

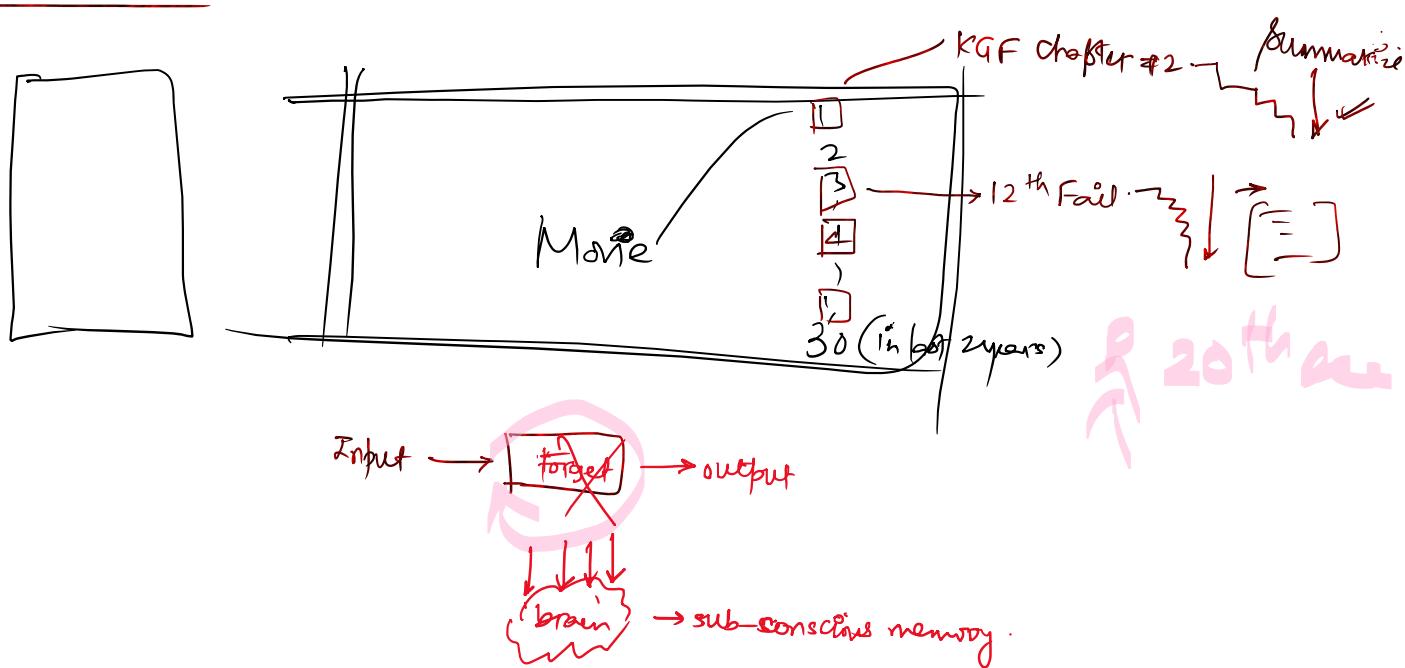
LSTM: Long Short-Term Memory
↳ primarily for long sequences.

LSTM networks are a special type of RNN model designed to learn and remember over long sequences.

LSTM is an advanced variant of RNN that excels at learning long term sequences - a common challenge in sequential data processing.

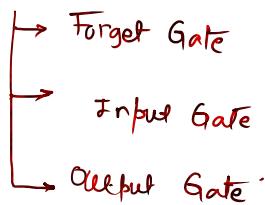
Unlike traditional RNNs that struggle with remembering distant past information (due to vanishing gradients), LSTM uses a unique gating mechanism to manage memory over long sequences.

