Note: - Pl. start your question paper from next page

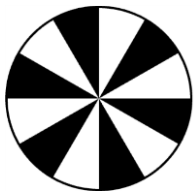
Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

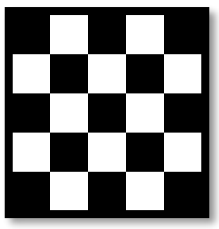
End Semester Examination, July 2020

Programme Name : M. Tech Automation & Robotics Engineering — **Semester : II**
Course Name : Image Processing and Machine Vision — **Time : 03 hrs**
Course Code : ECEG-7004 — **Max. Marks : 100**
Nos. of page(s) : 04
Instructions: Assume any data in programming, if required

SECTION A (5 x 4 = 20 Marks)

S. No.	Attempt ***all*** the questions	**Marks**	**CO**
Q.1	What is the difference between machine learning and artificial intelligence. Classify the machine learning algorithms.	**5**	**CO4**
Q.2	Distinguish between monochrome and grayscale image. You have a digital image that takes up 240 kB. The spatial resolution of the image is given by 600 x 200. What is bit depth?	**5**	**CO1**
Q.3	The Fig.1 presents the edge enhancement of an image. What type of enhancement method can be employed in the image. Write the MATLAB script to support the functionality.  Fig.1	**5**	**CO3**
Q.4	Classify the neural networks based on their architecture. Detail the perceptron training algorithm and functionality of BPN network.	**5**	**CO4**

SECTION B (4 x 10 = 40 Marks)

	Attempt ***all*** the questions		
Q.5	How K- Means clustering is helping in predicting the score based on trained data and test data. Write the mathematical equations, algorithm and flow. Apply the same concept on the image given below and predict possible score if the cluster size is varying from 8, 16, 32, 64, 128 to 256 pixels.  Fig.2	**10**	**CO4**

Q.6	**(a)** Draw the detailed diagram of image processing system. **(b)** How image arithmetic is helping for image processing. Write the MATLAB/ SCILAB script for at least 5 operations of image arithmetic.	**5** **5**	**CO1**
Q.7	Apply the region splitting and merging technique for the image given below. Draw the quadtree for (8 x 8), 2D image. Explain the detailed operation to support your answer.  Fig. 3 ***OR*** Write the flow of optical character recognition-based machine vision system with example.	**10**	**CO3**
Q.8	**(a)** Perform the histogram equalization of the image and plot the histogram. $\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$ (**b)** Draw the block diagram of the automated pattern recognition system.	**6** **4**	**CO2**
	SECTION-C (2 x 20 = 40 Marks) Attempt the followings		
Q.9	**(a)** Consider a case of multiclustering image processing system (8 x 8). Explain the optimal routing scheme with the mathematical calculations about maximum availability and links. **(b)** Explain the role of median filter in image processing and derive the mathematical expression for its behavior as low pass filter. Compute the value of the marked pixels shown in 3 x 3 mask. $\begin{bmatrix} 18 & 22 & 33 & 25 & 32 & 24 \\ 34 & 128 & 24 & 172 & 26 & 23 \\ 22 & 19 & 32 & 31 & 28 & 26 \end{bmatrix}$	**10** **10**	**CO2**
Q.10	**CASE STUDY** Wavelet analysis can be used divided the information of an image into approximation and detailed sub image signal. The approximation sub signal shows the generally pixel value of image, and three detailed sub signal show horizontal, vertical and diagonal details. Otherwise if these detail is very small than they can be set to zero without significantly changing the picture. If the number of zeroes is greater than the compression ratio is also high. There is two types of wavelet is used in image compression. First one is Continues wavelet transform and second one is discrete wavelet transform. The Wavelet analysis is computed by filter bank. This is combination of high-pass and low-pass filters. High pass filter kept high frequency information and lost low frequency information. Low pass filter		**CO5**

kept law frequency information and lost high frequency information. So signal is effectively decomposed into two parts, a detailed part (high frequency) and approximation part (law frequency). The Level 1 detail is horizontal detail, the level2 detail is vertical detail and level 3 details is diagonal detail of the image signal. The Flow chart representation of DWT algorithm for image compression according HAAR DWT algorithm, first applying reset signal is one then run the simulator, so all the value of the previous input and output will be zero. After then applying a clock pulse on the clock signal and the reset signal will be zero, all above condition will be done after then the original 2D image will be convert the set of pixels

Every pixels of the 2D image have own x-axis and y-axis, so we will represent the image pixels in histogram representation. After then the image will be applying to a filter bank, the filter bank will consist of Low-pass and High-pass filters, then the image signal will be separated high band signal and low band signal, according the HAAR DWT algorithm the low band and high band image signal have four possible combination, such as LL,LH,HL,HH. The LL band is more significant band it contains more information of the original image, so it is most important part of the algorithm process. The LL band again sub divided to lower band till to the desired output will not obtained, this process shown below in the Fig 4.

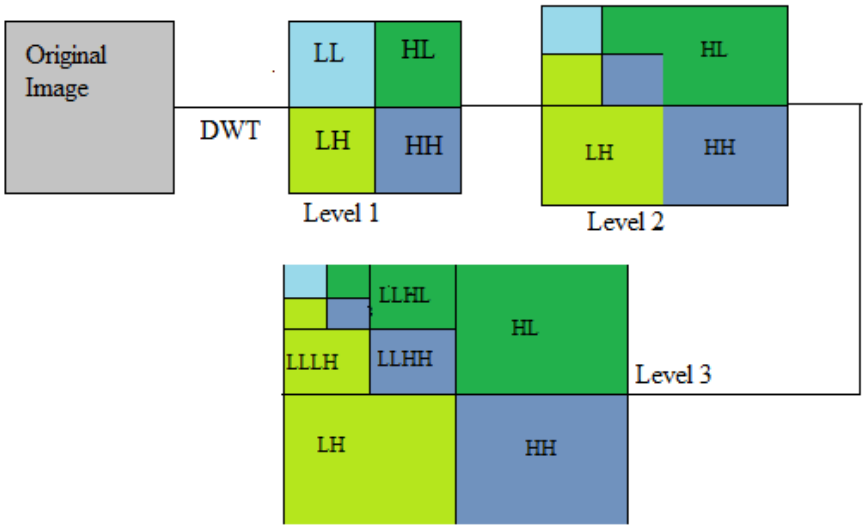


Fig.4 Decomposition of wavelet transforms

Based on the above discussion

(a) Can we used DWT for any machine vision application? Suggest the application and detail how we will use it.

(b) Can we apply DWT to detect the number plate of a car for security purpose at any tollbooth as depicted in Figure 3? Suggest the scheme to support your answer.

Fig. 5 Car Number plate detection

(c) Detail the wavelet decomposition technique using HAAR wavelet. Consider 256 x 256 DWT and decompose the image shown in Fig 6. till 2nd level.

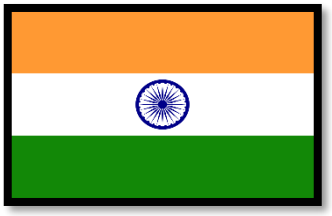


Fig. 6 Original Image for HAAR wavelet processing