

Lecture 3d: RNN

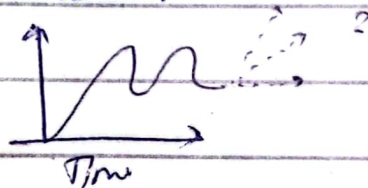
(Recurrent Neural Network)

Time-Series Data (over a period of Time)

example → stock market rates

- (i) (based) on stock market rates
- (ii) Daily Temperature
- (iii) Natural Language
- (iv) sales (have order)

"predicting future values based on past-time ordered data".



How it is different

→ Time is important factor

AI Drives demand
forecasting

• Time Series / Sequential Data

weather prediction (predict Temperature)

Time Step (individual entry in time series) data

A time step is a single point in a sequence of data, representing moment in time.

- Time series analysis (on basis of past data)
- Time series predictor / for future predictive analytics

Can feed forward Neural Network predict future values by historical data.

(No)

① can't handle sequential data

② Consider only current input

③ can't memorize the previous inputs

- in previous models model was independent of previous inputs

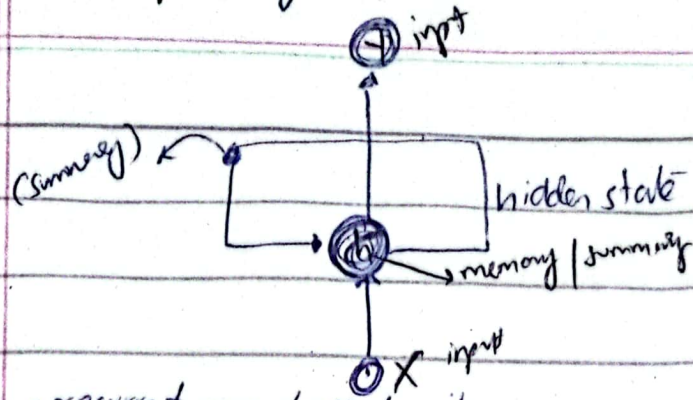
- know only current input
- not have memory

So need of some solution \Rightarrow A different neural network

Recurrent Neural Networks (RNN)

Class of neural networks designed to recognize patterns in sequence of data, such as time series or natural language.

- composed of recurrent units.

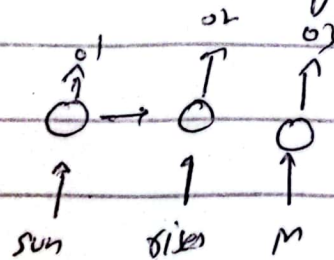


- recurrent neuron/cell/unit

- RNN have one or more neurons and have one or more multiple layers.

input sample + summary \Rightarrow output

\rightarrow have summary of previous steps 22-30
individual entry \rightarrow time step



- each running cell has summary of previous step

if a sequence is much larger than it over-rides.

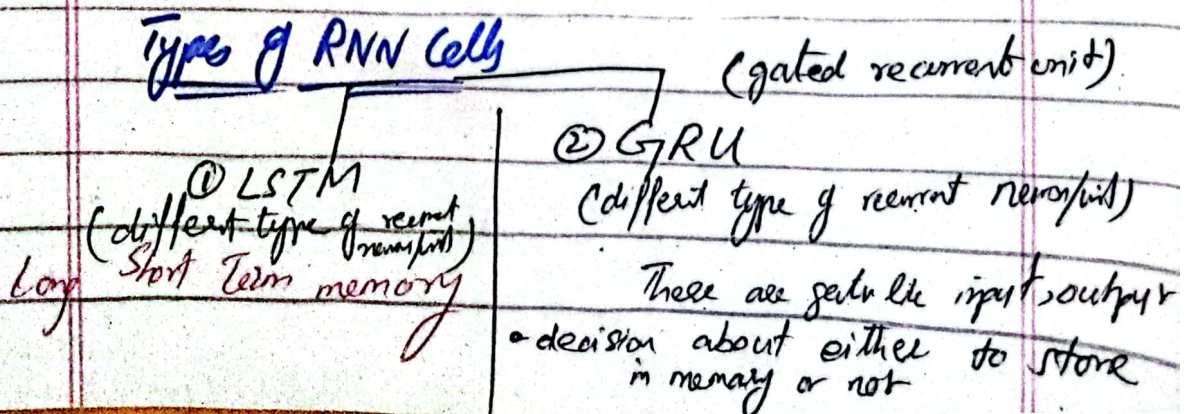
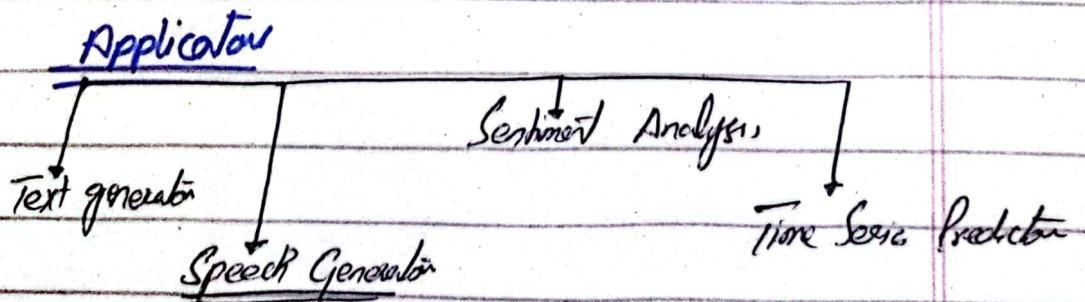
key characteristics

Have an internal state (memory) that captures information about previous inputs.

Then we draw layers at the head. (e.g. classifiers, generators, etc.)

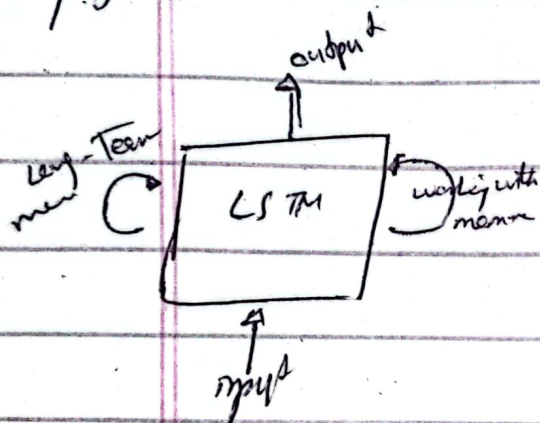
What makes RNN Special?

- ① Internal memory
(can remember past input & use the context which processing new information)
- ② Sequential Data Processing
excel with sequential data.
- ③ Variable size input support
- ④ Contextual understanding
(analyze current inputs with previous one, offering crucial context)
- ⑤ Dynamic Processing
(update their memory with new data, adapting to changing patterns in a sequence)



Can selectively remember and
forget information, focus
on relevant data and
ignore noise

• forget gate



- simplified version of LSTM with fewer gates (reset updates)
- computationally more efficient while handling long term dependencies