Recurrent Neural Network (RNN) and Long Short Time Memory (LSTM)

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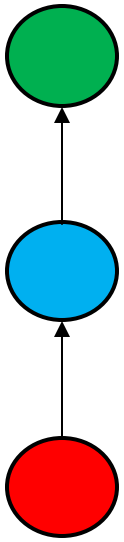
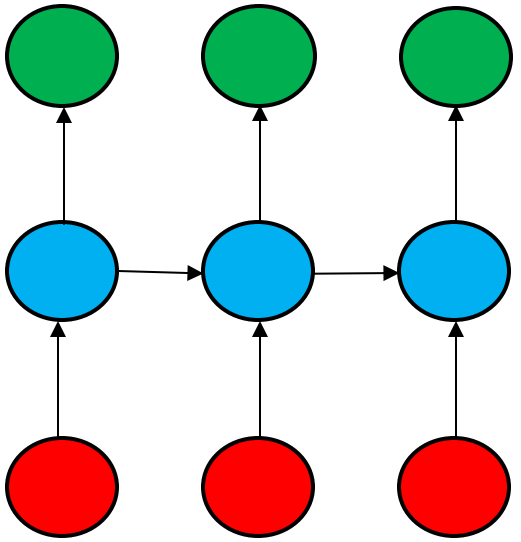
RNN

