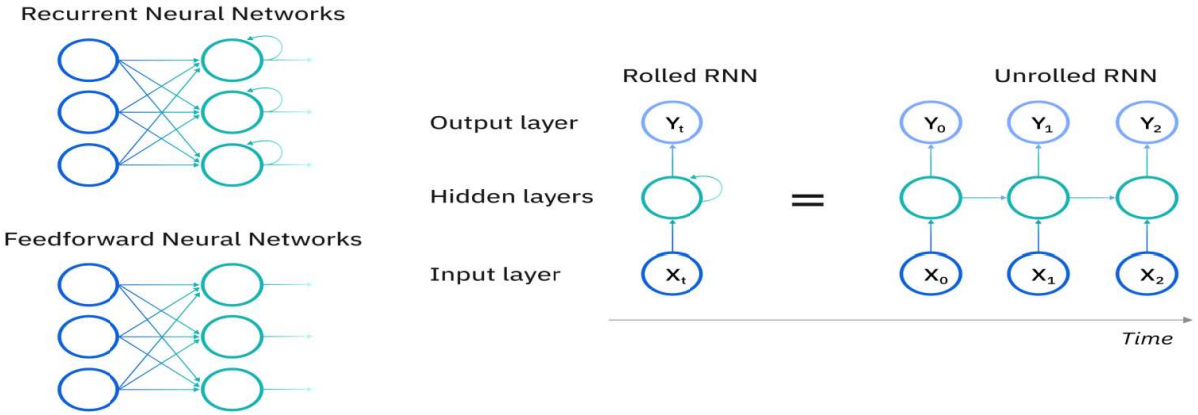
Recurrent neural network

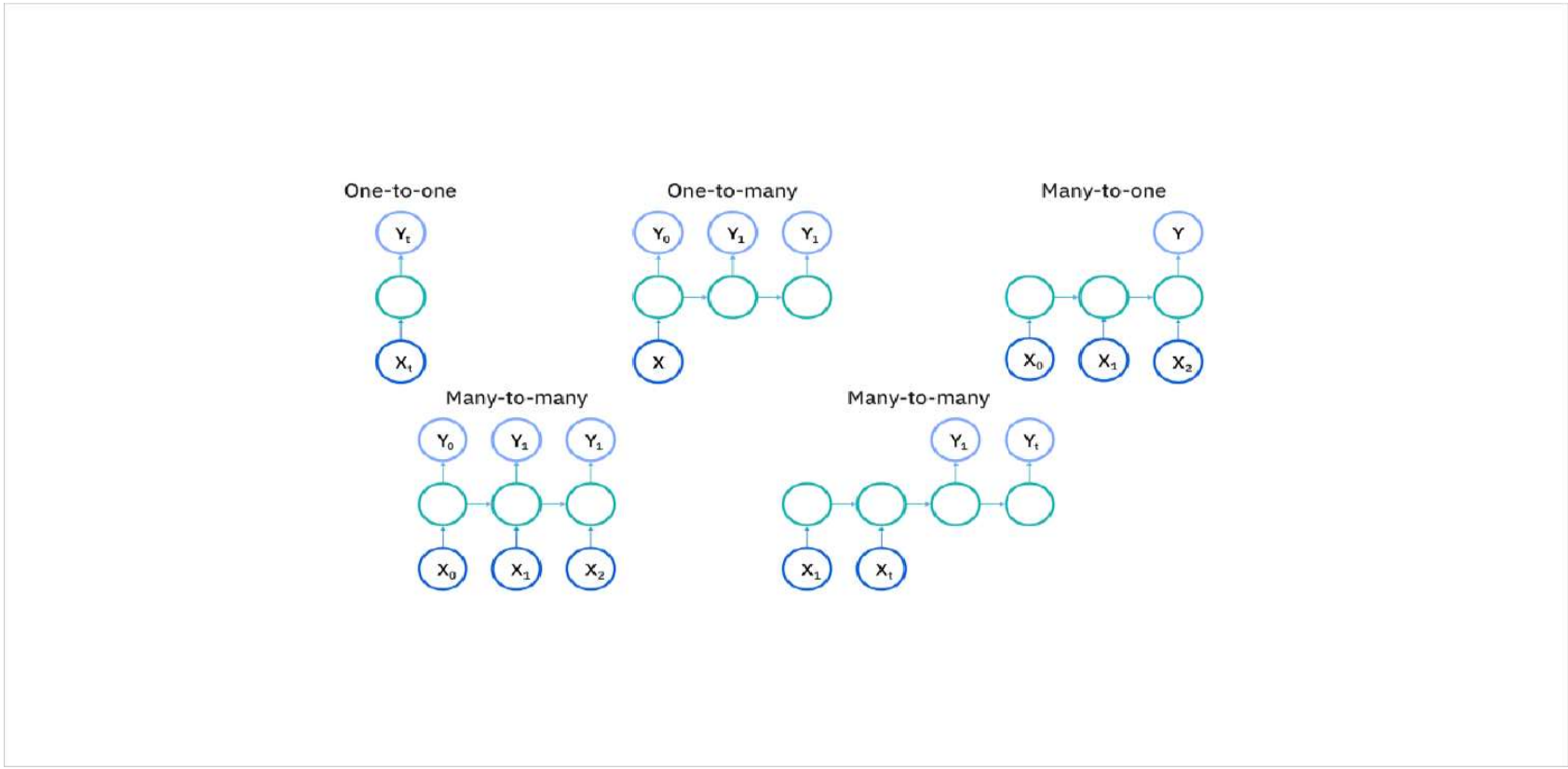
- Temporal data
- Should remember the past data
- It consists of cells
- Cells consist of gates
- Gates form a hidden state

