

National University of Computer and Emerging Sciences, Lahore Campus



Course: Natural Language Processing
 Program: BS(Data Science)
 Duration: 20 Minutes
 Paper Date: 13-March-2024
 Section: SA
 Exam: Quiz 2

Course Code: CS 4063
 Semester: Fall 2024
 Total Marks: 15
 Weight
 Page(s): 3

Q1) Draw RNN architecture diagram and write equations along with dimensions of all layers and weight matrices for the following. Suppose the input words are one hot encoded vectors. input sequence of length 3 (lets say 3 words).

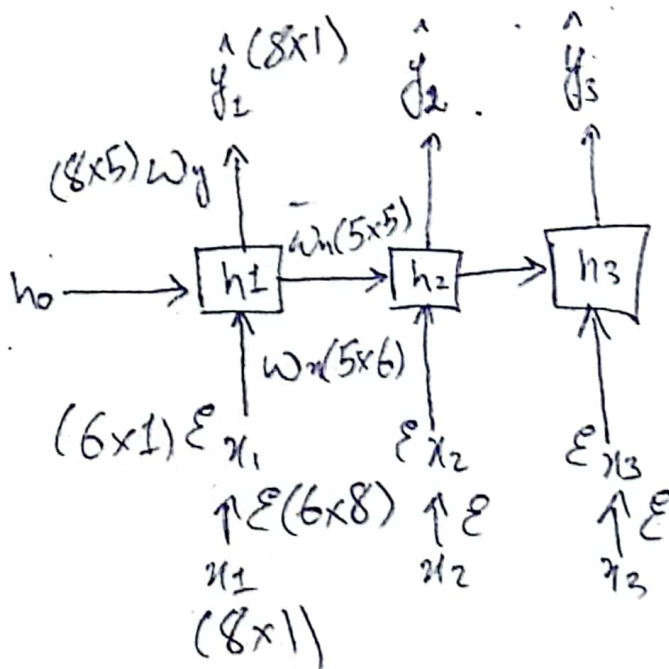
Hidden layer units are 5

Embedding size (dense word vector dimensions) = 6

V = vocabulary = 8

Total number of parameters are 8:
 E, W_x, W_h, W_y

What are total number of parameters?



$$h_t = W_x E_{x_t} + W_h h_{t-1}$$

$$W_h = (5 \times 5)$$

$$W_y = 8 \times 5$$

$$\hat{y} = W_y \cdot h_t$$

$$\hat{y} = (8 \times 5) \cdot (5 \times 1)$$

$$\hat{y} = 8 \times 1$$

$$x_1 = x_2 = x_3 = (8 \times 1)$$

$$E = (6 \times 8)$$

$$E_{x_1} = E \cdot x_1 = (6 \times 8) \cdot (8 \times 1) = (6 \times 1)$$

$$W_x = (5 \times 6)$$

$$h = W_x \cdot E_{x_1} = (5 \times 6) \cdot (6 \times 1) = (5 \times 1)$$

$$h_t = (5 \times 6) \cdot (6 \times 1) + (5 \times 5) \cdot (5 \times 1)$$

$$h_t = (5 \times 1)$$

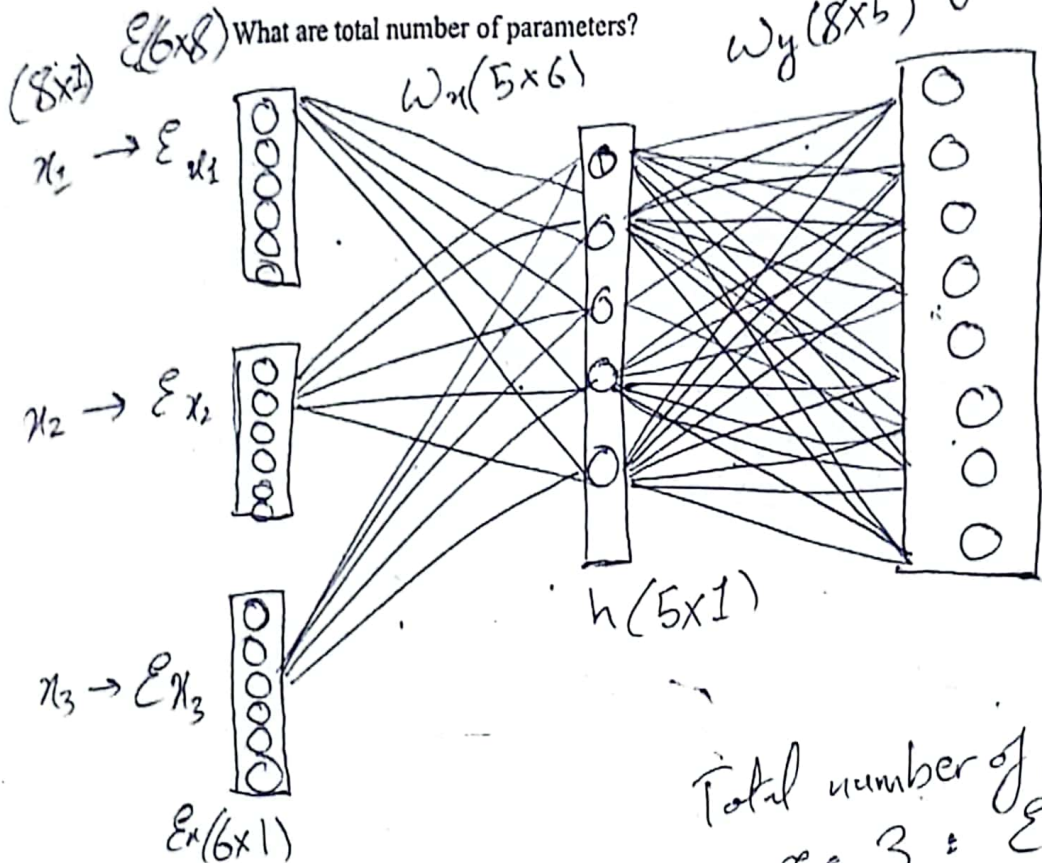
Q2) Draw neural network (for the task of neural language model) architecture diagram and write equations along with dimensions of all layers and weight matrices for the following. Suppose the input words are one hot encoded vectors.

input sequence of length 3 (lets say 3 words).

Hidden layer units are 5.

Embedding size (dense word vector dimensions) = 6

V = vocabulary = 8



$$x_1 = x_2 = x_3 = (8 \times 1)$$

$$E = (6 \times 8)$$

$$E \cdot x = (6 \times 8) \cdot (8 \times 1) = 6 \times 1$$

$$W_x = (5 \times 6)$$

$$h = W_x \cdot E \cdot x = (5 \times 6) \cdot (6 \times 1) = 5 \times 1$$

$$W_y = 8 \times 5$$

$$\hat{y} = W_y \cdot h = (8 \times 5) \cdot (5 \times 1) = 8 \times 1$$