

'Possible' Final Test Questions

CSC751, Digital Image Processing

Final:
SDSM&T

Chapter 1

Chapter 2

Chapter 3: Filters

1. What is a **recursive filter**?

A recursive filter is one, which operates upon itself by updating the image on the fly (vs. using a new image to update values). It has an infinite impulse response. Thus, these filters are called IIRs.

2. Give an example of a **recursive filter**:
3. When should you not use a **recursive filter**?

The recursive filter wouldn't be used in techniques such as averaging, or any 3x3 or larger filter because we will be operating on old data, along with new data which will not properly represent the effect we are trying to achieve.

4. What is **deconvolution**?
5. What is **size filtering**?

We look at the # of pixels in the histogram and if it doesn't have a certain amount or #, we eliminate it.

Chapter 4: Frequency Domain

6. What is the **complex conjugate**?
7. What does the Fourier Transform produce?

It yields the frequency components in a time or space-varying signal.

8. What is the equation for the **Fourier transform**?
9. What is the equation for the **inverse Fourier transform**?
10. What is the complexity of the **Fourier transform** on a 2D image?
11. What is separability and why is it relevant to the Fourier transform?

Separability is the idea that we can decompose a 2-d filter into a 1-D filter. The benefit of using this filter is that when we decompose the filter, instead of having $O(N^2 * M^2)$ time complexity, we are left with $O(N^2 * (2 * M))$, or $O(N^2 * M)$. A speed-up factor of M (over an N^2 sized image).

12. What is the Fourier transform of the **Gaussian**?

A Gaussian

13. What are the equations for **magnitude** and **phase**?

$$\text{Mag } |z| = \sqrt{x^2 + y^2}$$

$$\text{Phase } \theta = \tan^{-1}\left(\frac{y}{x}\right)$$

Chapter 5: Image Restoration

14. What are the statistical distributions of **noise** common in images?

Chapter 6: Image Compression

15. What is Image compression and how is it performed?

Compress an image or data, by exploiting redundancies in:

- a. **Data** (Images tend to have a high degree of spatial correlation).
 - b. **Code** (why use 8 bits per pixels)?
 - c. **Psychological characteristics** of the human visual system.
16. What is **lossy** compression?
17. What is **lossless** compression?
18. Name a few compression standards/schemes that are Lossy:
19. Name some compression schemes that are Lossless:
20. Name some simple compression schemes:
- ◆ Reduce spatial compression: (remove every 1 row and column)
 - ◆ Reduce Intensity Resolution:
21. What is **quadtree encoding**?
22. What is **contour decoding**?
23. What is **binary RLE** encoding?
24. What is **differential Encoding**?
25. What is **Predictive Coding**?
26. What is **Huffmann Encoding**?

Chapter 9: Morphological Operations

27. What is the **Hough Transform**?

The Hough Transform

28. Describe the Hough Transform algorithm:
29. Define **skeletonization**:
30. What is **erosion**?
31. What is **dilation**?

32. Define an **opening operation**

$$A \circ B = (A \ominus B) \oplus B$$

An opening operation consists of performing an erosion of A and B followed by a dilation of B.

33. What effect does opening have on an image/object?

34. Define a **closing operation**

$$A \bullet B = (A \oplus B) \ominus B$$

A closing operation consists of performing a dilation of A and B followed by a closing of B.

35. What effect does closing have on an image/object?

36. What is **thickening**?

37. What is **thinning**?

38. How are morphological operations performed on gray-scale images?

39.

Chapter 10: Image Segmentation

40. What is the time **complexity** of a 3x3 filter?

The filter must iterate over an N x N image, over a neighborhood of M x M.

O (n² * m²)?

41. What is **Image Segmentation**?

42.

43. What is **Thresholding**?

44. What is **Basic global thresholding**?

45. What is **Basic Adaptive Thresholding**?

46. What is **region-based segmentation**?

47. What is **region growing**?

48. What is region splitting and merging?

49. How would you select the seed for region growing?

50. What is the Hough Transform?

51.

Chapter 11: Representation and Description

Chapter 12: Object Recognition

Definitions

52. Define **isomorphic**:
- a. The idea that two sets have a one-to-one transform.

Other Questions

53. How does one determine a low point between two high points, or...how does one determine local minima between two maxima?

54. What is **image segmentation**?

It is the partitioning an image's pixels into meaningful groups.

55. What operations can be done with the **histogram**?

1. Contrast Stretching
2. Segmentation
3. Thresholding