Recurrent Neural Network

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ML II

Final Project

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Introduction

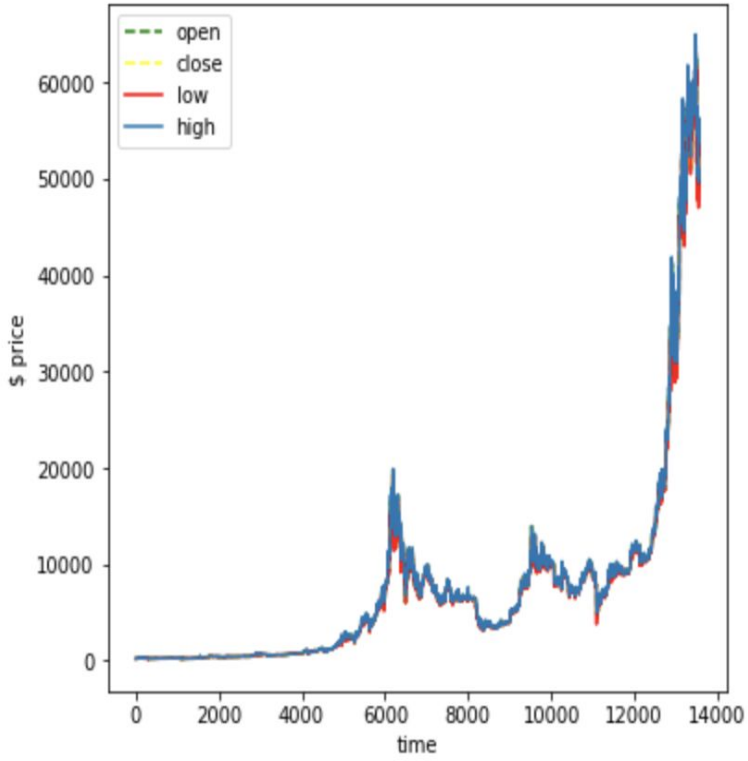
Aim of Study

- Increase of stock trending during the pandemic
- Suggest smart investment strategies with deep learning models
- Find the best model

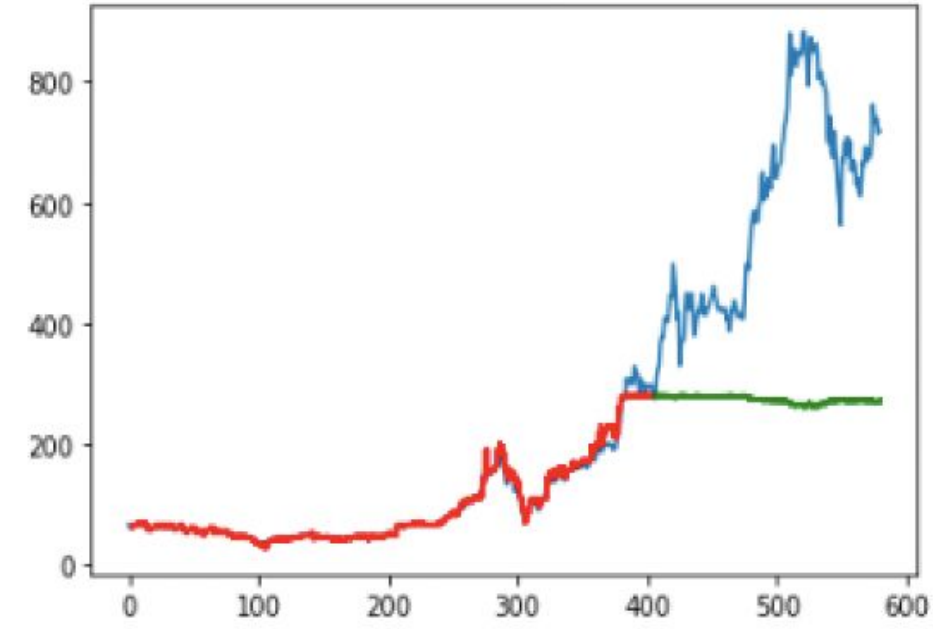
Dataset

Dataset & Data Preprocessing

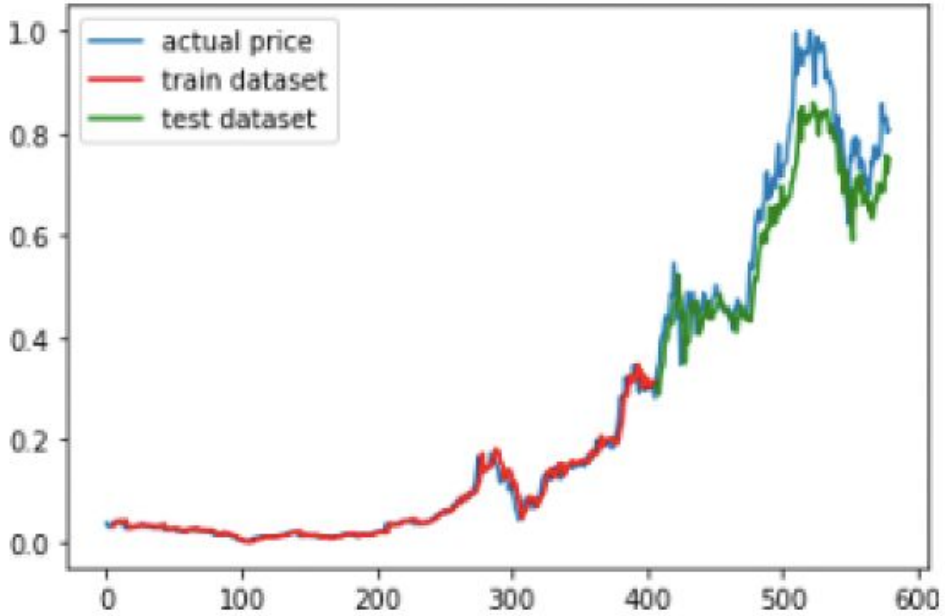
- Polenix - Crypto currency exchange
- Requested Polenix API and imported the Bitcoin dataset into the Python, using Polenix library
- The dataset consists of daily prices of open, close, low, and high prices
- MinMaxScale() used for the datapreprocessing