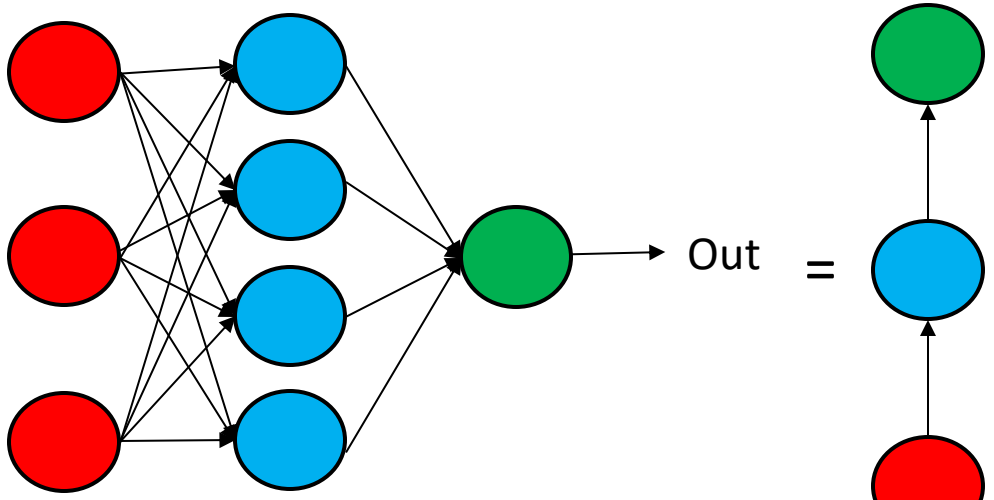


One to One

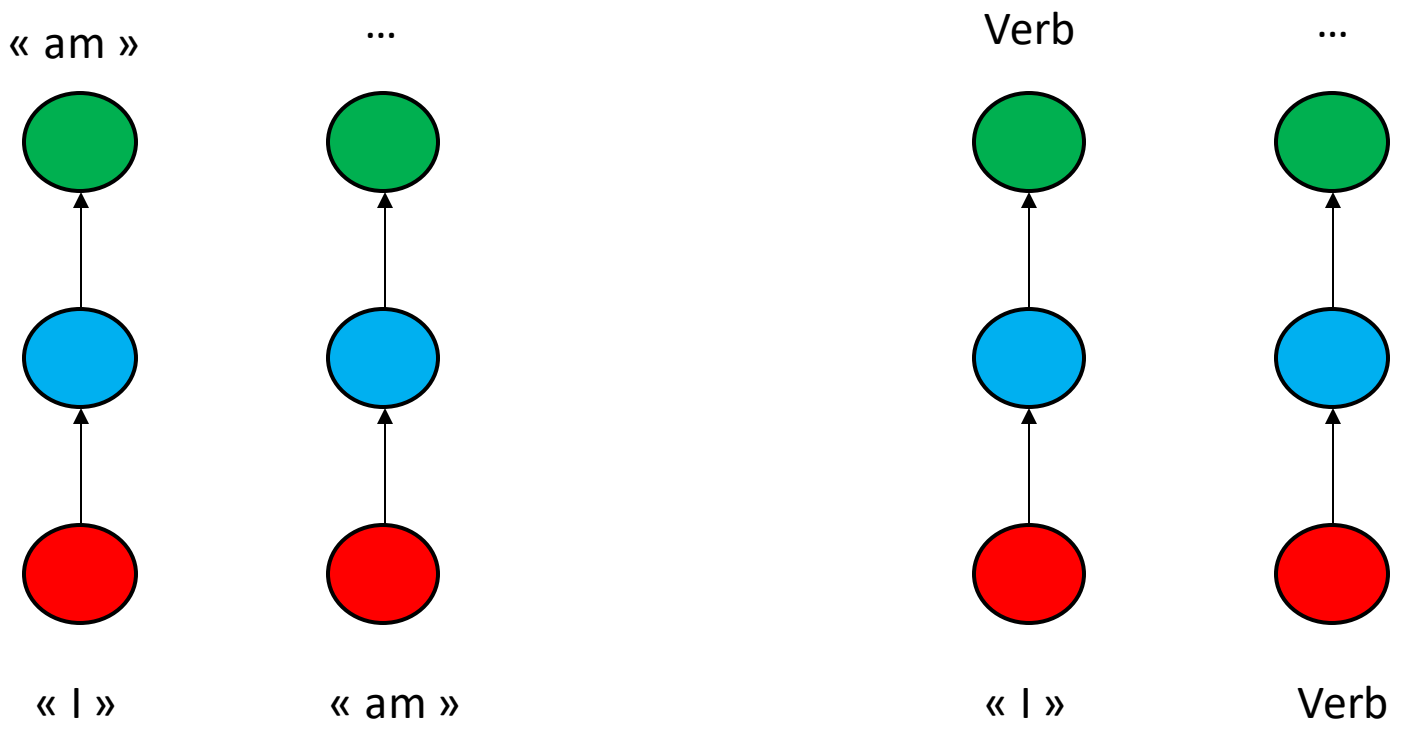


Many to Many

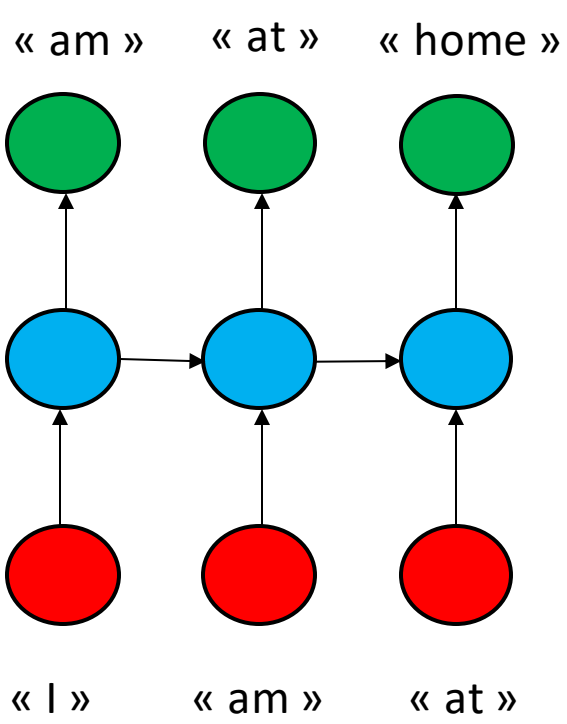
RNN : The feedforward

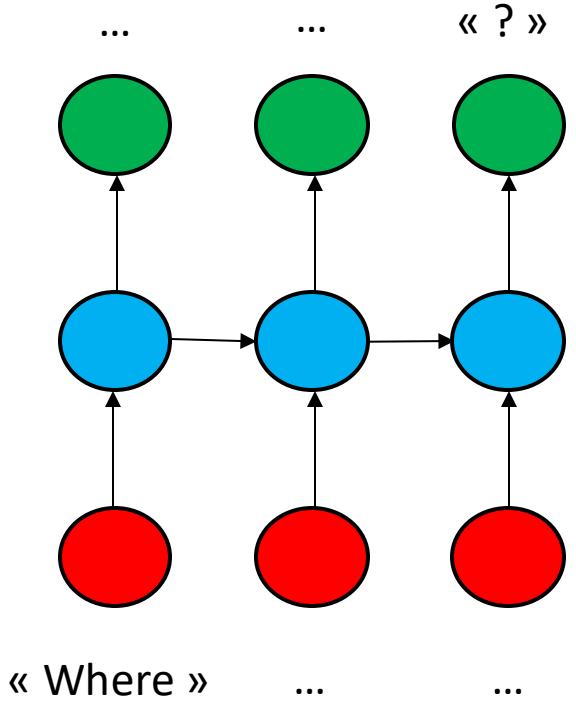


RNN : The feedforward

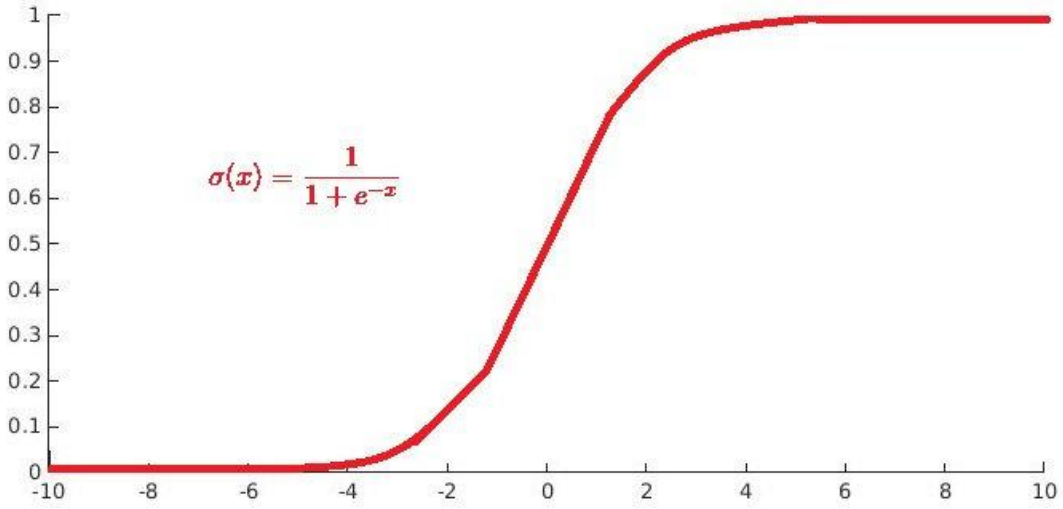


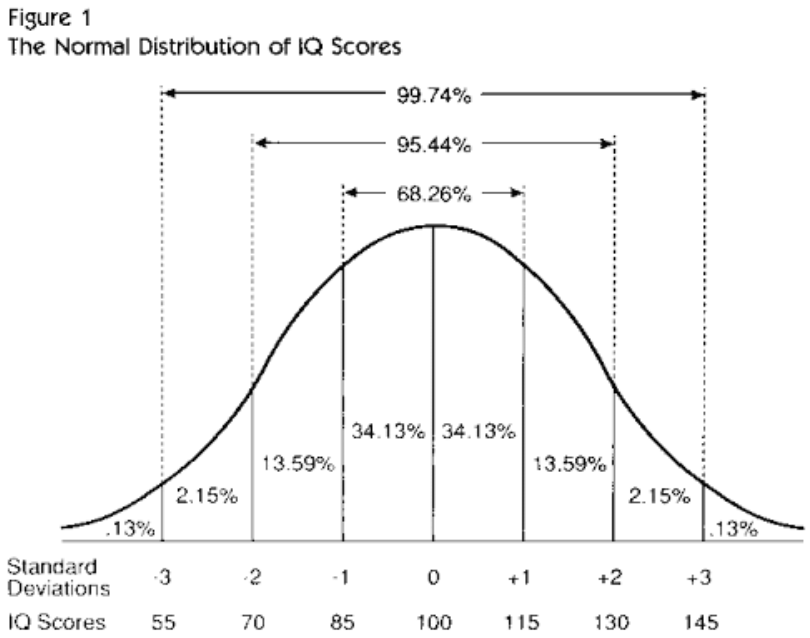
RNN : The recurrent neural network





RNN : Vanish gradient





LSTM : Three main operations

- Forget Gate
- Input Gate
- Output Gate

LSTM : The forget Gate

- Gets t-1 output value
- Apply a sigmoïd function to it
- Saves the result in the memory called « C »

$$f_t = \sigma_g(W_f x_t + U_f h_{t-1} + b_f)$$

LSTM : Input Gate

- Aplly tanh and adds a bayes to the memory
- Proposes new interesting values
- Aplly the input gate function to these values

$$i_t = \sigma\left(W_i \cdot [h_{t-1}, x_t] \; + \; b_i\right)$$
$$\tilde{C}_t = \tanh(W_C \cdot [h_{t-1}, x_t] \; + \; b_C)$$

LSTM : Output Gate

- Apply the sigmoïd function on the memory
- Apply tanh on the actual memory
- Multiply the previous results

$$o_t = \sigma\left(W_o\left[h_{t-1}, x_t\right] + b_o\right)$$
$$h_t = o_t * \tanh\left(C_t\right)$$