

30.9.2025

Lab 9: Building a Rnn

Aim :

To build and train a simple Recurrent Neural Network (RNN) for sequence data to perform a prediction task (e.g., gender).

Objective

Understand the working of an RNN and how it processes sequential data.

Implement a basic RNN model using PyTorch.

Train the model on sample sequential data.

Analyze the model's performance and visualize the output.

Formula :

$$h_t = \tanh(W_h x_t + W_h h_{t-1} + b_h)$$

$$y_t = W_g h_t + b_y$$

w_{hx} , w_{hh} , w_{hy} are weight matrices,
 b_h , b_y are bias vectors,
 \tanh is the activation function,
 h_t is the hidden state at time t ,
 y_t is the output at time t .

pseudocode

```
1st Initialize weights and hidden state  
     $h_0$   
    for each epoch:  
        for each sequence:  
             $h = h_0'$   
            for each time step  $t$ :  
                 $h = \tanh(w_{hx}^T x_t + w_{hh}^T h + b_h)$   
                 $y = w_{hy}^T h + b_y$   
                calculate loss ( $y, \text{target}$ )  
                update weights via backpropagation.
```

observation

As training progresses, the model's loss decreases, indicating better fit to the data.

The RNN captures temporal dependancies between time steps.

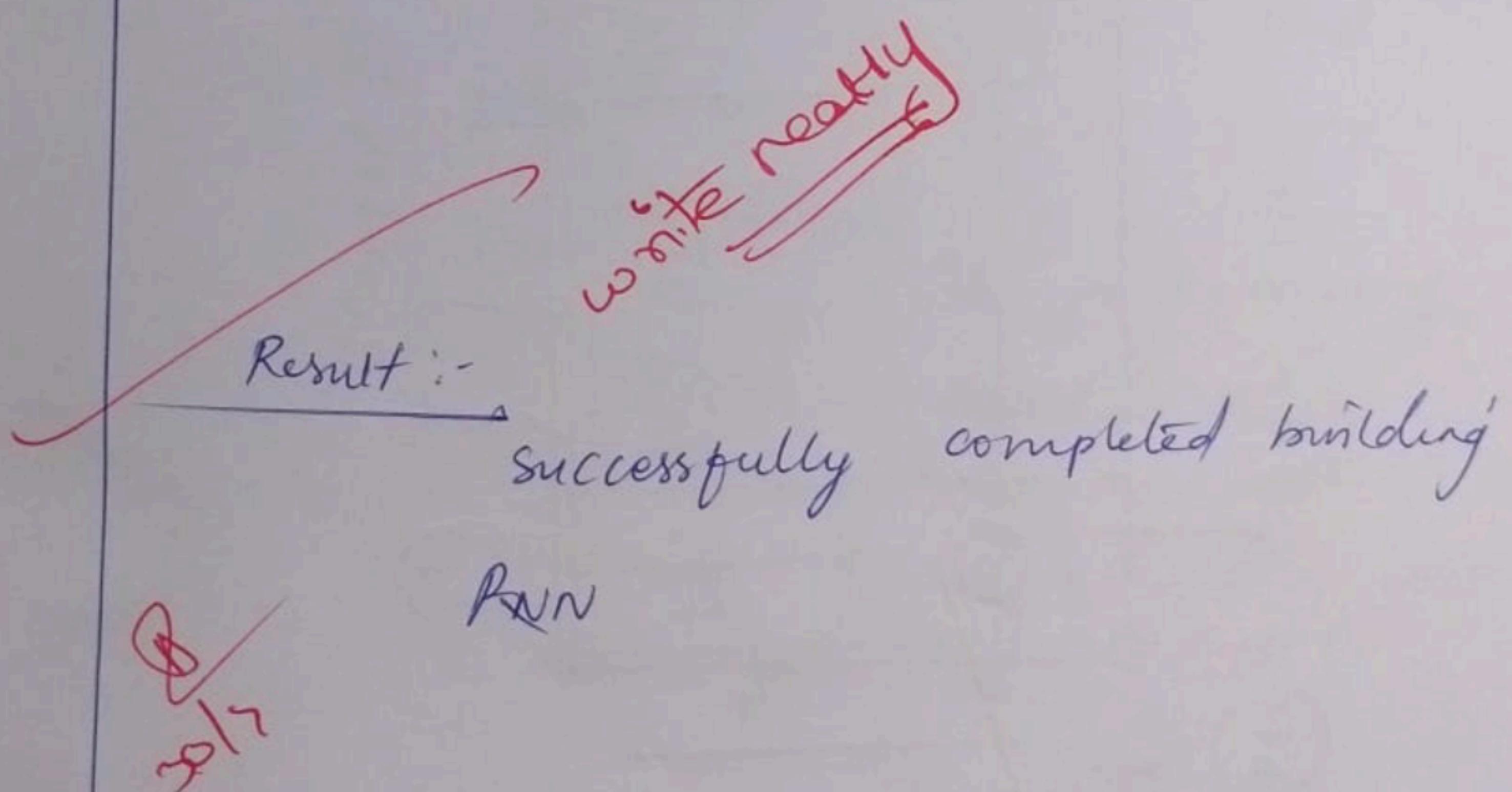
For short sequences, a simple RNN is effective; for longer sequences,

more advanced models like LSTM or
GRU may perform better.

