M.Sc. Semester-IV Examination, 2015

Computer Science

Course : MCSC - 41

(Digital Image Processing)

Time : Three Hours **Full Marks : 40**

Questions are of value as indicated in the margin.

Answer **any four** questions.

1. (a) Explain with a suitable diagram, different types of neighbourhood of a pixel in a digital image.
   (b) Hence, discuss how connectivity is different from adjacency.
   (c) Explain, how separate connected components are labelled in a digital image. 3+2+5=10

2. (a) Justify the importance of a Kernel in transforming a digital image from spatial domain to frequency domain and back.
   (b) Indicate the forward and backward Fourier Kernel pair used in digital image processing. Hence, derive the computational overhead of transforming an N×N digital image using Fourier transform.
   (c) Explain, in details, as to how computational overhead is reduced by the use of Fast Fourier transform. 2+((1+1)+2)+4=10

3. (a) Mention the forward and backward Kenel of (i) Discrete Walsh transform, (ii) Discrete Hadamard transform and (iii) Discrete Cosine transform in the context of digital image processing.
   (b) Explain, the following in the context of frequency domain transform of a digital image - (i) Separability (ii) Symmetry. ((1+1)×3)+(2+2)=10

4. (a) Define digital image enhancement. Hence, indicate as to what are the different image inhancement techniques in use.
   (b) Provide, with due justification transfer functions used for - (i) Image negation, (ii) Contrast stretching (iii) contrast shrinking (reverse effect of conhast stretching). (1+3)+2×3=10

5. (a) Explain, with suitable example, the following - (i) Mean Fittering (ii) Median Filtering. Hence, deduce their computational overhead with respect to an image of size M×N.
   (b) Discuss the principle of histogram equilization in digital image processing. (2+2)+(2+2)+2=10

6. Write short notes on any **two** : 5×2=10
   (a) Image registration
   (b) Basic image transformation (Linear)
   (c) Thresholding

M.Sc. Semester-IV Examination 2017
Computer Science
Course : MCSC-41
(Digital Image Processing)

Time : 3 Hours **Full Marks : 40**

Questions are of value as indicated in the margin

Answer **any four** questions

1. (a) Explain the role of kernel used in a digital image transformation. State the forward fourier kernel and the backward fourier kernel used in digital image. 2+2=4

   (b) Determine the complexity of transforming a spatial digital image of size mxn into its frequency counterpart using fourier transform. Justify how this can be reduced by using fast fourier transformation? 2+4=6

2. (a) What is adjacency of a pixel in a digital image? Explain how it is different from connectivity. Justify "Adjacency is preserved under translation". 1+2+3=6

   (b) Explain the importance of distance metric with respect to adjacency. In this context define a path connecting two pixels in a digital image. 2+2=4

3. (a) Indicate the significance of image enhancement. Explain in this context –

   (i) Contrast stretching (ii) Gray level slicing 1+(3×2)

   (b) Explain histogram equalization with an example. 3

4. What do you mean by image registration? With an example indicate a mask based procedure used for image registration. 2+8=10

5. (a) What is image differencing? State one of its uses. 2+2=4

   (b) What is the significance of Laplacian in digital image processing? In this context provide two different Laplacian operators used. 2+2+2=6

6. (a) Explain mean filtering and median filtering with suitable examples. 2+2=4

   (b) Reduce the computational complexity associated to these filters used on a digital image of size mxn. 3+3=6

M.Sc. Examination 2018
Semester-IV
Computer Science
Course : MCSC-41
(Digital Image Processing)

Time : 3 Hours **Full Marks : 40**

Questions are of value as indicated in the margin

Answer **any four** questions

1. a) Explain Histogram Equalization with an example. 7
   b) Illustrate Image Differencing. Indicate a use of this. 2+1=3
2. a) Explain indicating respective transfer characteristics of (i) Gray image negation, (ii) Contrast stretching, (iii) Slicing. 2×3=6
   b) What is image binarization? Indicate the significance of thresholding in binarization. Can you suggest use of multiple thresholding to achieve infinitive gradation of a grey image? 1+1+2=4
3. a) What is image sharpening ? Explain how Laplacian operator may be useful to achieve this. 1+4=5
   b) Define distance metric. Illustrate (i) Eucleadian distance, (ii) Manhattan distance (iii) chessboard distance. 2+(1×3)=5
4. a) Discuss how (i) Translation (ii) Rotation (iii) Scaling may be represented in respect of digital images. Hence explain composition. (2×3)+1=7
   b) Explain - (i) N_4, (ii) N_D, and (iii) N_8 neighbour of a pixel. 1×3=3
5. a) State – (i) Mean filtering, (ii) Median filtering with requisite diagram. Deduce their computation overhead in respect of a digital image of size MXN. (2×2)+(1×2)=6
   b) Describe Discrete Fourier Transform. 4
6. Write short notes on (**any two**) : 5×2=10
   a) Image Registration
   b) Image digitization and sampling
   c) Frequency Kernel