Data preprocessing



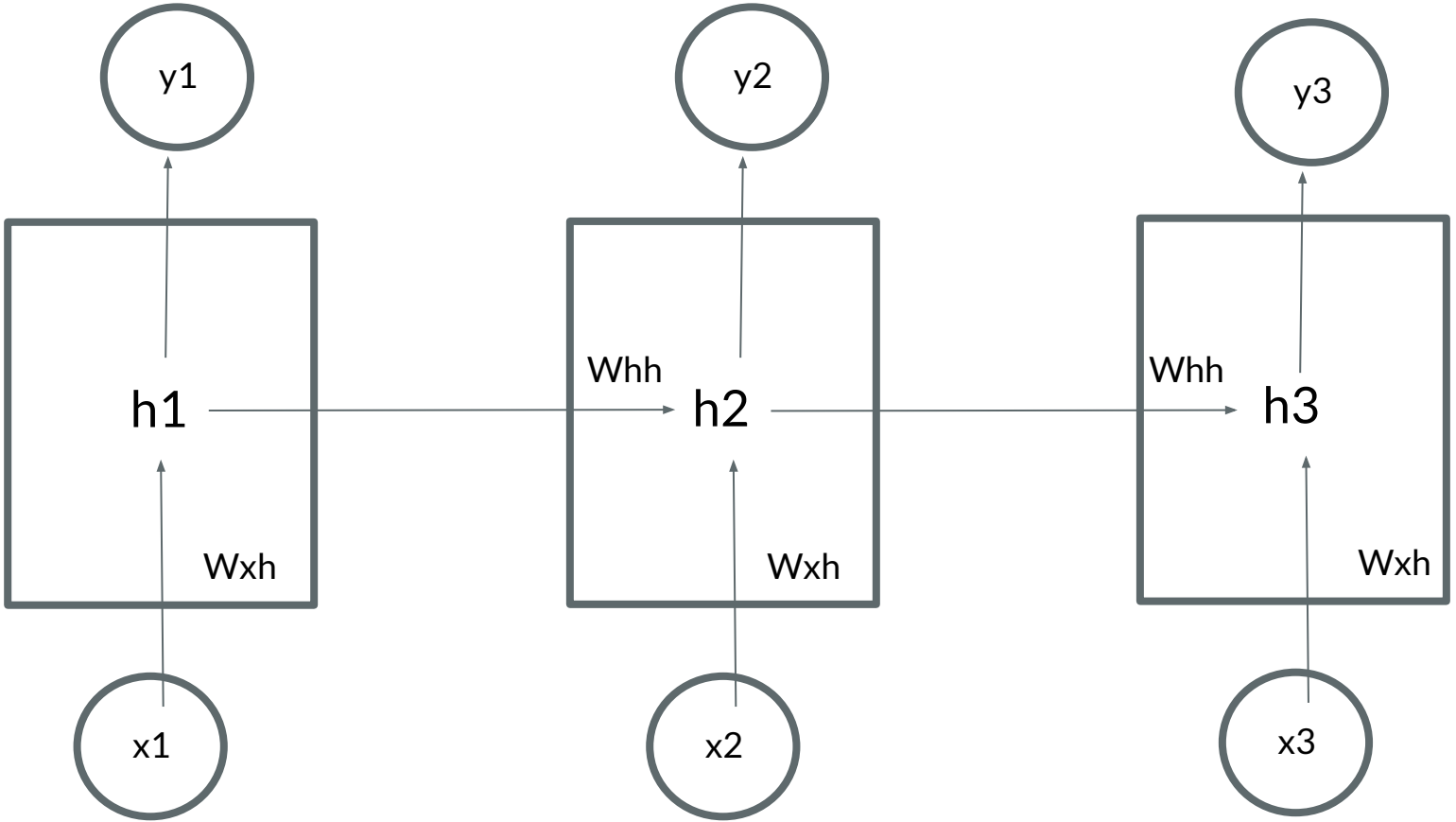
Before preprocessing



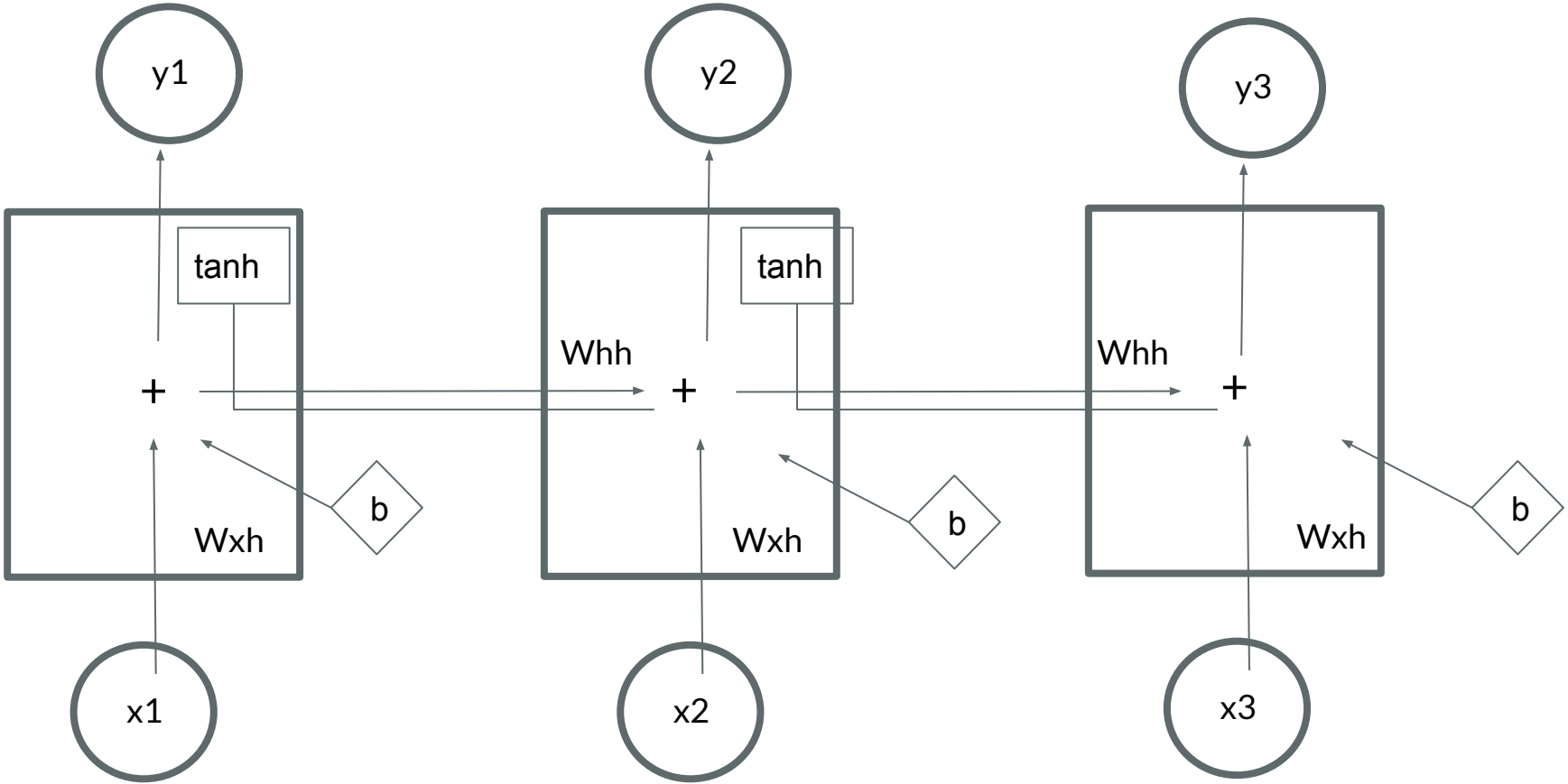
After preprocessing

Models

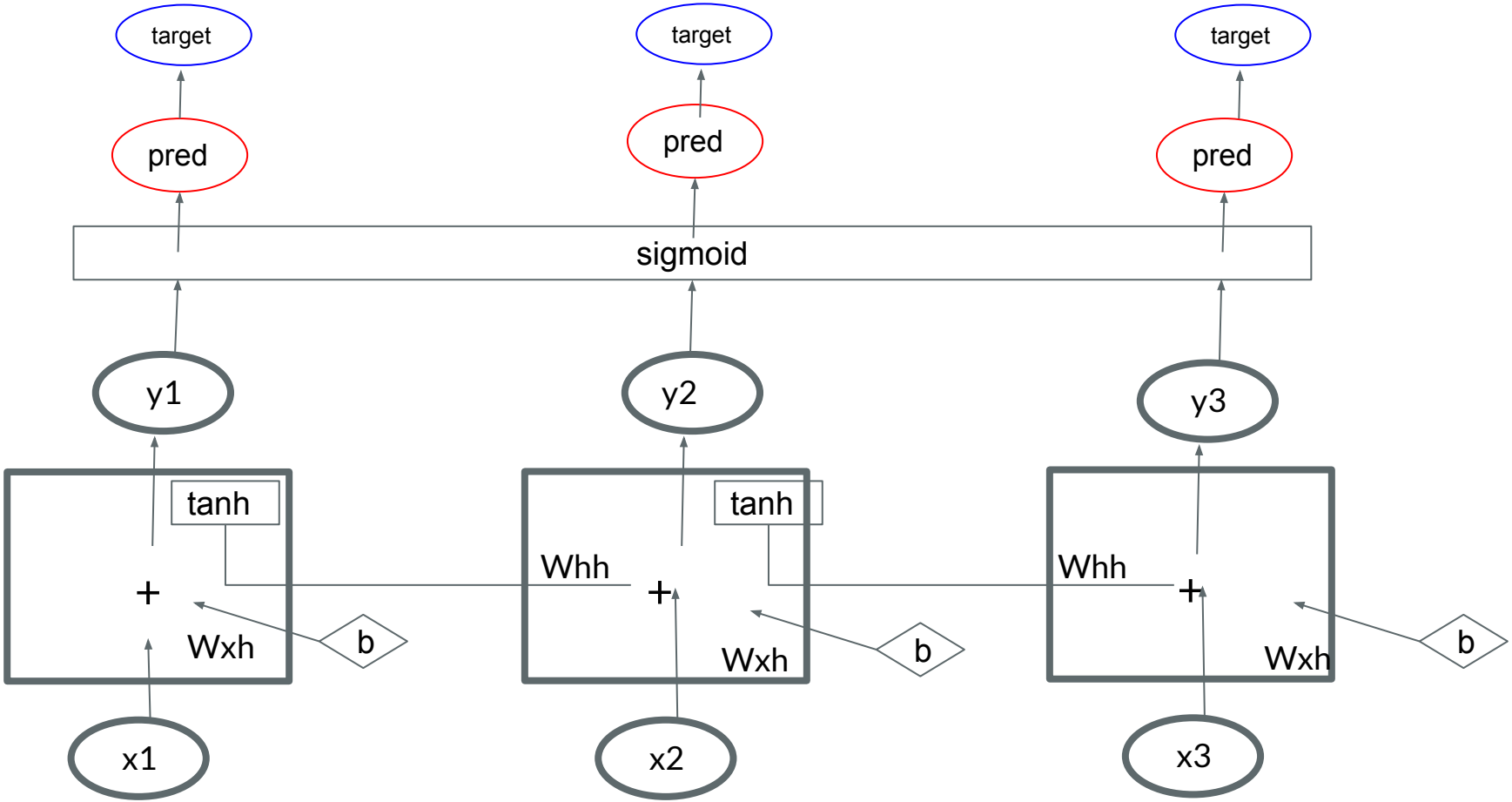
Recurrent Neural Network