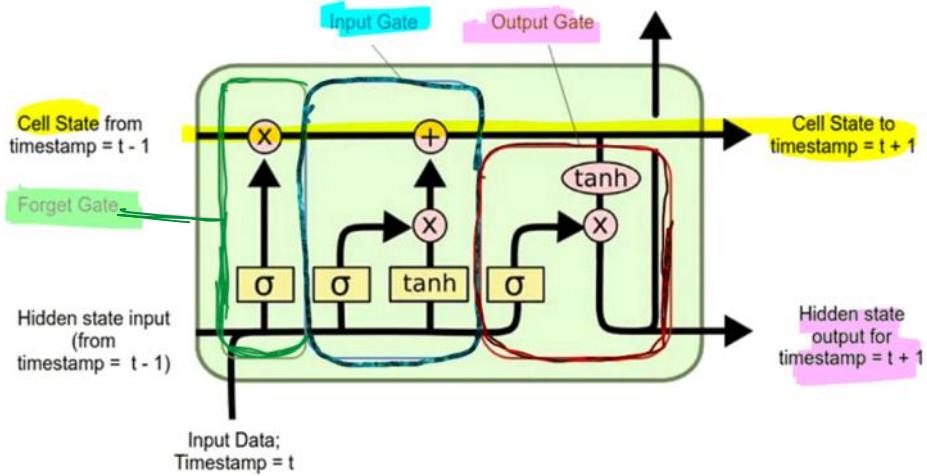
LSTM Architecture



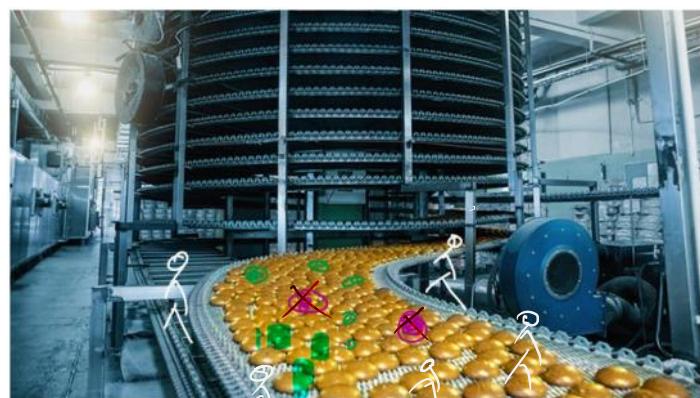
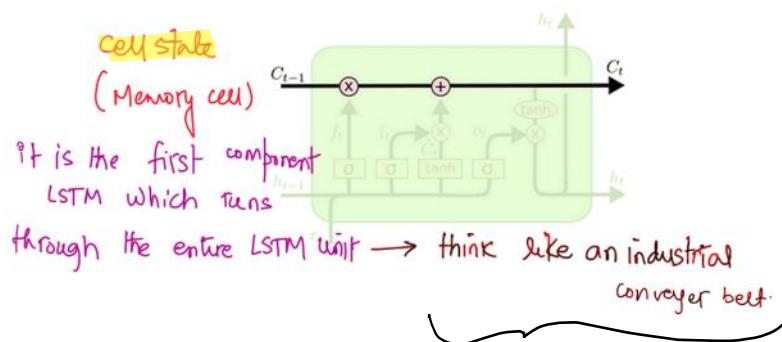
LSTM architecture includes :

- * a memory cell and three gates





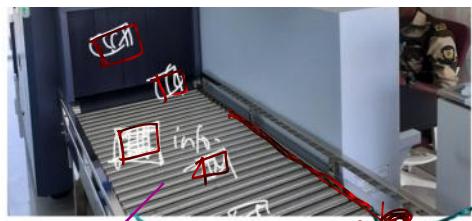
- ① Memory cells: The central component of the LSTM is the memory cell which retains information across the long sequences, and the memory cell decides what information to keep, to update, or to discard using gating mechanisms.
- ② Keep → ③ Update → ④ Discard.



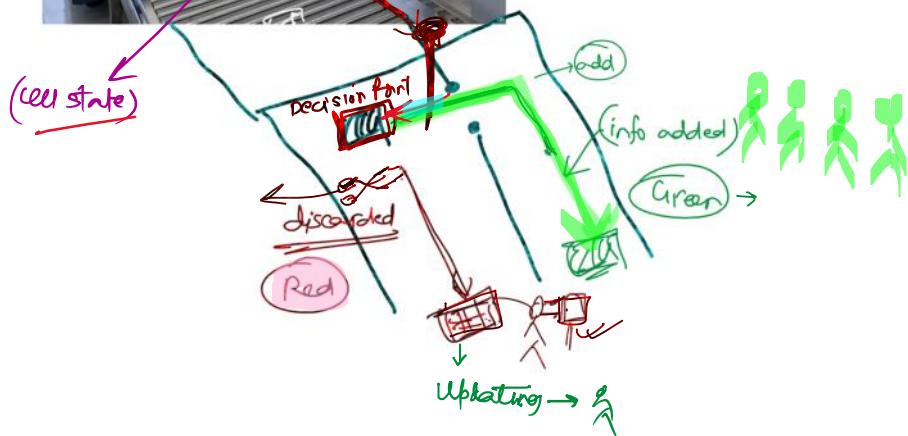
④ disc

Flow of the memory



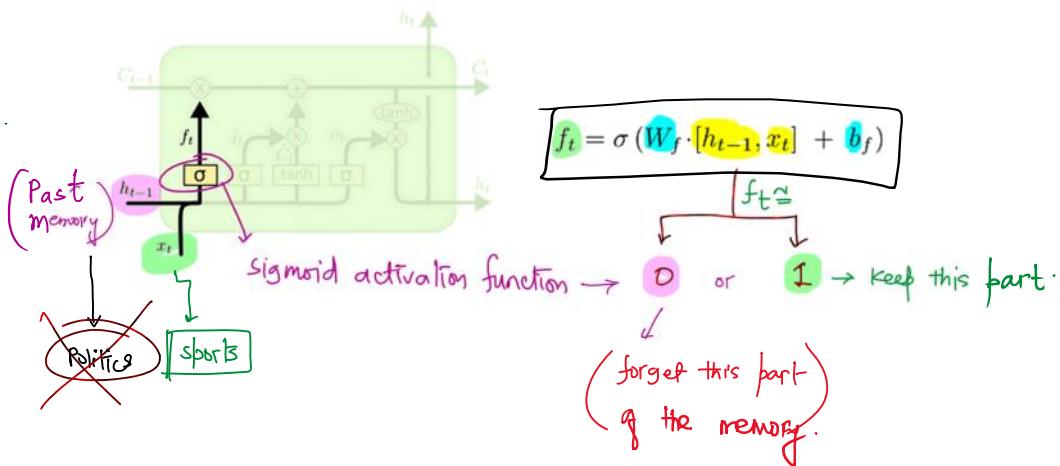


Flow of the memory

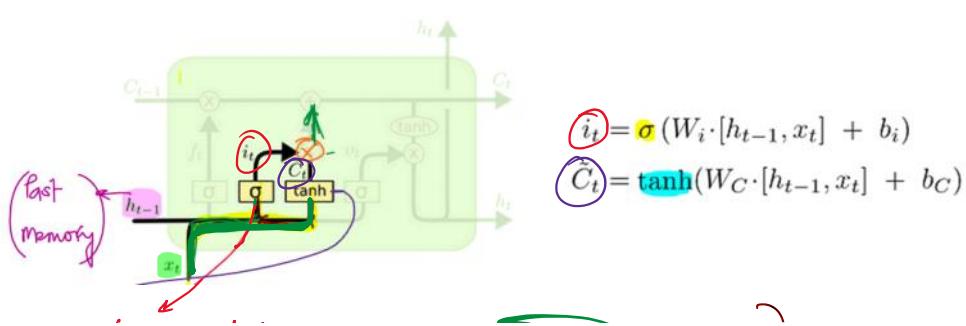


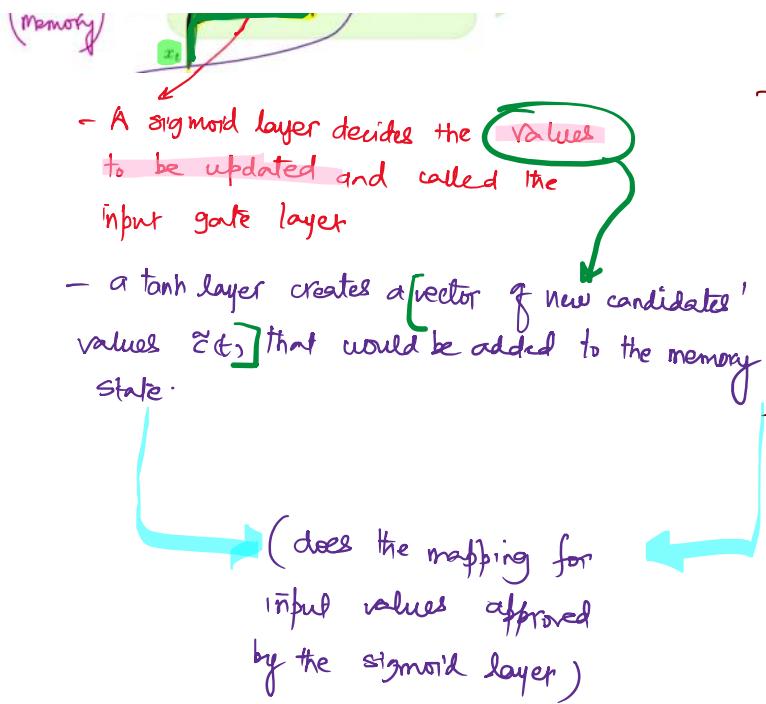
*2 Gates LSTM uses gates to control the flow of information