M.Sc. Examination, 2019
Semester-IV
Computer Science
Course : MCSC-41
(Digital Image Processing)

Time : 3 Hours **Full Marks : 40**

Questions are of value as indicated in the margin

Answer **any four** questions

1. a) What is image registration? In this context explain the use of template image. 2+1=3
   b) State the significance of cross-correlation. Justify its limitation with a small example. 1+3=4
   c) Hence mention as to how the limitation of cross-correlation measure may be overcome? 3
2. a) What is the importance of Discrete Fourier Transform in digital image processing? In this context, indicate the forward Fourier Kernel and backward Fourier Kernel. 2+(1+1)=4
   b) State and prove any two properties of Discrete Fourier Transform. (1+2)×2=6
3. a) What is Laplacian operator. State its significance in digital image processing. 2+2=4
   b) Design a two dimensional Laplacian operator of order 1 and hence deduce the corresponding Laplacian mask. 2+2=4
   c) Derive the time overhead of applying a first order Laplacian mask on an image of size M×N. 2
4. a) State one linear and one nonlinear spatial image filter. Explain their functionings. (1+2)×2=6
   b) Hence, compute the space and time overheads for such filters of order r, applied on image of size M× N. (1+1) ×2=4
5. a) Explain with a suitable example – 3×2=6
      i) Histogram equalization ii) Contrast stretching
   b) Explain the following transformations –
      i)Translation ii) Rotation iii) Scaling
      Justify the use of homogeneous representation. (1×3)+1=4
6. Write short notes on (**any two**) : 5×2=10
   a) Walsh-Hadamard Transform
   b) Colour Image Processing
   c) Pixel Adjacency

M. Sc Semester – IV Examination, 2021

Time: 3 hours **Digital Image Processing (MCSC – 41)**

Full marks: 40

The question paper contains six questions. You may answer any four out of them.
All questions are of equal marks

1. Explain how the colour sensation is created in human eyes. In this context, explain different colour models clearly indicating their interrelationships.

$2 + 8 = 10$

2. What is the importance of image registration? Explain, with a suitable example, how template matching is useful in this context. Discuss, in details, the significance of normalization of cross-correlation in image registration.

$2 + 2 + 6 = 10$

3. What is spatial domain enhancement in digital image processing? What are different types of spatial domain enhancement? Explain, with an example, how is contrast stretched in a digital image representation. Discuss histogram equalization with an appropriate example.

$2 + 3 + 5 = 10$

4. Explain, with suitable example, (i) Mean filtering and (ii) Median filtering. Also derive their computational complexity respectively. Explain the use of Laplacian operator indicating the technical implication of using different masks for the purpose of Laplacian.

$2 + 2 + (2 + 4) = 10$

5. Derive in two-dimensional form of transformations – (i) Translation, (ii) Rotation, (iii) Scaling. Explain, in this context, the necessity of introducing coordinate system. Discuss, with an example, how composition is done with a number of such transformations.
Explain various types of neighborhood in the context of pixels in a digital image. What is Adjacency?

$(3 + 1 + 2) + (3 + 1) = 10$

6. Write short notes on (any two):
   (a) Pseudo-colour generation and use
   (b) Discrete Fourier Transform and its complexity
   (c) Distance metrics used in digital image processing

$5 \times 2 = 10$

M. Sc. Semester – IV Examination 2022
(Computer Science)
Image Processing
MCSC – 41

Answer any four questions.
Questions are of equal marks.

1. Expiain with suitable figures – (i) four neighbourhood, (ii) diagonal neighbourhood, (iii) eight neighbourhood of a pixel in a digital image. Hence, elaborate M-connectivity with requisite figure. State how adjacency is different from connectivity.

   6 + 2 + 2 = 10

2. Define a distance metric. In this context, explain with suitable figures – (i) Manhattan distance, (ii) Chessboard distance, (iii) Euclidean distance, (iv) Minkowski distance.

   2 + 8 = 10

3. Specify the significance of pixels in the formation of a digital image. Explain - (i) binary image, (ii) grey image, (iii) pure colour image, (iv) true colour image duly justifying their storage requirement.

   2 + 8 = 10

4. State the importance of forward kernel and backward kernel for transformation of a digital image between spatial domain and frequency domain representations. Compare and contrast - (i) Discrete Fourier transform, (ii) Discrete Cosine transform, (iii) Discrete Walsh transform, (iv) Discrete Hadamard transform.

   2 + 8 = 10

5. Explain, the significance of thresholding in transforming the character of an image, specifying the rationale of choice of the threshold. What is image histogram? Explain, Histogram Equalization with an appropriate example.

   4 + 1 + 5 = 10

6. Write short notes on any two:
   (a) Convolution
   (b) Fast Fourier transform
   (c) Laplacian operator

   5 + 5 = 10