Output predictions follow the trend
of input sequences closely after
training.

6. Graph :-

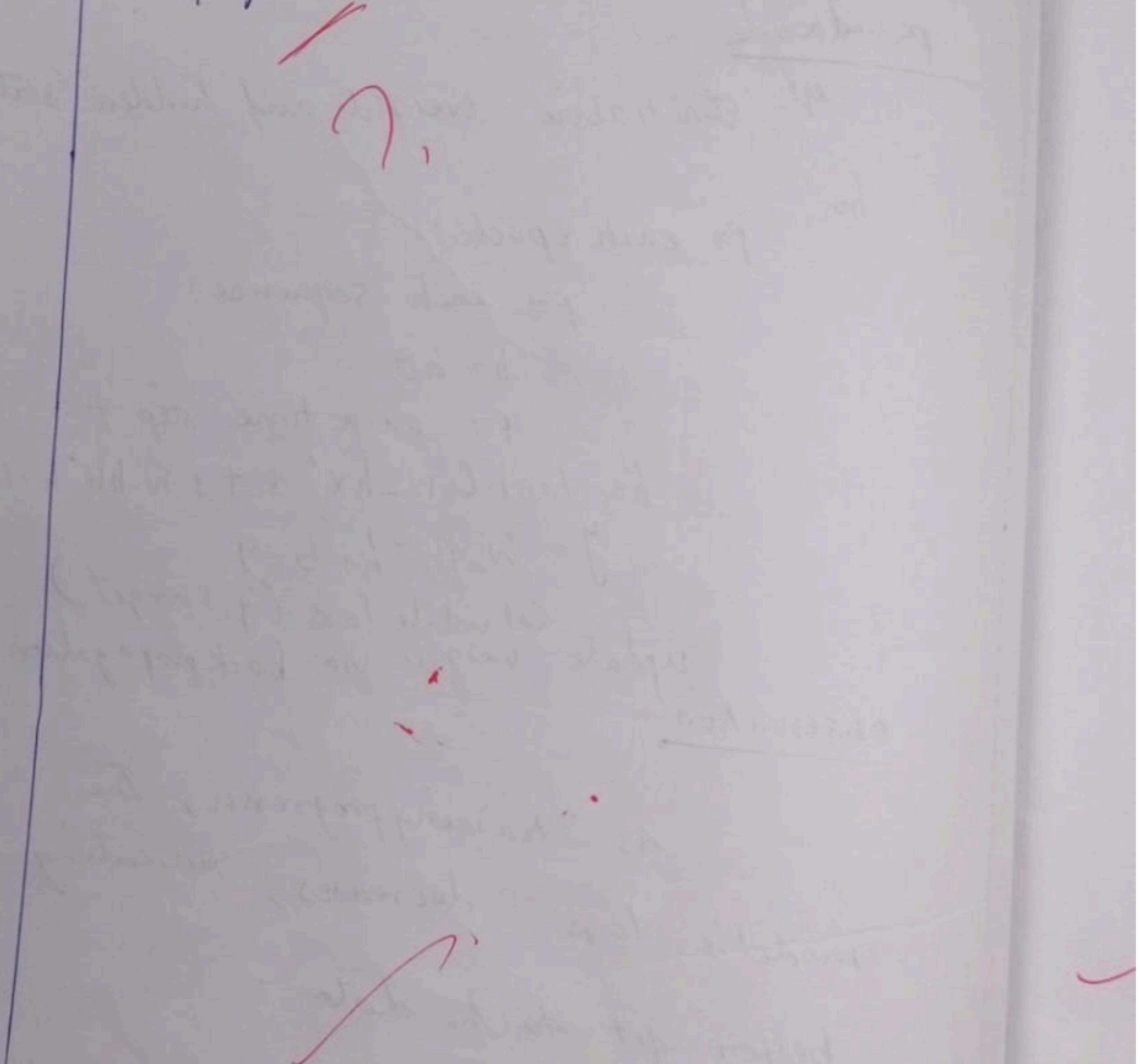
loss curve during training.

