

What is RNN?

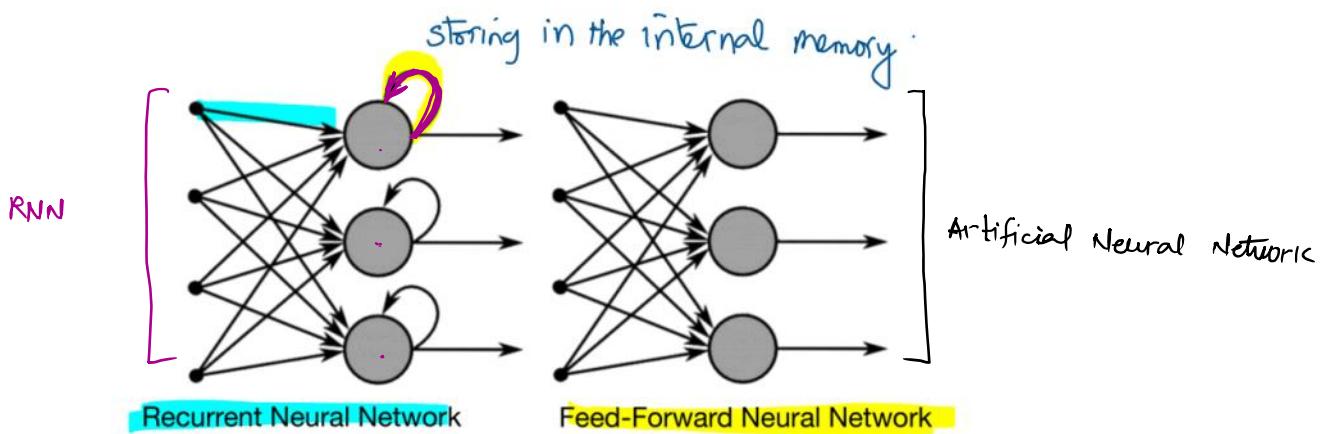
↳ Recurrent Neural Network

Why is it called recurrent?

- the term 'recurrent' itself in RNN comes from the repetition (or recurrence) of operations over time series / time steps in a sequence.

In RNN,

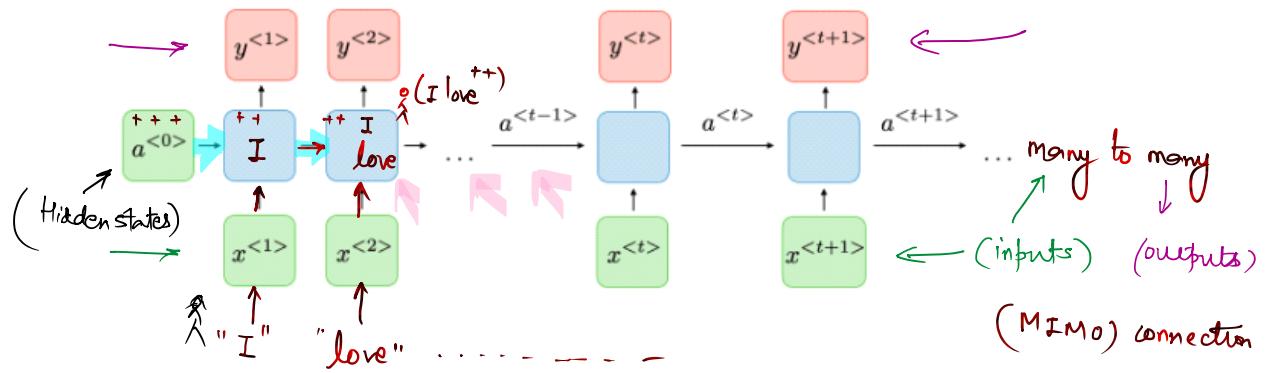
- the same operation is applied repeatedly at every step.
- n/w feeds its output (hidden state) from the previous time step back into itself
- this loop-like architecture allows it to remember previous information
↳ hence making it suitable for time-series data.



RNN allows previous outputs to be used as inputs while having hidden states

$\left[\text{stock price} \right] \rightarrow \text{RNN}$

"I love to teach deep learning".



① $x^{<t>}$ represents sequence of inputs

All the green boxes at the bottom denote the input

sequences labelled as $x^{<1>} , x^{<2>} , x^{<3>} , \dots , x^{<t>} , x^{<t+1>}$

say if input is a sentence then

$x^{<t>}$ represents a word token in general.

② $a^{<t>}$: Hidden state

Blue boxes in the middle indicate represent hidden states

which maintain the memory of the now.

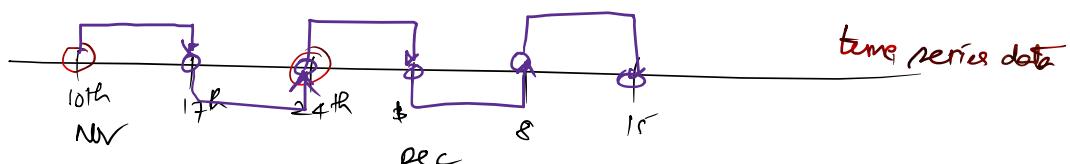
Each hidden state $a^{<t>}$ carries the information from the past inputs upto the current state t

③ Outputs $y^{<t>}$

Red boxes at the top denote the outputs of RNN at each time step labelled as $y^{<1>} , y^{<2>} , y^{<3>} , \dots$ and so on.

RNN key features

① Sequential data processing



RNNs are designed to handle sequences of data

- Time-series - Tesla stock prices handling
- Text

- speech
- Video Frames

RNNs are designed to process one element at a time while maintaining a memory of previous inputs.

② Memory of previous inputs (Hidden state Memory)

- RNNs have an internal hidden state that is updated at each time step and this allows them to capture the **context**.

↓ (understand the intent)
 RNNs can interpret new data in the context of prior information which is essential for understanding the meaning and the flow in natural language tasks.

③ Dynamic Adaptation RNNs continuously update internal states allowing them to adjust to evolve patterns within the sequences: