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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES, DEHRADUN

End Semester Examination, Dec 2021

Course: Deep Learning Fundamentals **Semester: VII**

Program: B.Tech (CSE-AI/ML) **Time: 03 hrs**

Course Code: CSBD 4007 **Max. Marks: 100**

Section A

1. **Each question will carry 4 marks**

(5Qx 4M = 20 Marks)

S. No.	Question	CO
Q1	What is the vanishing gradient problem? List out the activation functions that cause it? **(2+2 Marks)**	**CO1**
Q2	Provide fundamental objective of the following tasks in one or two lines. a) Object detection **(1 Mark)** b) Semantic Segmentation **(1.5 Marks)** c) Instance Segmentation **(1.5 Marks)**	**CO1**
Q3	A model has high training accuracy and low testing accuracy. What problem do you think the model is suffering from? Provide a solution. **(1+3 Marks)**	**CO1**
Q4	What are the three components of UNet model? Write a short introduction (one or two lines) to each of the three components. **(1+1+1+1 Marks)**	**CO2**
Q5	What is the formula of sigmoid activation function? Prove that the value of its derivative ranges between 0 to 0.25. **(1+3 Marks)**	**CO3**

SECTION B

1. **Each question will carry 10 marks**
2. **In Question 4, attempt any one in 4 (a) and 4 (b)**
3. **In Question 4(b), there are three choices. Attempt any two.**

(4Qx10M = 40 Marks)

Q1	You are designing a deep learning model cancer detection system using Lung X-Ray images. Now, what loss function you will choose in your model. Explain why? Provide proper explanation by providing formula by showing loss values for each class. **(2+8 Marks)**	**CO2**
Q2	You are designing a deep learning system to detect driver fatigue in cars. It is crucial that that your model detects fatigue, to prevent any accidents. Which of the following is/are the most appropriate evaluation metrics: Accuracy, Precision, Recall, Sensitivity, Specificity, F1-Score, Loss Value. Explain your choice **(3+7 Marks)**	**CO2**
Q3	Compare deep learning and machine learning in terms of work strategy, advantage and limitations. Do you believe that machine learning will be extinct because of deep learning? **(6+4 Marks)**	**CO3**
Q4	**(a)** Why GRUs are said to be faster than LSTMs ? Provide your analysis. **(10 Marks)**	**CO3**

	OR **(b)** Write down a detailed introduction of the following **(ATTEMPT ANY TWO)** 1. Variational Autoencoders **(5 Marks)** 2. Image to Image GANs **(5 Marks)** 3. Principle Component Analysis (PCA) **(5 Marks)**	

SECTION C

1. Each Question carries 20 Marks.

2. Instruction: a) Write long answer

b) In Question 1, attempt any one in 1 (a) and 1 (b)

(2Qx 20M= 40 Marks)

Q1	a) Suppose you are working on a medical image classification problem (you can assume any disease classification as per your convenience). Now before you use any deep learning model for disease classification problem, you are required to ensure the quality of the image is reliable for the diagnosis. Provide a solution (deep learning model) for the automatic quality assessment of medical images. **(10 Marks for Proposed Solution/Model and 10 Marks for Reason Explanation)** **OR** b) You have a dataset D1 with 1 million labelled training examples for binary classification, and dataset D2 with 100 labelled training examples. Your friend trains a model from scratch on dataset D2. You decide to train on D1, and then apply transfer learning to train on D2. 1. State one problem your friend is likely to find with his approach. How does your approach address this problem? **(5+5 Marks)** . 2. The above problem of binary classification task of classifying images as cat vs. non-cat. You design a CNN with a single output neuron. Let the output of this neuron be **z**. The final output of your network, y is given by: $y = \sigma(ReLU(z))$ Here σ is sigmoid activation function. You classify all inputs with a final value $y \geq 0.5$ as cat images. What problem are you going to encounter? And how will you solve it. **(5+5 Marks)**	**CO4**

Q2	You come up with a CNN classifier. For each layer, calculate the number of weights, number of biases and the size of the associated feature maps. The notation follows the convention: **a)** CONV-*K*-*N* denotes a convolutional layer with *N* filters, each them of size *K*×*K*, Padding and stride parameters are always 0 and 1 respectively. **b)** POOL-*K* indicates a *K* × *K* pooling layer with stride *K* and padding 0. **Fill the appropriate values in the table given below**	**CO4**

Layer	Activation map dimensions	Number of weights	Number of biases
INPUT	128 × 128 × 3	0	0
CONV-9-32			
POOL-2			
CONV-5-64			
POOL-2			
CONV-5-64			
POOL-2			

END