Recurrent neural network

Architecture:



Recurrent neural network - configuration

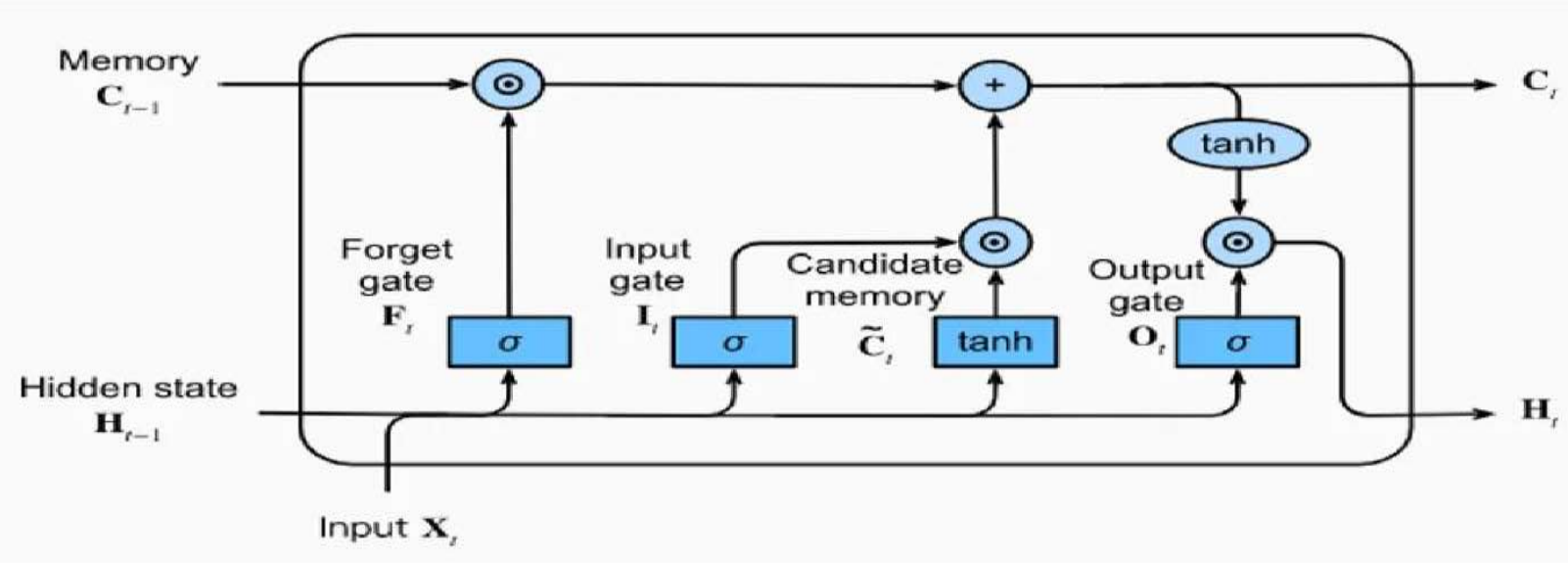


Different types of RNN

LSTM

- **Forget Gate:** LTM goes to forget gate and it forgets information that is not useful.
- **Learn Gate:** Event (current input) and STM are combined together so that necessary information that we have recently learned from STM can be applied to the current input.
- **Remember Gate:** LTM information that we haven't forget and STM and Event are combined together in Remember gate which works as updated LTM.