Recurrent Neural Network

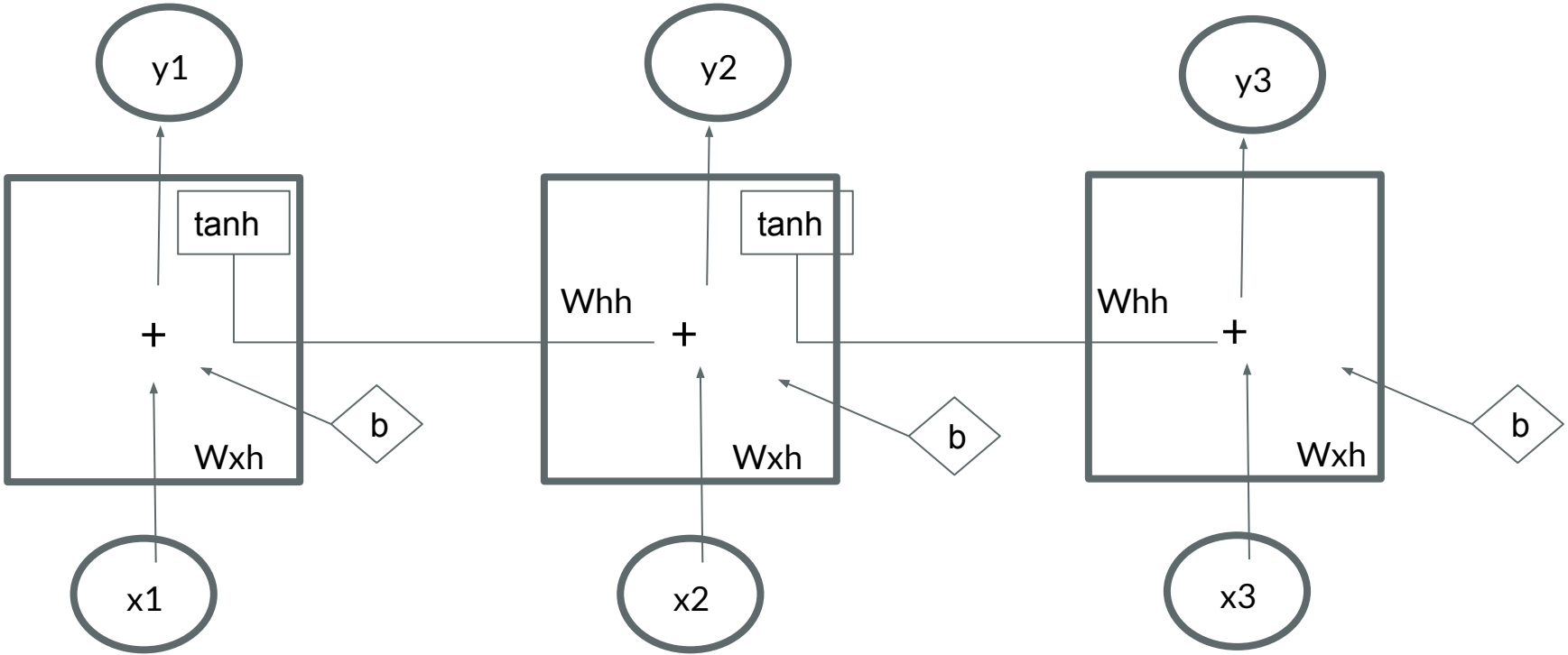


Recurrent Neural Network



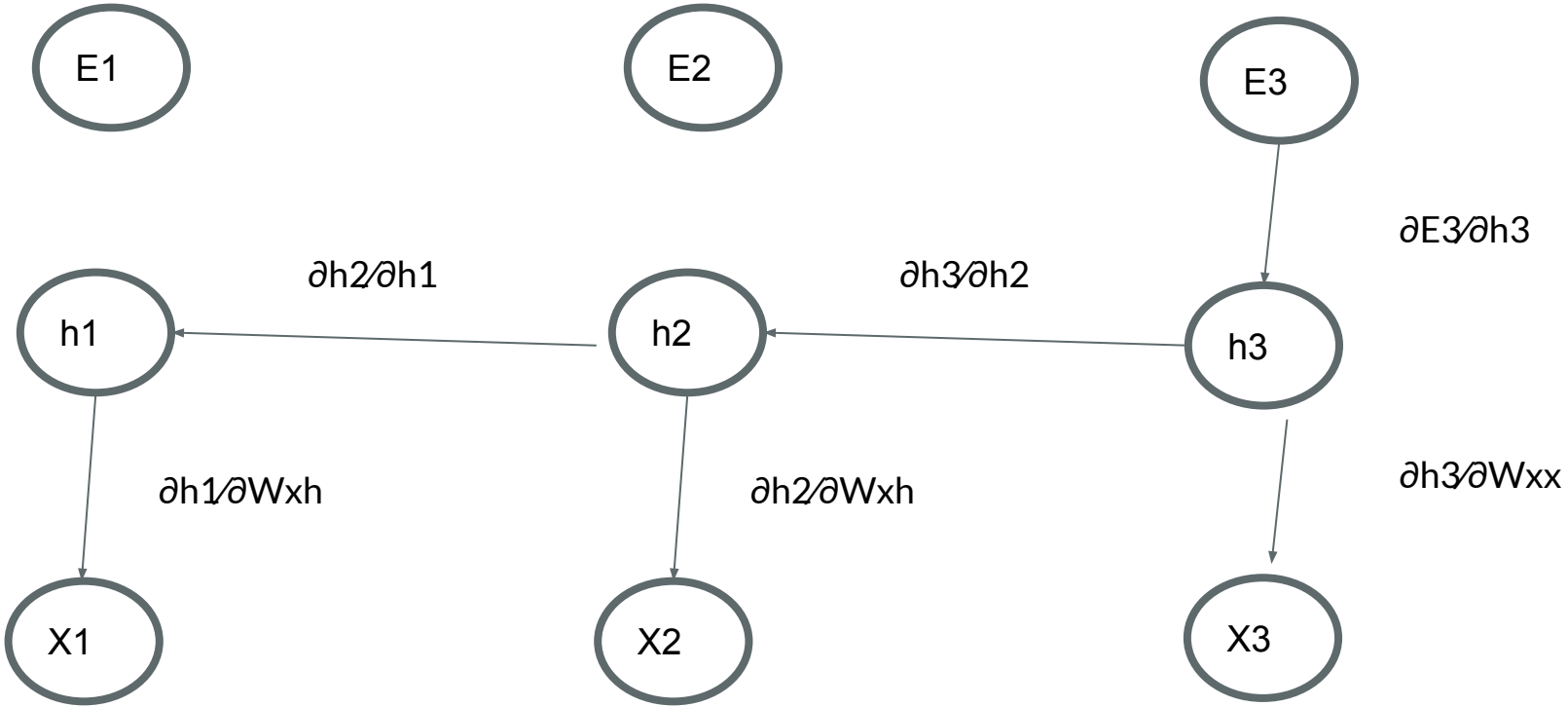
Recurrent Neural Network

Gradient Weight Optimization : W = W - learning rate * ∂E/∂W

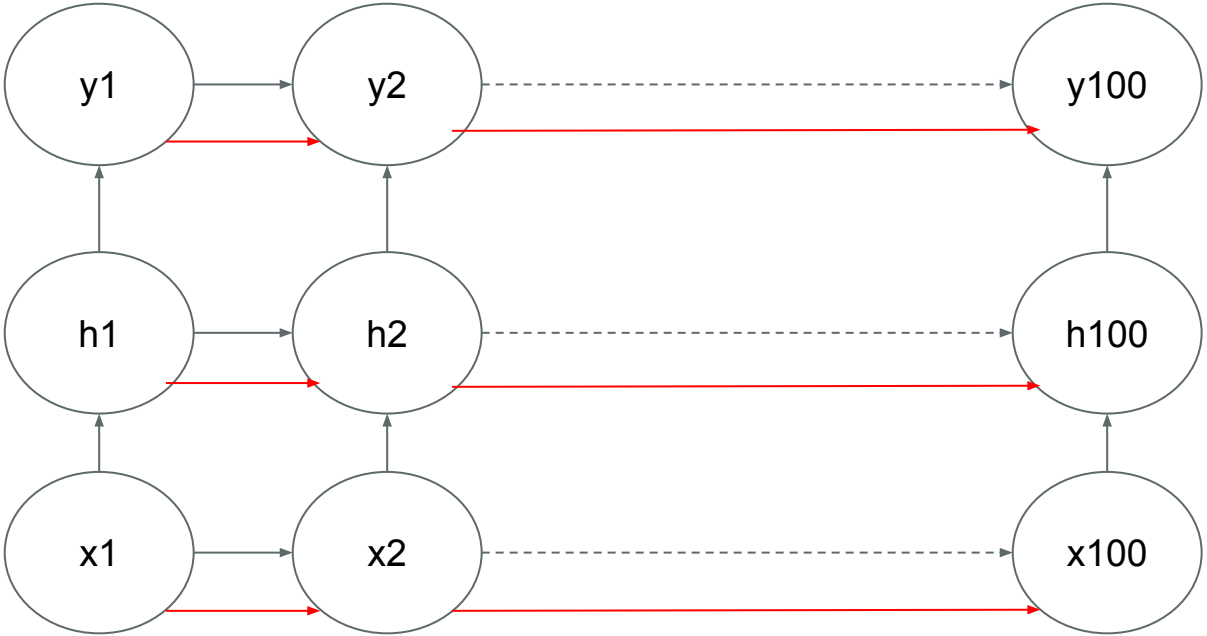


Recurrent Neural Network

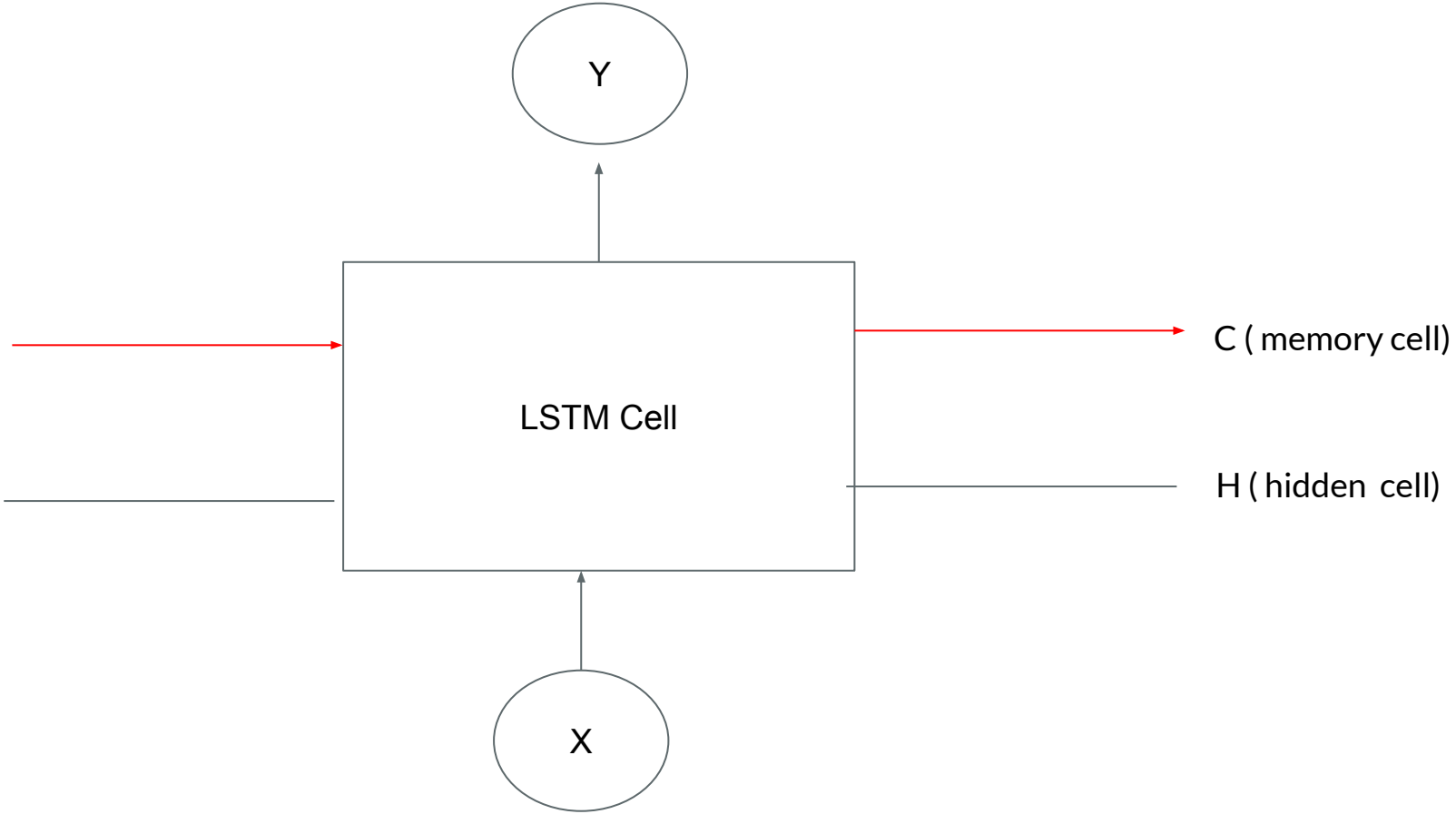
$$\partial E/\partial W = \partial E1/\partial W + \partial E2/\partial W + \partial E3/\partial W$$