Forget Gate: As the name suggests, forget gate decides what information should be forgotten or discarded from the cell state is done by the forget gate.

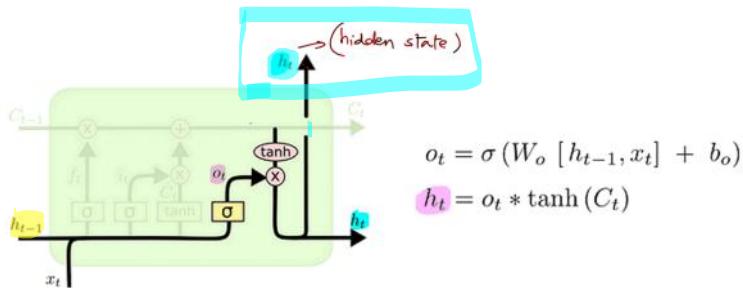


Input Gate: it decides what new information getting added to the cell state

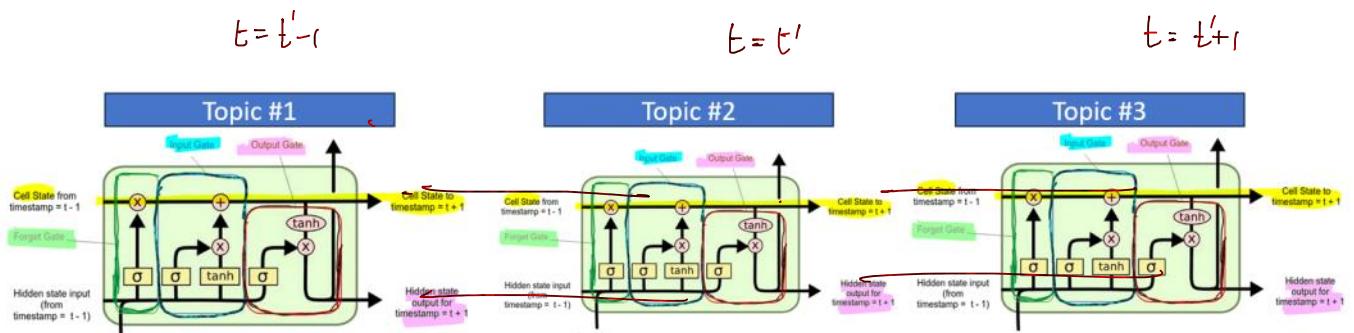


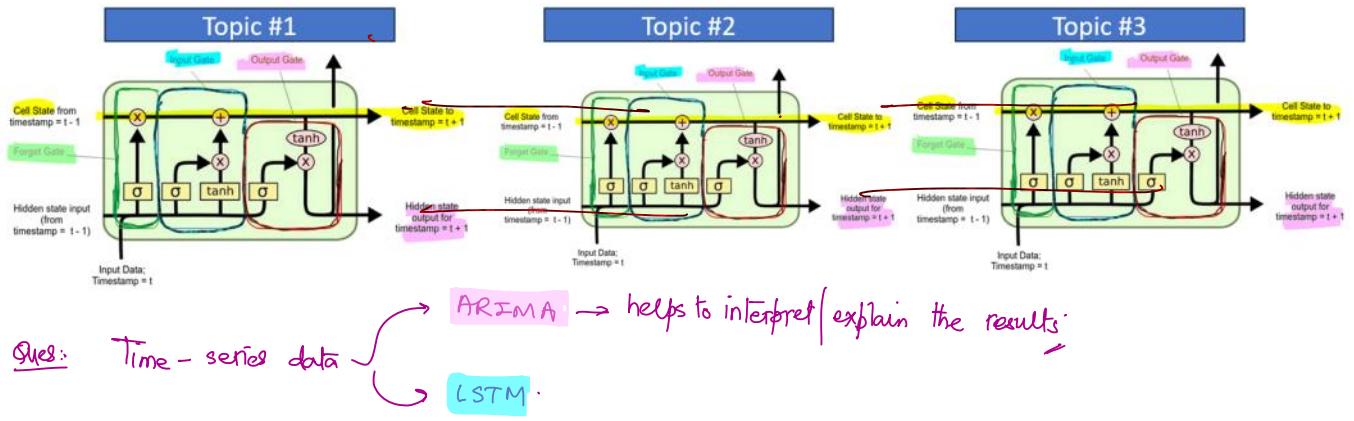


Output Gate: The output of the LSTM Unit depends on the new cell state → it decides what part of the cell state is moved forward to the output as the hidden state.

