School of Comp

MINOR EXAM - II

Course: Machine Learning

USN: 01FE18BCS125

Course Code : 17ECSC306

Semester : V

Date of Exam : 11/02/2021

Duration : 75 mins

Q.No.	Questions	Marks
1a	What linearly separable problem? Design a neural network of perceptron to implement three input i) XOR ii) AND gates.	10
1b	Consider the 2-dimensional dataset (1, 5), (4, 20), (5, 25), (6, 30), (8, 48). Apply PCA algorithm and determine principal components.	10
2a	Calculate the number of Parameters and Flops for each layer of AlexNet (given in Table-1), for an input of size 3 × 227 × 227. The network operates in inference mode. **(Refer worksheet which is in next page)**	10

S.No	Layer	#Params	#Flops
1	Conv2d: 64c 11w 4s 2p		
2	ReLU		
3	MaxPool2d: 2w 2s 0p		
4	Conv2d: 192c 5w 1s 2p		
5	ReLU		

Table -1

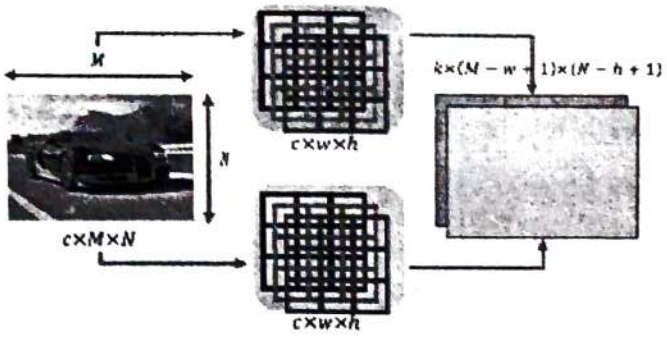
2b	What is multilevel classification? Explain the same for neural network with appropriate architecture diagram.	10
3a	List the differences between back-propagation and forward-propagation? Explain how Back-propagation is implemented in neural networks.	10
3b	Apply SVM algorithm for the data points in Table-2 and find dimension of hyperplane to classify them.	10

X	Y	Label
4	2	-1
4	-2	-1
6	1	-1
6	-1	-1
8	0	1
10	-1	1
12	2	1
12	-2	1

Table -2

Worksheet

2D Convolution Layer (conv) in a network



Width of input tensor = M
Height of input tensor = N
Number of Channels in input tensor = c

Width of 2D convolution kernel = w
Height of 2D convolution kernel = h
Channels of 2D convolution kernel = c

Padding on width of input tensor = p_w
Padding on height of input tensor = p_h

Stride along width of input tensor = s_w Stride along height of input tensor = s_h

Number of 2D convolution kernels = k

Width of output tensor = $\frac{M-w+2p_w}{s_w}+1$ Height of output tensor = $\frac{N-h+2p_h}{s_h}+1$

Number of channels in output tensor = k

Number of multiplications per output channel per location = cwh

Number of additions per output channel per location (with bias) = cwh

Number of ops. using Multiply-Accumulate (MAC) blocks per channel per location = $cwh+1$

Number of operations per output channel = $(cwh+1)\left(\frac{M-w+2p_w}{s_w}+1\right)\left(\frac{N-h+2p_h}{s_h}+1\right)$

Total number of operations in layer (with bias) = $k(cwh+1)\left(\frac{M-w+2p_w}{s_w}+1\right)\left(\frac{N-h+2p_h}{s_h}+1\right)$

ReLU Transfer Function

Width of input (output) tensor = M
Height of input (output) tensor = N
Channels in input (output) tensor = c

Total number of comparison operations = cMN
Total number of assignment operations = cMN
Total number of operations = $2cMN$

Fully-connected (Linear) Layer

Number of input nodes = n
Number of output nodes = k
Number of multiplication per output node = n
Number of additions per output node (with bias) = $n+1$
Number of ops. using MAC blocks per output node (with bias) = $n+1$
Total number of operations = $(n+1)k$

2D Max-pooling Layer

Width of input tensor = M
Height of input tensor = N
Channels in input (output) tensor = c
Width of 2D pooling kernel = w
Height of 2D pooling kernel = h
Total number of comparison operations per location = $wh-1$
Total number of operations in layer = $c(wh-1)\left(\frac{M-w+2p_w}{s_w}+1\right)\left(\frac{N-h+2p_h}{s_h}+1\right)$