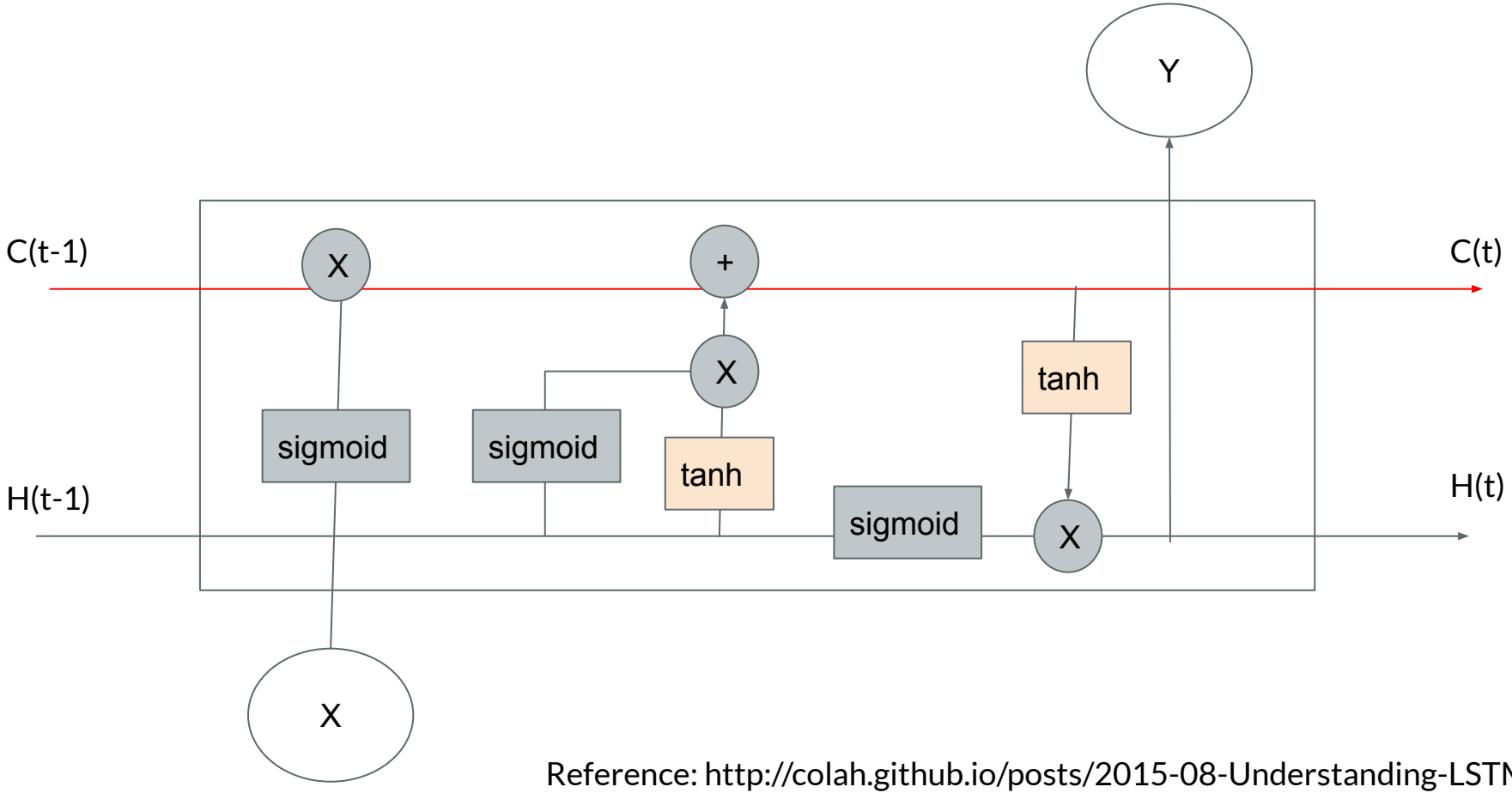
Long Short Term Network (LSTM)