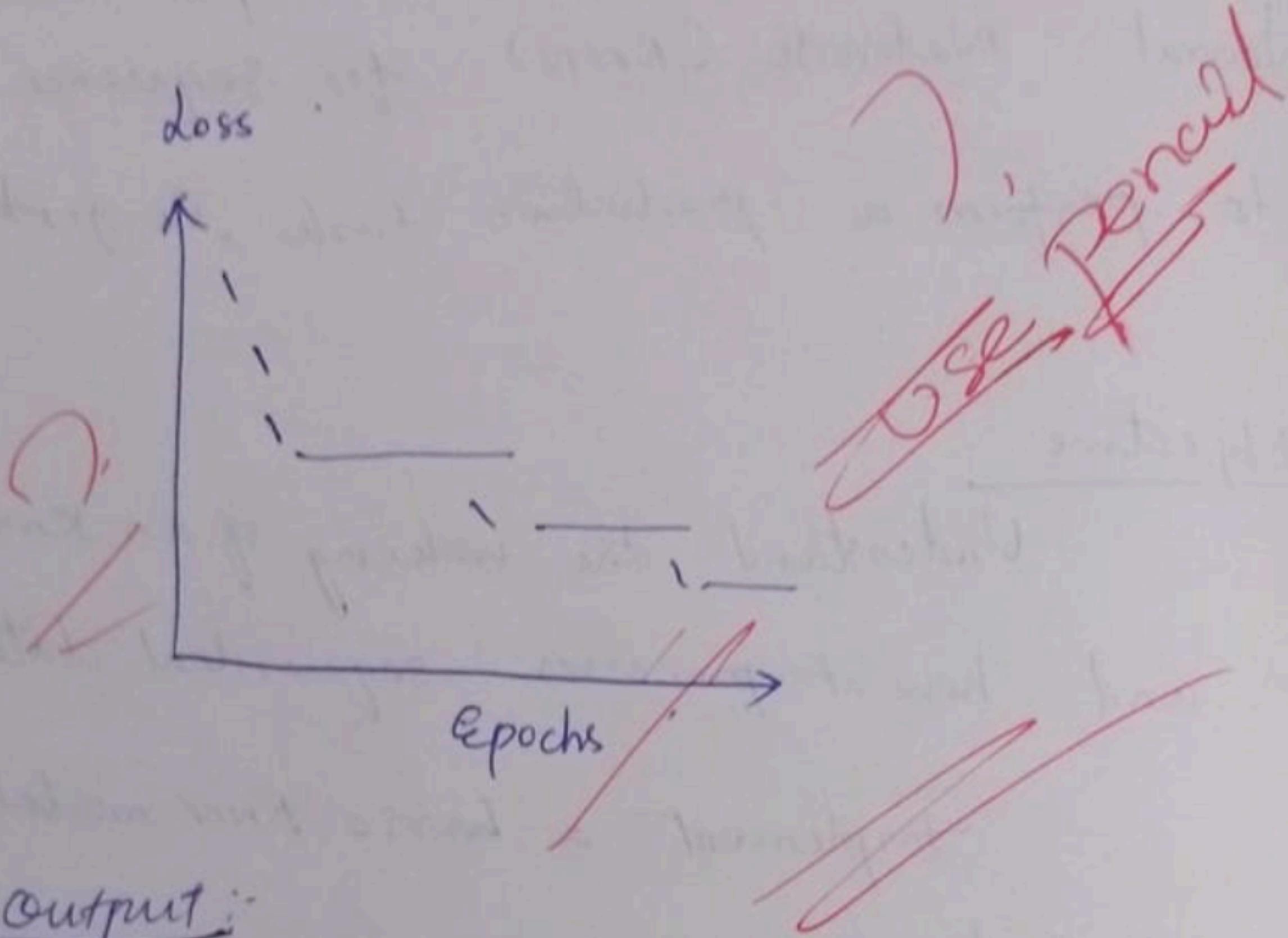


Epoch 17/20 , loss : 0.0696
epoch 18/20 , loss : 0.1027
epoch 19/20 , loss : 0.0855
epoch 20/20 , loss : 0.0992

Accuracy : 96.50%

Graph:





Output:

Epoch 1/20, Loss : 0.4129

epoch 2/20, Loss : 0.1541

epoch 3/20, Loss : 0.1241

epoch 4/20, Loss : 0.1376

epoch 5/20, Loss : 0.1049

epoch 6/20, Loss : 0.0556

epoch 7/20, Loss : 0.0877

epoch 8/20, Loss : 0.0729

Epoch 9/10, Loss : 0.0869

Epoch 10/10, Loss : 0.0729

epoch 11/20, Loss : 0.0881

epoch 12/20, Loss : 0.1198

epoch 13/20, Loss : 0.0895

epoch 14/20, Loss : 0.0733

epoch 15/20, Loss : 0.0706

epoch 16/20, Loss : 0.0938