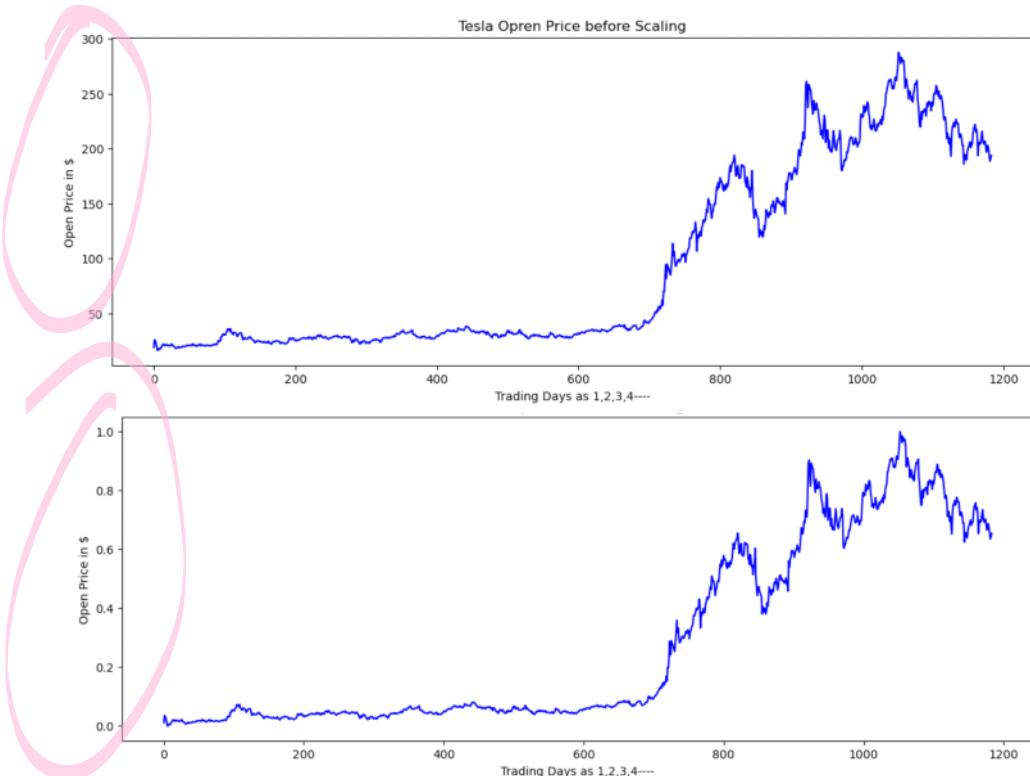


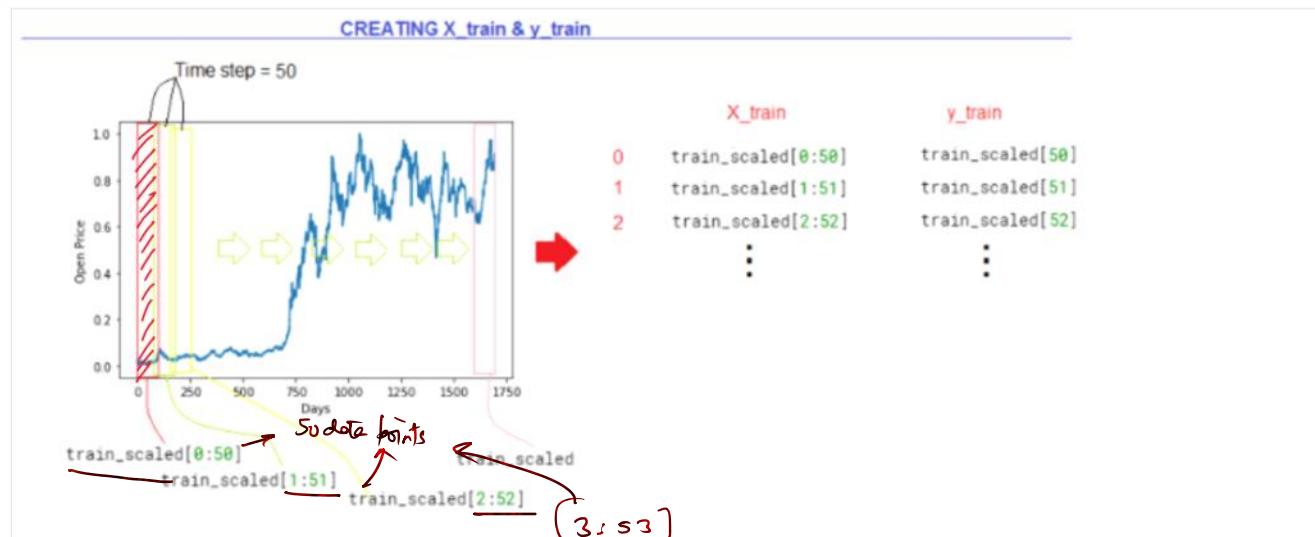
Gate	Purpose	Formula	Activation
Forget Gate f_t	What old info to forget from C_{t-1}	$\sigma(W_f [h_{t-1}, x_t] + b_f)$	Sigmoid (0~1)
Input Gate i_t	What new info to store in C_t	$\sigma(W_i [h_{t-1}, x_t] + b_i)$	Sigmoid