- **Use Gate:** This gate also uses LTM, STM, and Event to predict the output of the current event which works as an updated STM.

LSTM architecture



$$h_t = \sigma(W^{hx}x_t + W^{hh}h_{t-1})$$

$$y_t = W^{yh}h_t$$

Training recurrent neural model

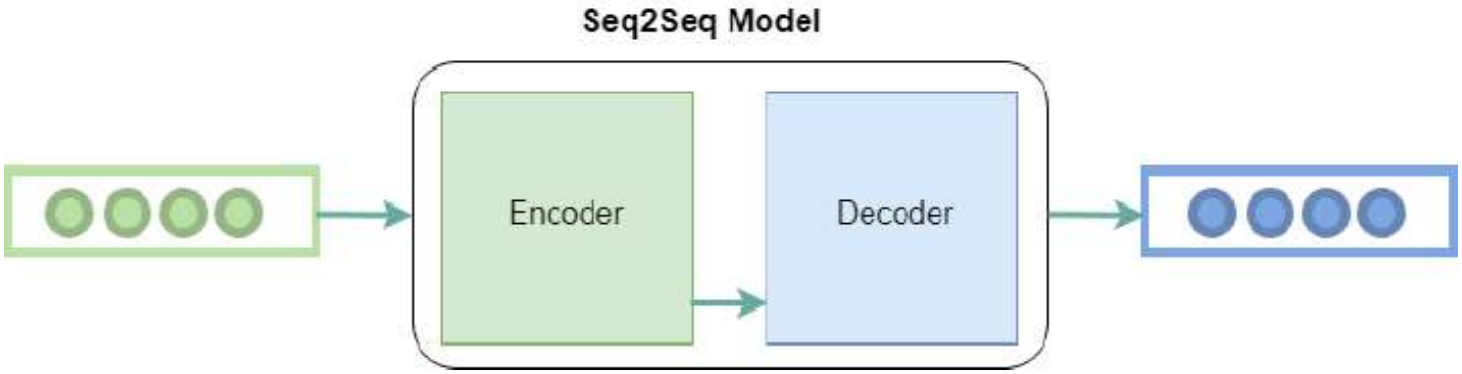
- Backpropagation algorithm
- Backpropagation through time

Recurrent Neural Network

Where it can be used:

- Language modeling
- Time series prediction
- Language translation
- Video analysis

Sequence-to-sequence model



Sequence-to-sequence model in optimization

- Pointer network
- Inputs as combination of input data
- Output as a sequence of point in the solution