CS-255 Computer Graphics

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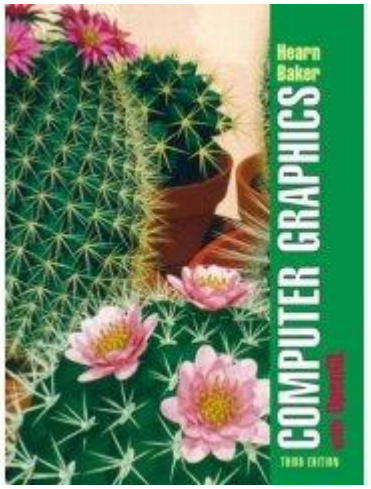
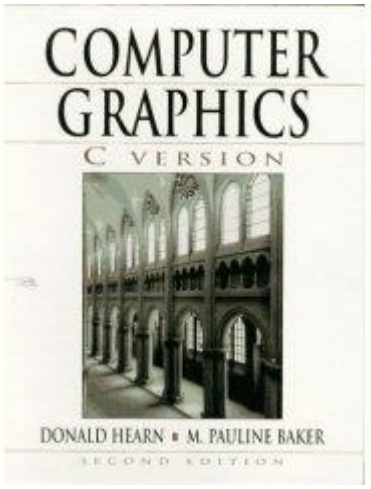
Reading