Output Gate o_t	What to output as hidden state h_t	$\sigma(W_o [h_{t-1}, x_t] + b_o)$	Sigmoid



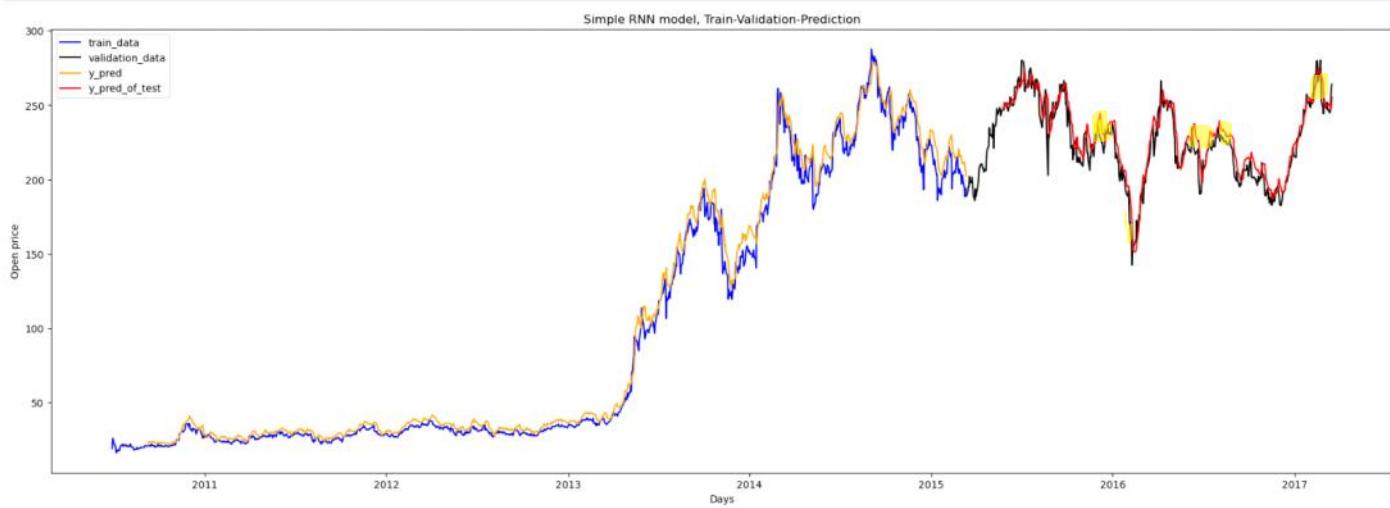


RNN & LSTM Hands-on using Tesla Stock Data





SIMPLE RNN TRAIN & VALIDATION CHART



RNN