LSTM cell

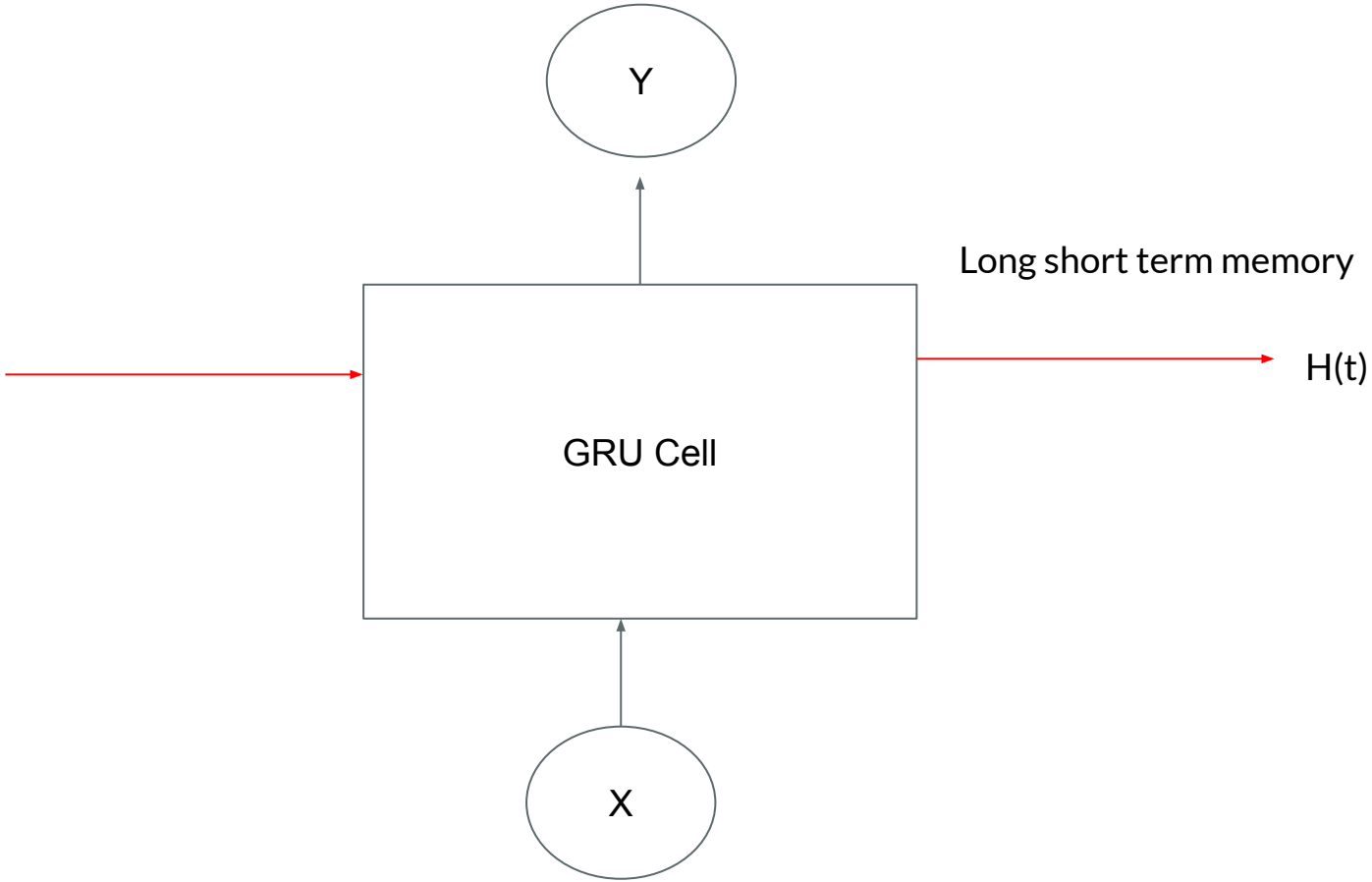


LSTM cell : output mechanism

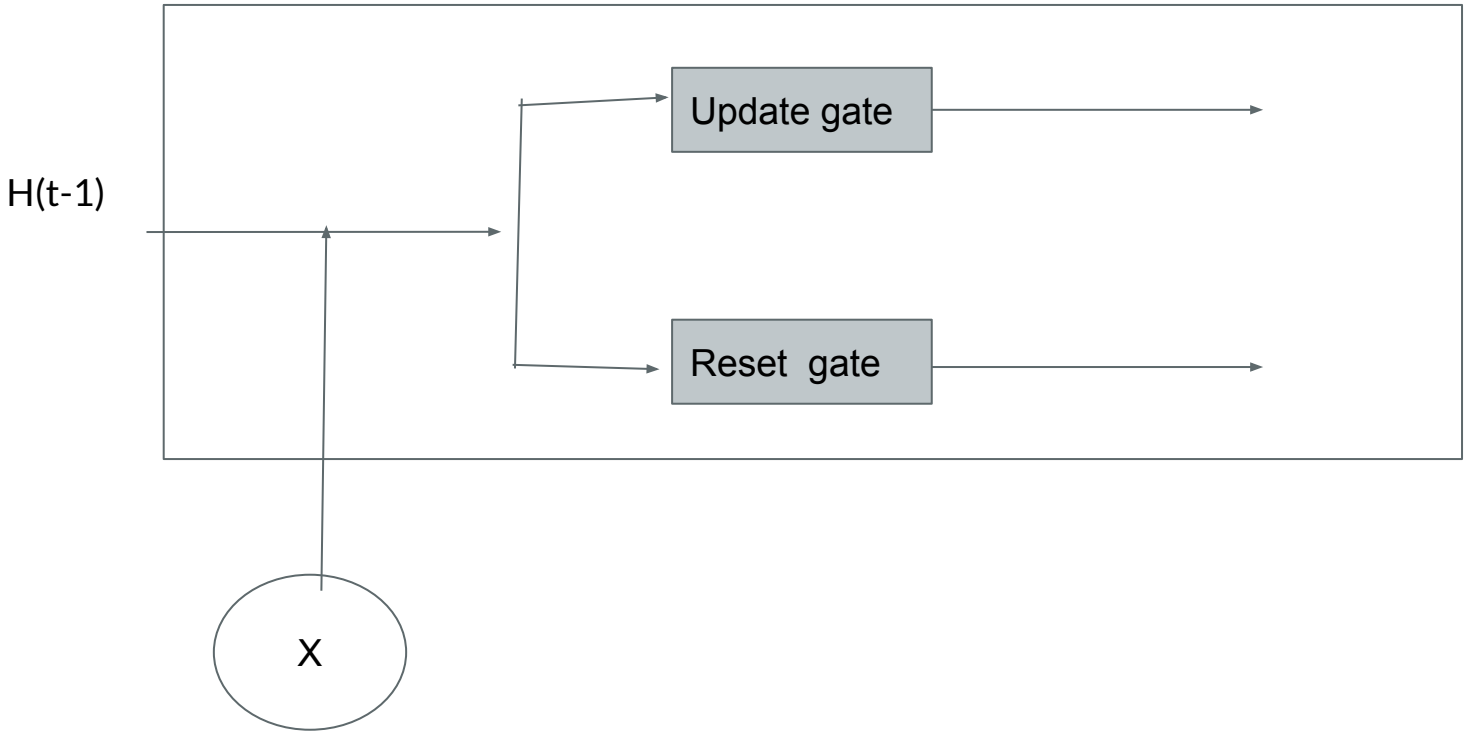


Reference: http://colah.github.io/posts/2015-08-Understanding-LSTM

GRU (Gated Recurrent Unit)

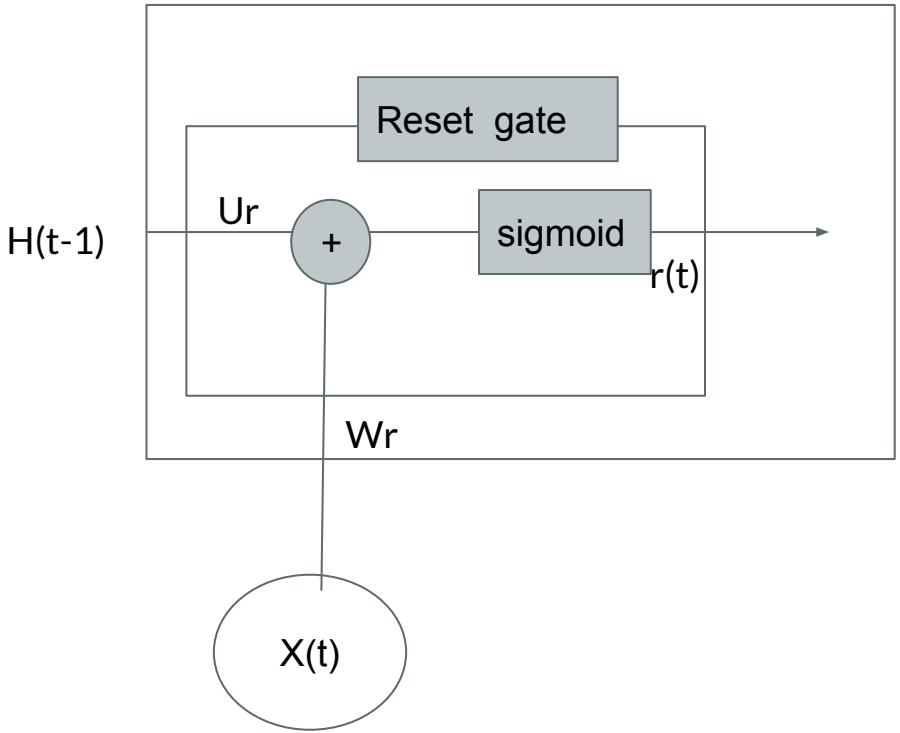


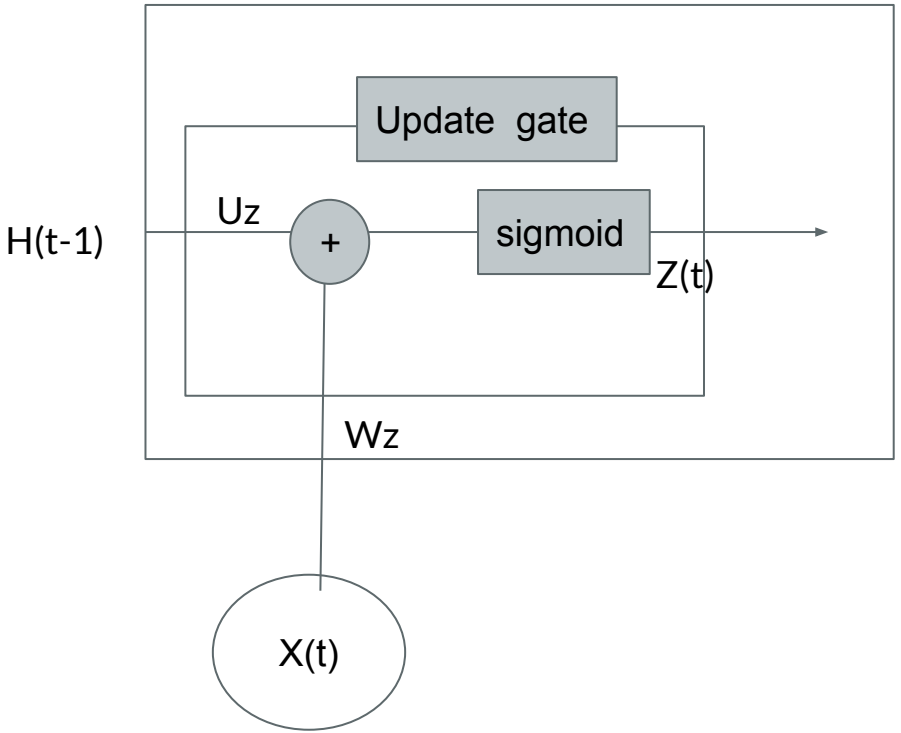
GRU (Gated Recurrent Units)



