A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY

PHD COURSEWORK EXAMINATION, DECEMBER 2021.

07DE8006 IOT AND DEEP LEARNING FOR IMAGE PROCESSING

Time – 3 Hours **Max Marks – 60**

PART – A

Answer all questions (6x3=18 marks)

1. What are the advantages of Raspberry Pi over Arduino?
2. Explain the concept of sampling and quantization?
3. Write short note on different morphological operations on images.
4. List three difference between machine learning and deep learning.
5. Give short note on bidirectional RNN.
6. Write short note on Restricted Boltzmann Machines.

PART – B

Answer all questions (6x7= 42)

7. a) With a neat diagram explain how sensors and actuators interact with physical world. Point out the different issues while parsing, exporting and processing the communication details.

OR

b) Design an IOT system build with smart objects and explain its working. List out the limitations of smart objects in Wireless sensor networks.

8. a) Define 4-adjacency, 8-adjacency and m-adjacency between pixels in an image. Check whether the underlined pixels given in the figure are 4-adjacent, 8-adjacent and m-adjacent.

$$\begin{matrix} 0 & 1 & \underline{1} \\ 0 & \underline{1} & 0 \\ 0 & 0 & 1 \end{matrix}$$

OR

b) For the image given below, apply histogram equalization to achieve image enhancement

$$f(x,y)=\begin{matrix}4 & 4 & 4 & 4 & 4\\ 3 & 4 & 5 & 4 & 3\\ 3 & 5 & 5 & 5 & 3\\ 3 & 4 & 5 & 4 & 3\\ 4 & 4 & 4 & 4 & 4\end{matrix}$$

9. a) For the image given below, apply Sobel filter both in X and Y direction and find the resultant image. Also, find the magnitude and angle of gradient at two underlined pixel positions.

$$f(x,y)=\begin{matrix}0 & 0 & 1 & 3 & 2\\ 2 & \underline{3} & 6 & 0 & 3\\ 5 & 4 & \underline{2} & 5 & 7\\ 1 & 2 & 0 & 4 & 4\end{matrix}$$

OR

b) Explain Butterworth and Gaussian high-pass filters. Explain three applications of high-pass filters in the frequency domain.

10. a) Consider two CNNs, one with 20 layers and other with 56 layers. In both networks, the error got decreased as the number of iteration increases. But it is also noted that the training error of CNN with 20 layers is approximately 1.2% and that of network with 56 layers is approximately 5%. What is the reason behind it? Explain it. Also suggest measures to overcome the situation.

OR

b) While developing a neural model, how can we avoid local minima? Give an outline of various optimization algorithms used in deep learning?

11. a) Explain in detail about back propagation through time in recurrent neural network training technique.

OR

b) Given a year and a month, illustrate how LSTM can be used to predict the number of international airline passengers in units of 1,000. The data set ranges from January 1949 to December 1960 (12 years) with 144 observations and is available in the following format in a file.

"Month", "Passengers"

1. "1949-01", 112

2. "1949-02", 118

3. "1949-03", 132

12. a) Explain about Deep Belief Network. Also, explain two applications of Deep Belief Networks.

OR

b) Describe Variational autoencoders. How they differ from traditional autoencoders? Compare PCA and autoencoder. Which is better? Justify your answer.