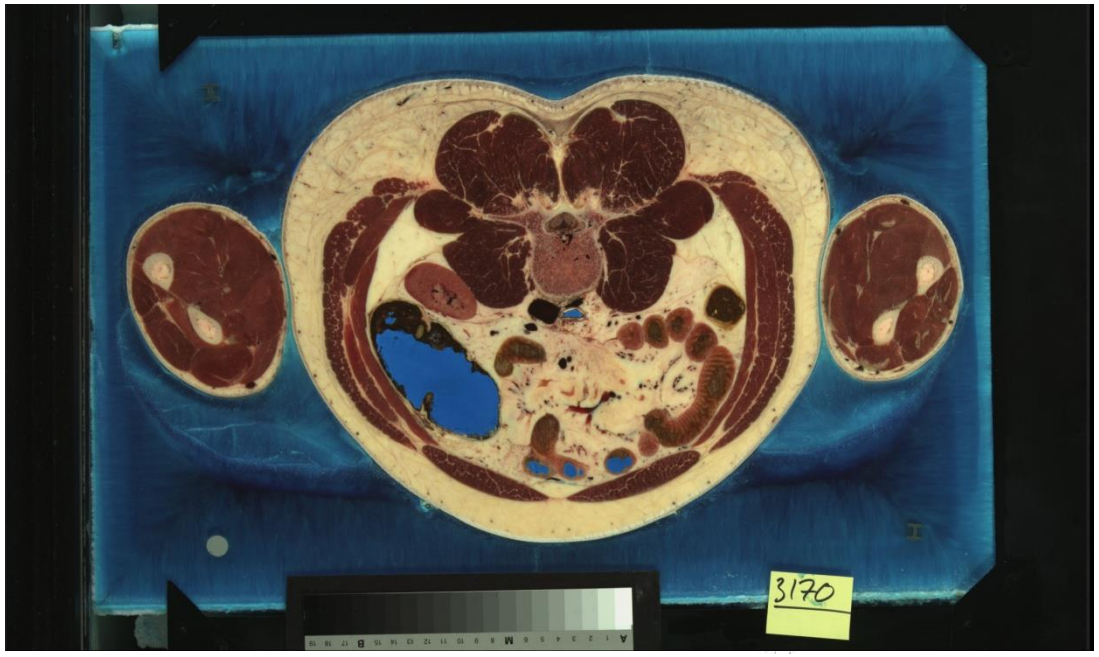


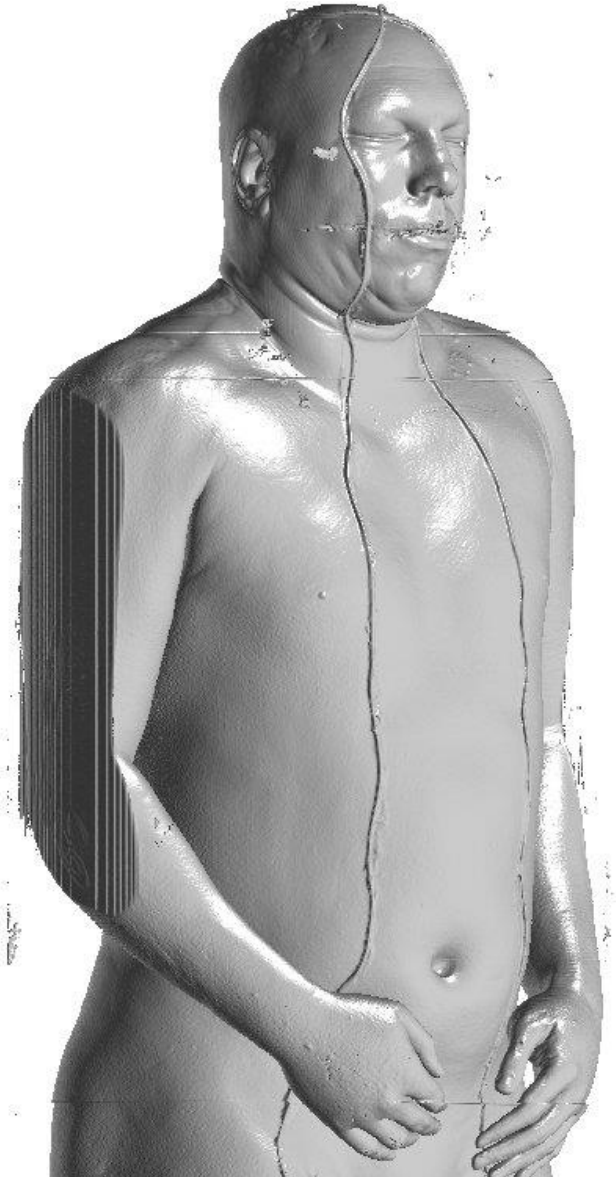


also
Computer Vision and Image Processing by Adrian Low

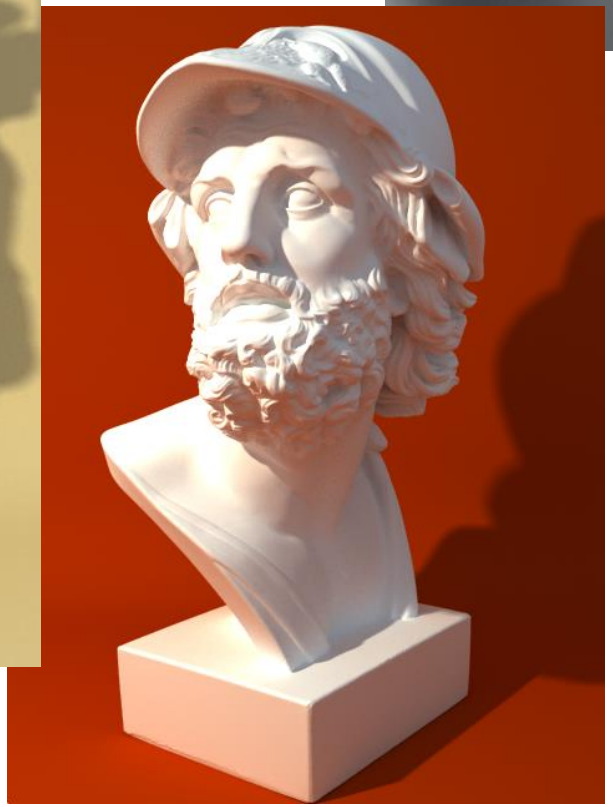
Computer Graphics by Hearn and Baker
2nd edition onwards (C/OpenGL and plain versions OK)
(1994 onwards)
(Does not have convolution in it)