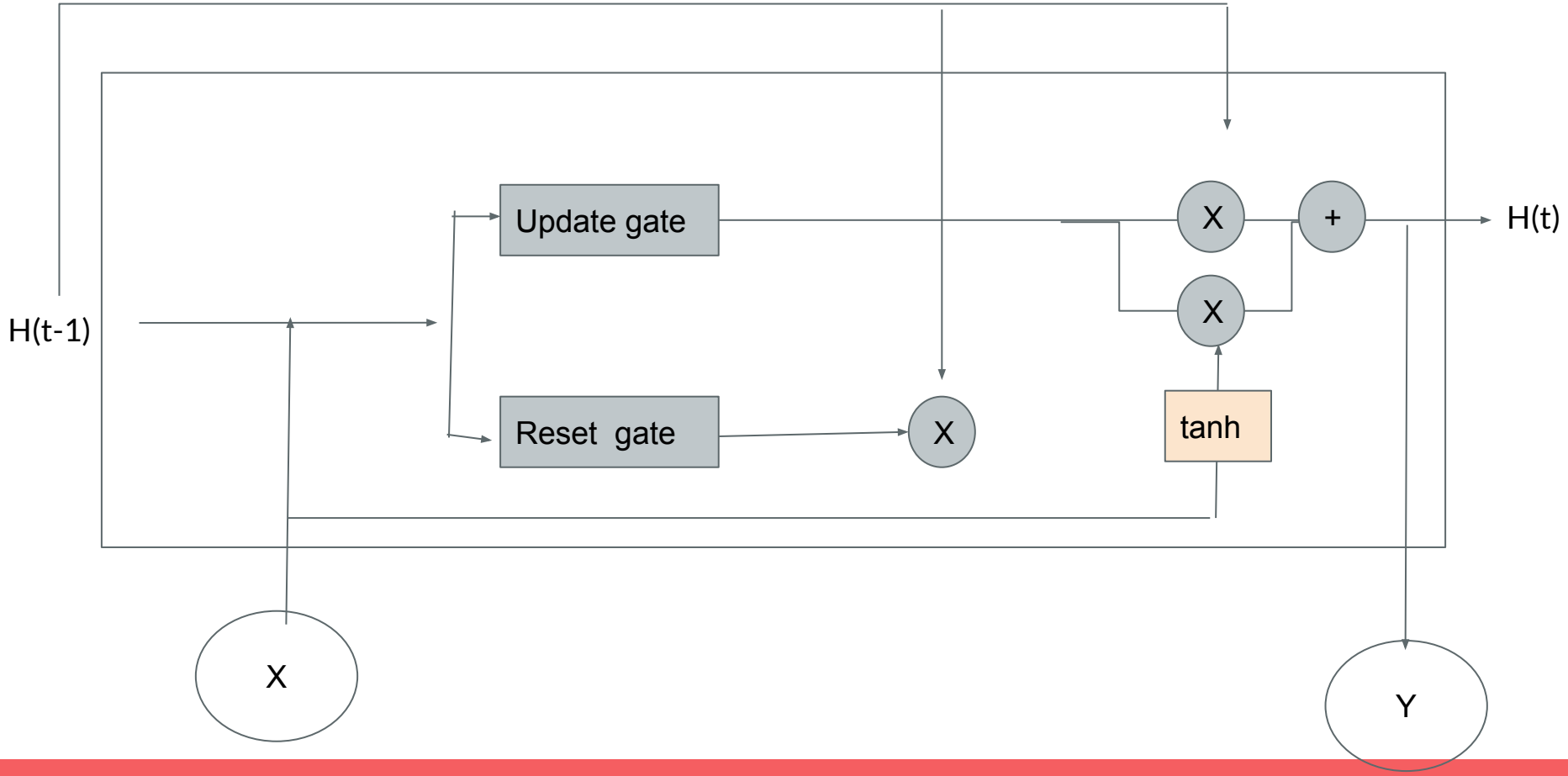
GRU (Gated Recurrent Units)

Reset gate: r(t) = ∂(Wr * X(t) + Ur * h(t-1)
Update gate Z(t) = ∂(Wz * X(t) + Uz * h(t-1)



