Question Paper

Exam Date & Time: 28-Jun-2023 (10:00 AM - 01:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

Manipal School of Information Sciences (MSIS), Manipal

Second Semester Master of Engineering - ME (Artificial Intelligence and Machine Learning) Makeup Examination - June 2023

Convolutional Neural Networks for Computer Vision Elective -2 [AML 5232]

Marks: 100

2)

Duration: 180 mins.

Wednesday, June 28, 2023

Answer all the questions.

- 1) Explain the following in connection with image processing in CNNs (TLO 1.2, L2) (4 X 2.5 marks) (10)
 - a) Sampling
 - b) Quantization
 - c) Thresholding
 - d) Types of images

Answer the following. Provide explanation of the steps used. Choose the kernel coefficients of your (10) choice, other than zeros and ones. (TLO 2.1, L3) (2 X 5 marks)

a) Apply 1X1X3 convolution on Image1 of which the R,G and B components are given below.

R component

5	10	2	10	5	5	10
10	5	5	5	10	10	5
5	5	5	10	10	10	2
10	2	5	2	2	10	1
5	10	2	1	10	5	1
10	5	5	5	2	2	2
10	10	10	10	2	2	5

G component

	5	10	2	1	10	5	1
	10	5	5	5	2	2	2
	2	2	10	1	2	2	2
	10	10	2	2	5	10	2
	5	5	10	10	10	2	2
	5	10	2	10	5	5	1
	10	5	5	5	10	10	5
B	com	ponen	t				
	10	5	5	5	2	2	2
	2	2	10	1	2	2	5
	10	10	2	2	5	10	1
	10	5	5	5	2	2	2
	10	10	10	10	2	2	5
	5	2	2	10	5	5	2
	10	5	2	5	10	10	5

b) Apply dilated convolution to the 5X5 matrix given below

20	10	20	20	30
10	10	20	30	10
40	20	20	10	40
10	10	30	20	40
40	20	30	20	10

3)

4)

Explain the process of using a 1X1 convolution to convert a hXwXd1 matrix to a hXwXd2 matrix, (d2 (10) >1) (TLO 2.1, L2)

Illustrate spatially separable convolution on the 5X5 matrix given below, with the kernel of your (10) choice, it should contain zeros, positive and negative integers. (TLO 2.1, L3)

20	10	20	20	30
10	10	20	30	10
40	20	20	10	40
10	10	30	20	40
40	20	30	20	10

5)

8)

Describe the loss functions namely binary cross entropy, hinge loss, L1 loss and L2 loss. (TLO 2.2, (10) L3)

6) Describe the necessary considerations regarding the dataset that is important in CNN training. (10) (TLO 2.3, L3)

What is meant by skip connection? Describe the role of skip connections in CNN design.(TLO 2.3, (10) L3)

For the feature map given below, answer the following questions. (TLO 2.1, L3) (4 X 2.5 marks) (10)

20	30	-10	-20	0
-1	-2	12	23	4
9	8	-1	-2	-30
10	0	10	-10	-20
-7	-9	-12	-30	9

a) Apply leaky RELU with alpha value as 0.1.

b) Apply 2X2 Max Pooling with stride as 1 onto the output of previous step

c) Apply flattening of result of previous step

d) Consider the flattened output as the dense layer. Calculate the raw score using appropriately sized nonzero weights matrix and bias vector of your choice for a single output node.

- 9) Propose an architecture for CNN classifier, to use both the global and local features for (10) classification in connection with breast histopathological images. (TLO 2.3, L6)
- 10) For a classification task, describe how you would use a CNN approach for training and evaluation (10) using various hyperparameters and metrics. (TLO 3.1, L4)

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