University of Engineering & Management, Kolkata

Term - II Examination, October - November, 2021

Program Name: B.Tech in Computer Science **Semester: 5th**

Paper Name: Deep Learning

Paper Code: PEC CS501

Full Marks:100 **Time: 3 hours**

GROUP A (20 Marks)

Answerthe following questions. Each question is of 2 marks.

1.

i. Differentiate RNN& CNN.
ii. Describe LSTM.
iii. If input volume has the following dimension $H_1 \times W_1 \times D_1$, kernel is of size $F \times F \times D_1$ what is the output dimension of the volume where stride is S and padding is P?
iv. State the disadvantages of RNN.
v. Although sigmoid function is having some disadvantages but still it is used in RNN/LSTM-Explain.
vi. Evaluate the relation between bias, variance and regularization method.
vii. Critically comment about the encoding and decoding function of a autoencoder with binary inputs.
viii. Criticize whether multiple filters can be used to extract feature maps.
ix. Describe ensemble method.
x. Consider the following 1D input vector [1, 2, 1, 3, 2, 1, 2, 3, 1] and kernel [0.01, 0.02, 0.05, 0.1, 0.5]. Find out the estimate of 5th observation using convolution operation?

GROUP B (30 Marks)

Answer the followingquestions. Each question is of 5 marks.

2. Find the output shape of the following convolution operations; consider stride = 1 and padding = 1. Show all calculations

Input	Filter
32x32x3	5x5x6
16x16x5	3x3x10

3. Discuss about Vanishing &Exploding gradients problem and its solution approach.
4. Illustrate the approach of choosing loss function for autoencoder with binary inputs.

5.A.
i) Explain the need of regularization method.
ii) Describe the Dropout method of regularization.
OR
B.
i) Illustrate the concept of bias variance trade-off
ii) Explain the encoding & decoding approach of autoencoder.

6.A.
Find the stride value used in the convolution operation using the following information for all layers. Consider padding = 0. Show all calculations

Layers	Input	Output	Filter Size	No. of Filters
CONV2D	32x32x3	28x28x6	5x5	6
MAXPOOL	28x28x6	27x27x6	2x2	NA
CONV2D	32x32x3	28x28x6	5x5	16
MAXPOOL	28x28x6	27x27x6	2x2	NA

OR
B.
Find the total no of parameters of the following CNN architecture. Show the no. of parameters for individual layers along with detailed calculations for each layer.

Layer	**Output Shape**
INPUT	32x32x1
CONVOLUTION (Filters = 6, Filter Size = 5, Stride = 1, Padding = 0)	28x28x6
MAXPOOL (Filter Size = 2, Stride = 1)	27x27x6
CONVOLUTION (Filters = 16, Filter Size = 5, Stride = 1, Padding = 0)	23x23x16

7.A.
i) What is convolution? Derive the relation between input shape, filter shape and feature map shape of a 2D convolution layer?
ii) Describe a sequence learning problem.
OR
B.
i) Critically comment about the presence of whiteboard analogy in RNN.
ii) Specify the need of autoencoder.

GROUP C (50 Marks)

Answer the following questions. Each question is of 10 marks.

8.i) a. State the properties of sequence in sequence learning problem.

b. Explain the role of recurrent connections in RNN.

ii) Discuss about backpropagation through time.

9. Find the total no of parameters of the following CNN architecture. Show the no. of parameters for individual layers along with detailed calculations for each layer.

Layer	**Output Shape**
INPUT	32x32x1
CONVOLUTION (Filters = 6, Filter Size = 5, Stride = 1, Padding = 0)	28x28x6
MAXPOOL (Filter Size = 2, Stride = 1)	27x27x6
CONVOLUTION (Filters = 16, Filter Size = 5, Stride = 1, Padding = 0)	23x23x16
CONVOLUTION (Filters = 32, Filter Size = 5, Stride = 1, Padding = 0)	19x19x32
MAXPOOL (Filter Size = 2, Stride = 1)	18x18x32
CONVOLUTION (Filters = 64, Filter Size = 5, Stride = 1, Padding = 0)	14x14x64
CONVOLUTION (Filters = 128, Filter Size = 3, Stride = 1, Padding = 0)	12x12x128
CONVOLUTION (Filters = 128, Filter Size = 1, Stride = 1, Padding = 0)	12x12x128
FULLY CONNECTED (Units = 64)	12x12x64
FULLY CONNECTED (Units = 10)	12x12x10

10. A.

i) a. How do we use 3D filters in convolution operations on 3D inputs?

b. If filter depth is not equal to the input depth, what kind of convolution operation can be performed with 3D filters and 3D inputs?

ii) a. If filter depth is equal to the input depth, what type of feature map is obtained from convolution operation?

b. How can we determine the depth of the output volume of a convolution layer?

OR

B.

i) a. Describe the dimension of different parameter in RNN.

b. Describe the architecture of traditional RNN.

ii) a. Describe the dataset augmentation method of regularization.

b. Compare feed forward neural network and autoencoder.

11. A.

i) a. Describe different types of autoencoder.

b. Describe the operations require to prevent identity encoding.

ii) Illustrate the approach of choosing encoding and decoding function for autoencoder with real inputs.

OR

B.

i) Explain the need of backpropagation algorithm in a feed forward neural network.

ii) Describe the concept of momentum based gradient descent.

12. A.

i) a. Compare stochastic gradient descent and mini-batch gradient descent algorithm.

b. Critically comment about the selection of loss function in case of feed forward neural network.

ii) Differentiate between backpropagation and backpropagation through time algorithm.

OR

B.

i) Compare vanilla gradient descent and adam.

ii) Estimate the gradient with respect to weight in case of backpropagation.

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