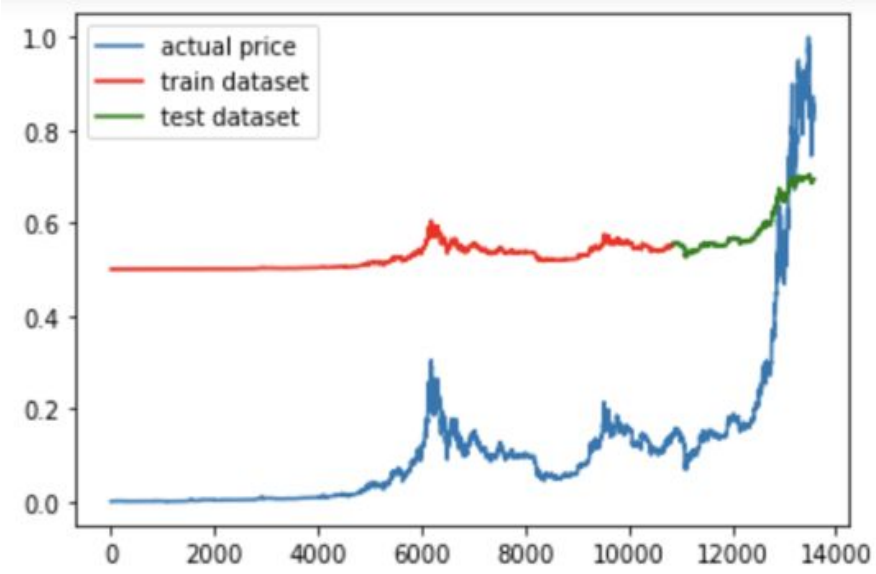


GRU (Gated Recurrent Units): output mechanism

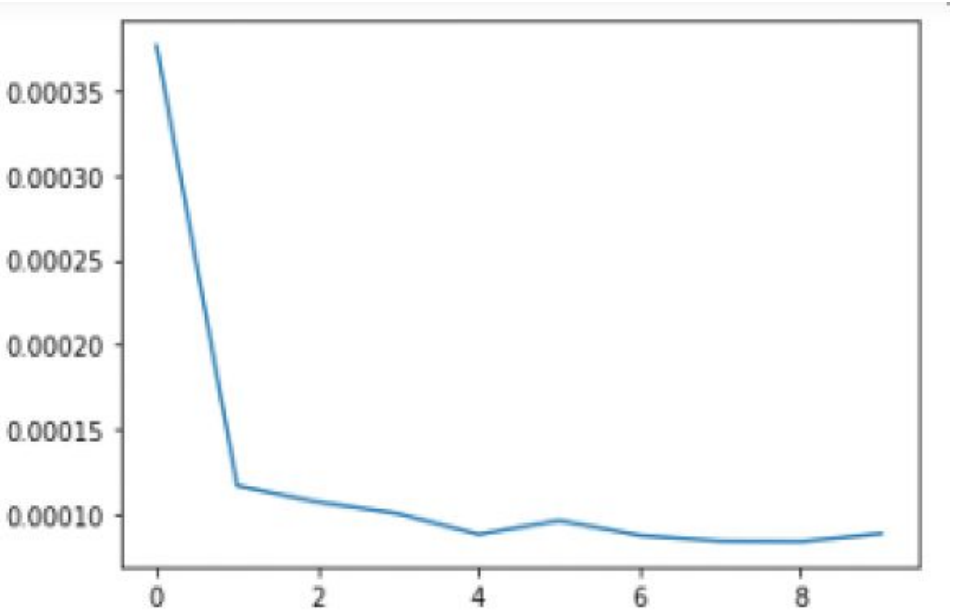


Result

RNN Result

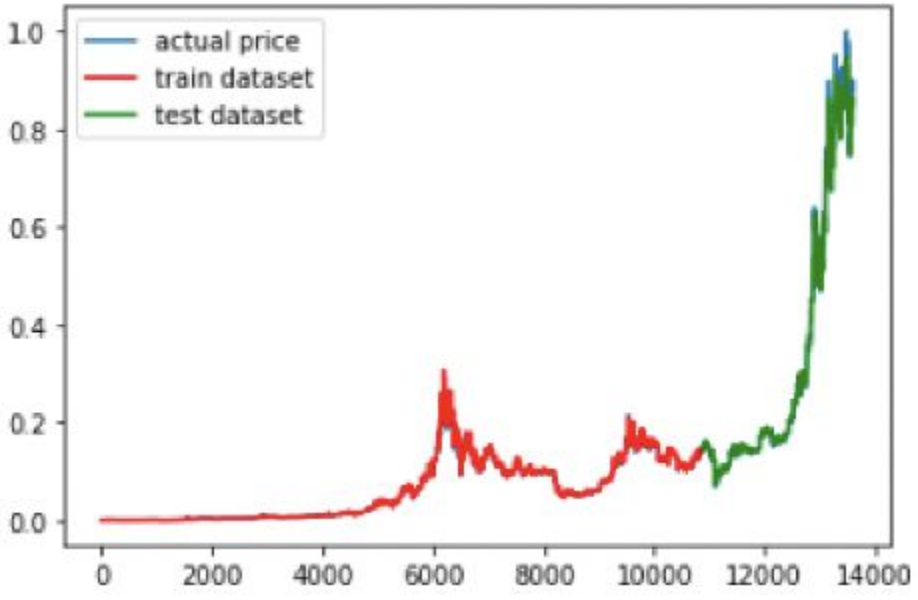


RNN Result

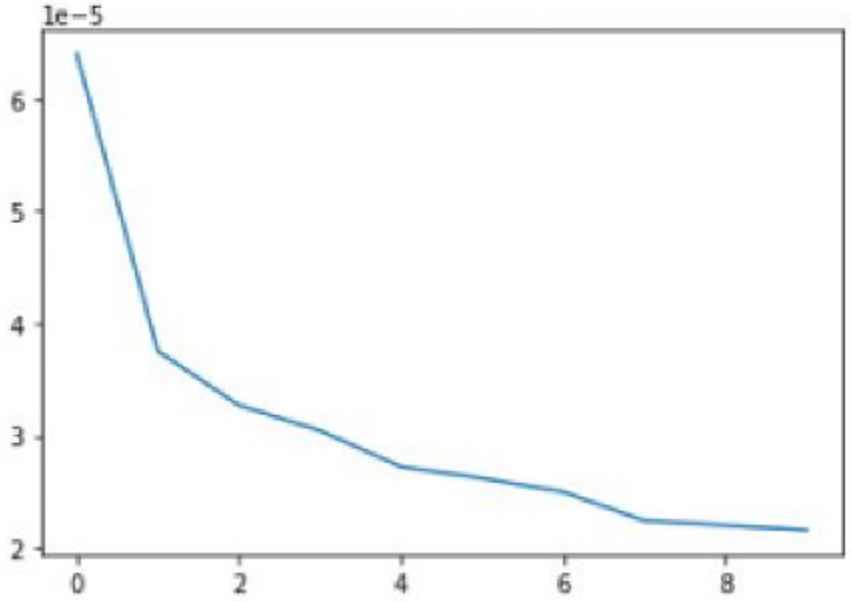


Loss Function

LSTM Result

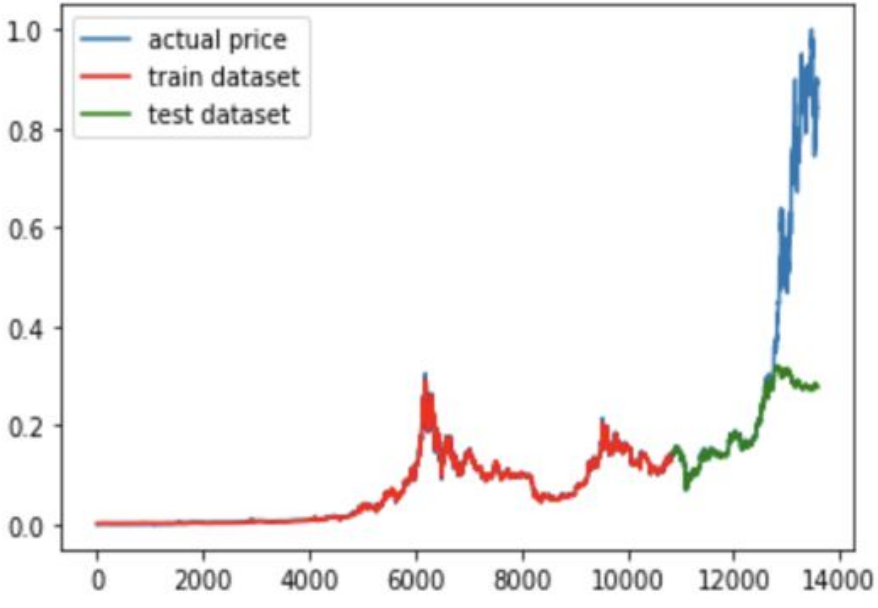


LSTM Result

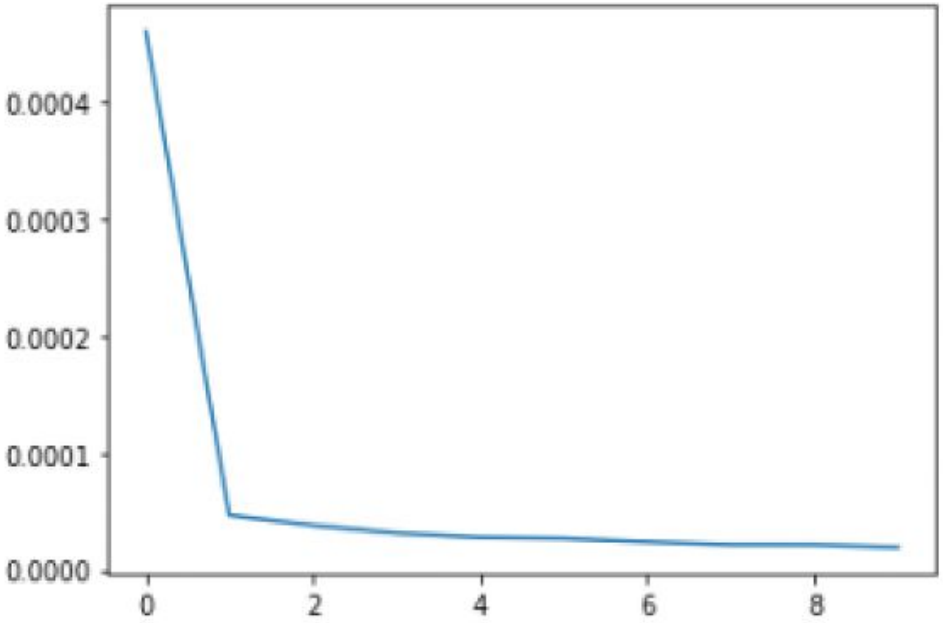


Loss Function

GRU Result



GRU Result



Loss Function

RNN vs LSTM vs GRU

	RNN	LSTM	GRU
Time	181 seconds	137 seconds	310 seconds
RMSE	0.3229	0.0015	0.2679

- RMSE is an absolute measure of fit which is widely used in the stock prediction evaluation
- LSTM is fast and returns low RMSE value, which means LSTM is the best fitted model

Summary

Summary

1. Built Vanilla, RNN, LSTM, and GRU models
2. Minmax Scale transformation used
3. Tanh activation function returned lower RMSE than sigmoid function and the models built with tanh activation function
4. LSTM has fastest and lowest RMSE value

Future Study

- Develop and test in torch model
- Consider open, high, and low prices to make more accurate predictions
- Built GAN model for RNN

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