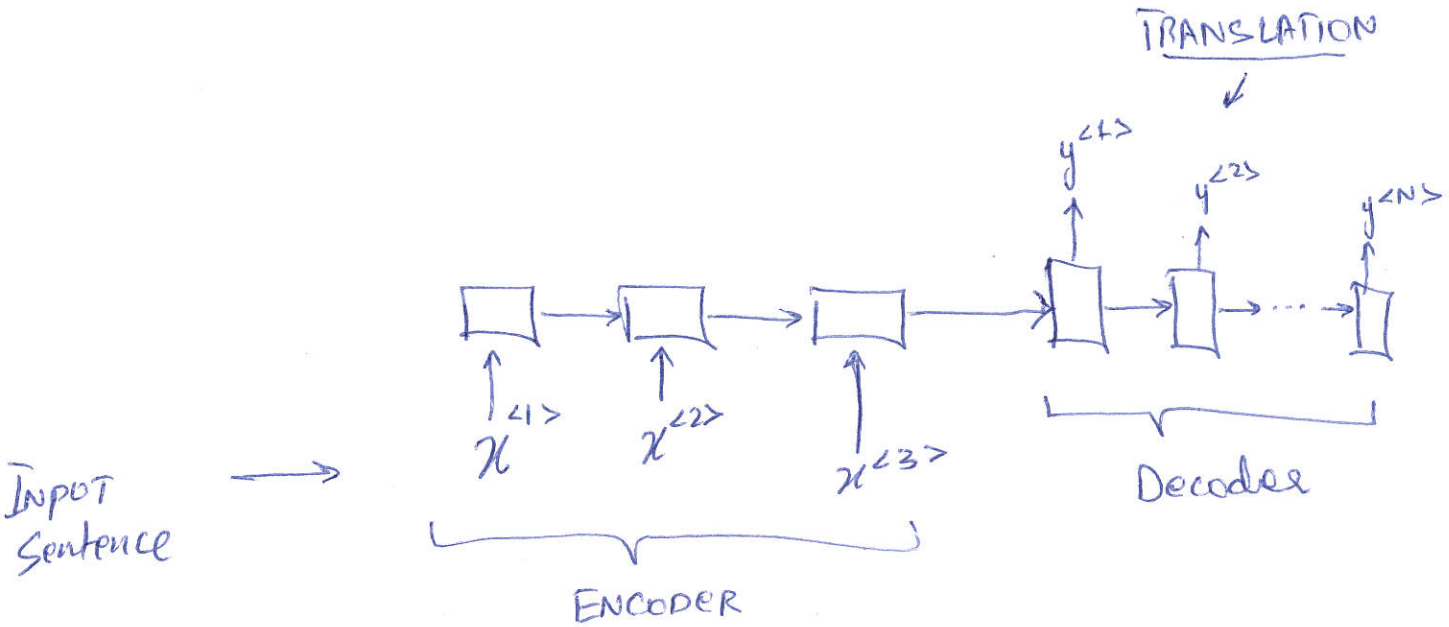


(2) ONE - to - MANY



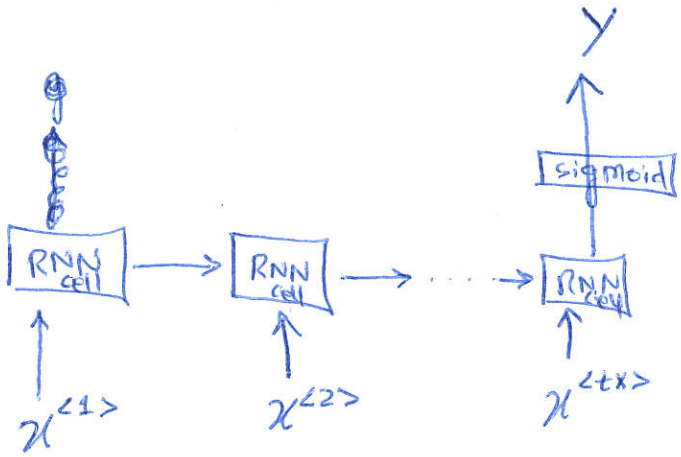
(4) MANY-to-MANY

(TRANSLATION)



(3) MANY-to-ONE

(Sentimoid Analysis)

