

Total No. of Questions – [3]

Total No. of Printed Pages: 2

G.R. No.	
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PAPER CODE	V321-242A (ESE)
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May 2022 (ENDSEM) EXAM

T.Y. (SEMESTER - II)

COURSE NAME: Machine Learning (Elective III)

COURSE CODE: ETUA32182A

(PATTERN 2018)

Time: [1Hr]

[Max. Marks: 30]

(*) Instructions to candidates:

- 1) **Figures to the right indicate full marks.**
- 2) **Use of scientific calculator is allowed**
- 3) **Use suitable data where ever required**

- Q.1) a)** In a certain PCA based application, the data is arranged in 2x2 matrix and is as follows **(4)**

$$A = \begin{bmatrix} 4 & 1 \\ 1 & 4 \end{bmatrix}$$

Calculate the co-variance matrix.

- b)** What is Principal Component Analysis (PCA)? Through detailed procedure describe how PCA is used for Dimensionality reduction. **(6)**

OR

- b)** Explain step by step expectation and maximization algorithm used for estimation of parameters in Gaussian Mixture models. **(6)**

- Q.2) a)** In a certain perceptron training, the value of the weight is 0.6, learning rate is 0.1 and the gradient of error with respect to weight is 0.0020. If simple gradient descent optimization is used, then calculate the updated value of the weight. **(4)**

- b)** Activations functions used in multilayer perceptron must be continuous, differentiable and easy to compute. Justify the appropriateness of the above statement. **(6)**

OR

- b)** You are training a multilayer perceptron for certain classification application. What will be the effect on training if

use 1) Stochastic gradient 2) Batch gradient and 3) Mini batch gradient.

Q.3) a) Five convolutional filter of size 7×7 with zero padding and stride of 1 are used in the first layer of convolutional neural network. If input image of resolution $224 \times 224 \times 3$ is applied to this layer, what are the dimensions of data next layer will receive? **(4)**

b) Consider the following Convolutional neural network where all the convolution filters are of size 3×3 . For all the convolution layers, the stride $S = 1$ and padding $P = 1$: **(6)**

- CONV1: convolutional layer which takes an image of size $28 \times 28 \times 1$ as input, and produces 64 outputs (64 filters of size $3 \times 3 \times 1$)

The number of parameters in layer are calculated as filter size \times number of filters. For example in CONV1 layer number of parameters will be $3 \times 3 \times 64 = 576$

- POOL1: 2×2 max-pooling layer
- CONV2: convolutional layer with 64 inputs, 128 outputs (128 filters of size $3 \times 3 \times 64$)
- POOL2: 2×2 max-pooling layer
- CONV3: convolutional layer with 128 inputs, 256 outputs
- CONV4: convolutional layer with 256 inputs, 256 outputs
- POOL3: 2×2 max-pooling layer
- FC1: fully connected layer with 1024 outputs

In the above example, calculate the size of the output after POOL1 layer.

OR

b) What is convolution? Explain 2D convolution process with suitable example? How 2D convolution is used in 3D filtering in Convolutional Neural networks? **(6)**