

## DL Assignment 5

Q1

No. of RNN unit = 2

$$W_x = \begin{bmatrix} 3 & -4 \end{bmatrix}$$

$$b_h = 0$$

$$W_h = \begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix}$$

$$b_y = 10$$

$$W_y = \begin{bmatrix} -4 \\ 2 \end{bmatrix}$$

$$h_0 = \begin{bmatrix} 0 & 0 \end{bmatrix}$$
$$x_1 = 1 \quad x_2 = 2$$
$$x_3 = 3$$

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

$$h_1 = \tanh (1 \times \begin{bmatrix} 3 & -4 \end{bmatrix} + 0 + 0)$$
$$= \begin{bmatrix} 0.99505 & -0.99932 \end{bmatrix}$$

$$h_2 = \tanh (2 \times \begin{bmatrix} 3 & -4 \end{bmatrix} +$$

$$\begin{bmatrix} 0.99505 & -0.99932 \end{bmatrix} \times$$
$$\begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix} + 0)$$

$$= \begin{bmatrix} 0.99999 & -1 \end{bmatrix}$$

$$h_3 = \tanh (3 \times \begin{bmatrix} 3 & -4 \end{bmatrix} + \begin{bmatrix} 0.99999 & -1 \end{bmatrix})$$

1st row [1000 - 500] + 100 = 1000  
 2nd row [1000 - 300] + 100 = 1000  
 3rd row [1000 - 500] + 100 = 1000  
 4th row [1000 - 500] + 100 = 1000

$$y_t = w_y \cdot h_t + b_y$$

$$y_t = w_y \cdot h_3 + b_y$$

1st row [1000 - 500] + 100 = 1000  
 2nd row [1000 - 300] + 100 = 1000  
 3rd row [1000 - 500] + 100 = 1000

$$= -6 + 10$$

$$y_t = 4$$

1st row [1000 - 500] + 100 = 1000

2nd row [1000 - 300] + 100 = 1000  
 3rd row [1000 - 500] + 100 = 1000

1st row [1000 - 500] + 100 = 1000

2nd row [1000 - 300] + 100 = 1000  
 3rd row [1000 - 500] + 100 = 1000

32 x  
 0  
 -1

Q.2 I. Embedding  $\rightarrow 72120$

$$\begin{matrix} 12020 & \times & 6 \\ \text{(input dim)} & & \text{(required)} \\ \text{= vocab length)} & & \text{output dim)} \end{matrix}$$

II. Simple RNN (1)  $\rightarrow 4544$

$$\begin{matrix} (64 \times 64) & + & (64 \times 6) & + & 64 \\ \text{(recurrent weights)} & & \text{(no. of} & & \text{(biases)} \\ \text{= no. of unit} & + & \text{units} \times & & \\ \text{x no. of units} & & \text{no. of features} & & \\ & & \text{from embedding)} & & \end{matrix}$$

III. Simple RNN (2)  $\rightarrow 3104$

$$\begin{matrix} (32 \times 32) & + & (32 \times 64) & + & 32 \\ \text{(recurrent} & & \text{(i/p weights} & & \text{(backprop)} \\ \text{weights)} & & \text{= no. of units} & & \\ & & \text{x no. of units} & & \\ & & \text{of previous} & & \\ & & \text{layer)} & & \end{matrix}$$

IV. Simple RNN (3)  $\rightarrow 784$

$$\begin{matrix} (16 \times 16) & + & (16 \times 32) & + & 16 \\ \text{(recurrent} & & \text{(i/p weights)} & & \text{(backprop)} \\ \text{weights)} & & & & \end{matrix}$$



IV. Dense  $\rightarrow$  408  
 $(24 \times 16) + 24$   
 (no. of units  
 $\times$  no. of units  
 of previous  
 RNN layers) (backprop)

V. Dense (output layer)  $\rightarrow$  150  
 $(6 \times 24) + 6$   
 (no. of o/p  
 units  $\times$  no. of  
 units of  
 previous  
 hidden  
 layers) (backprop)