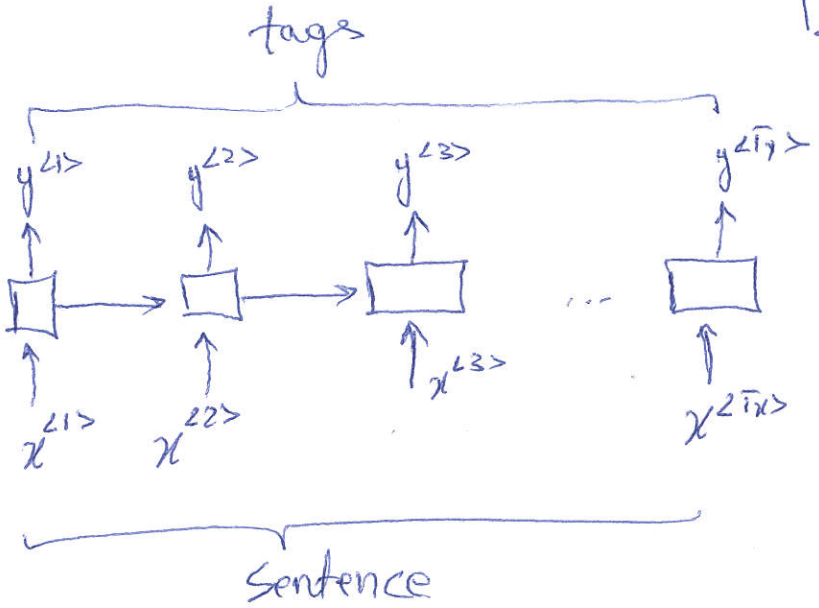



RNN cell can be replaced By LSTM cell

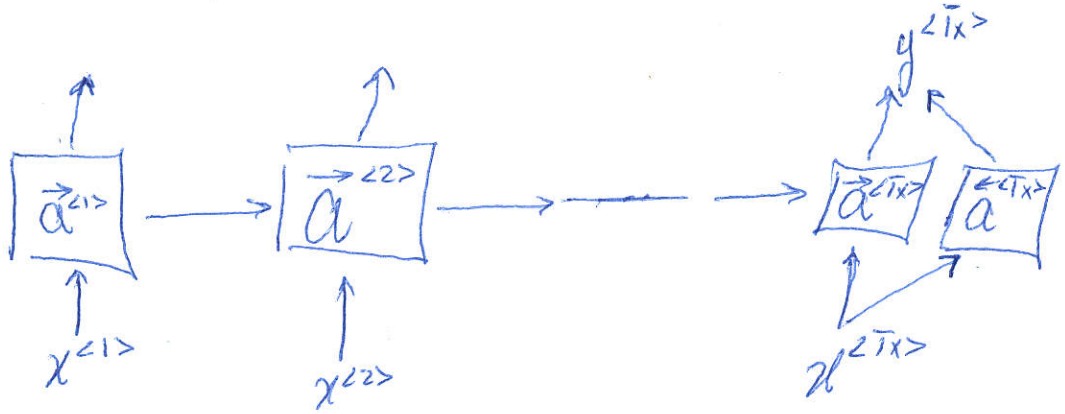
(5) MANY-to-MANY

NER

$T_x = T_y$



# Bidirectional RNN



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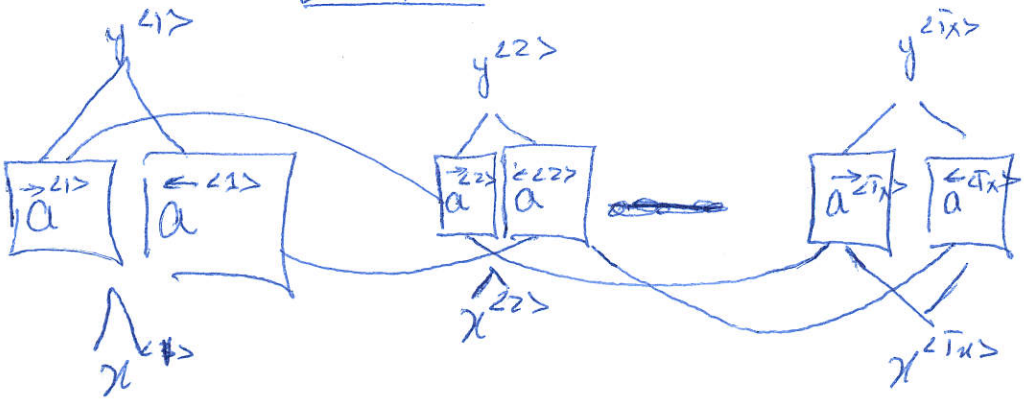
Let $T_x = 3$



Incorporating future tokens or inputs