Visualising Medical Data

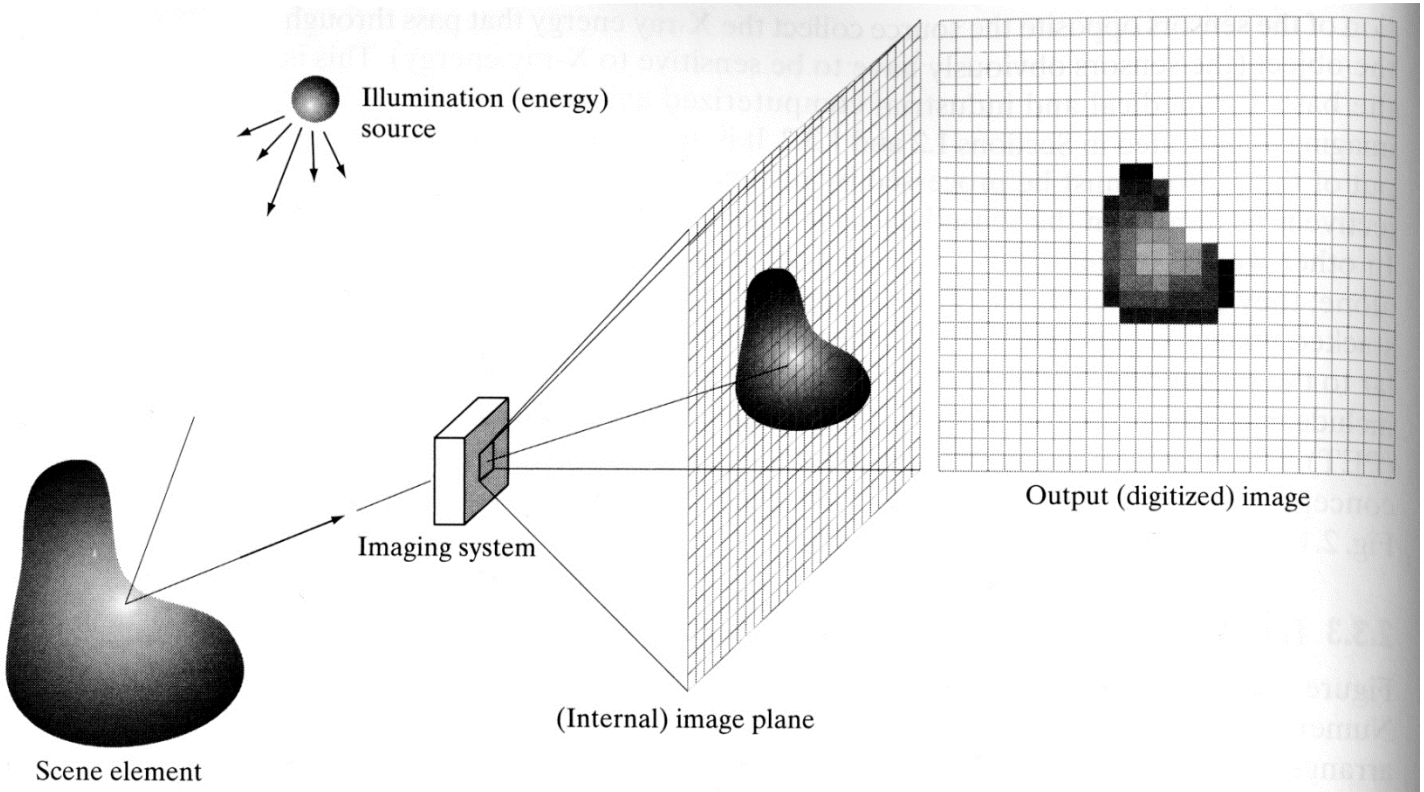




Global Illumination



Digital Images

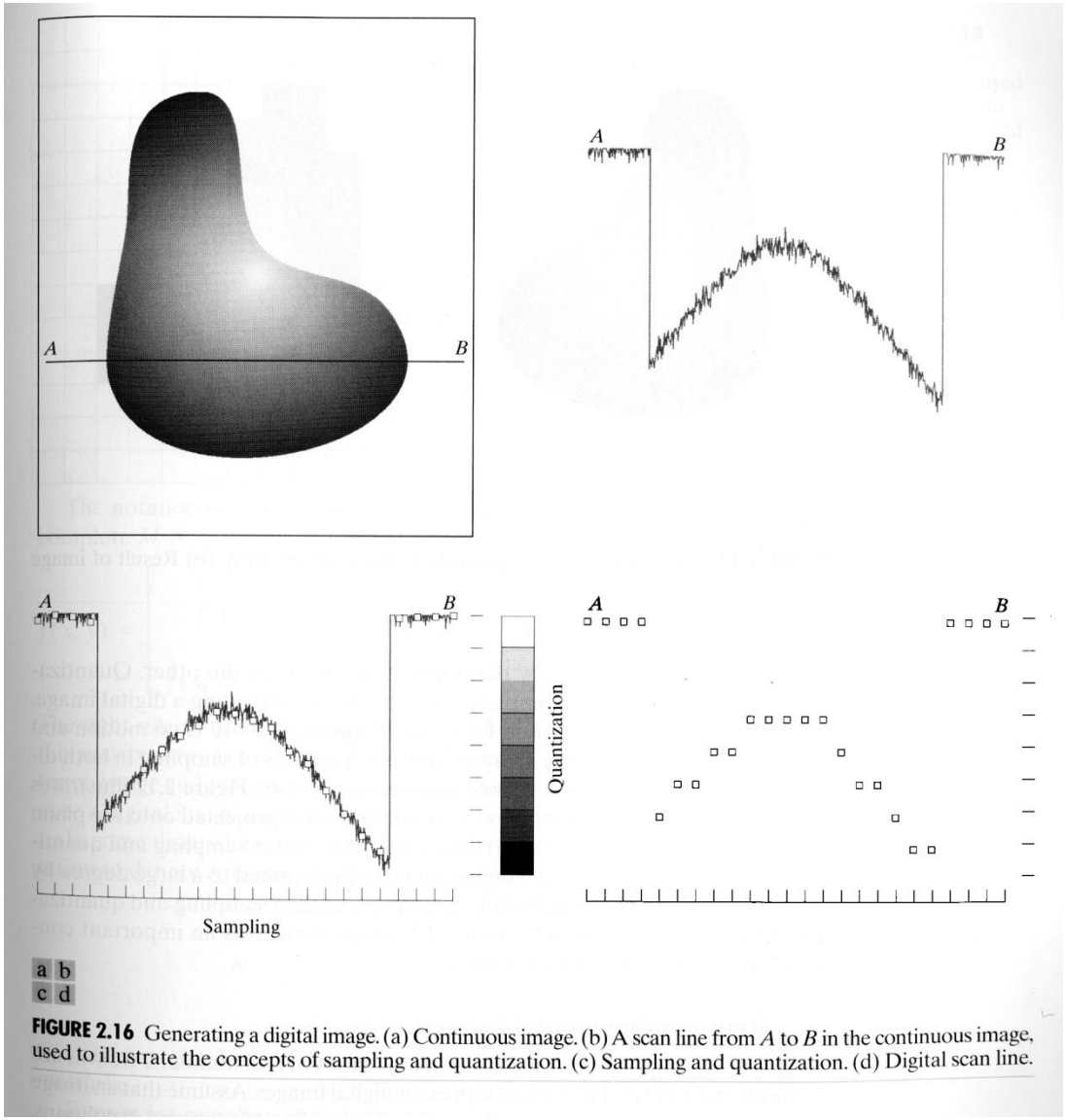


a
b c d e

FIGURE 2.15 An example of the digital image acquisition process. (a) Energy ("illumination") source. (b) An element of a scene. (c) Imaging system. (d) Projection of the scene onto the image plane. (e) Digitized image.

Digital Image Processing 2nd Edition, Rafael Gonzalez and Richard Woods, Prentice Hall, 2002, Chapter 2, page 50.

Sampling and Quantization

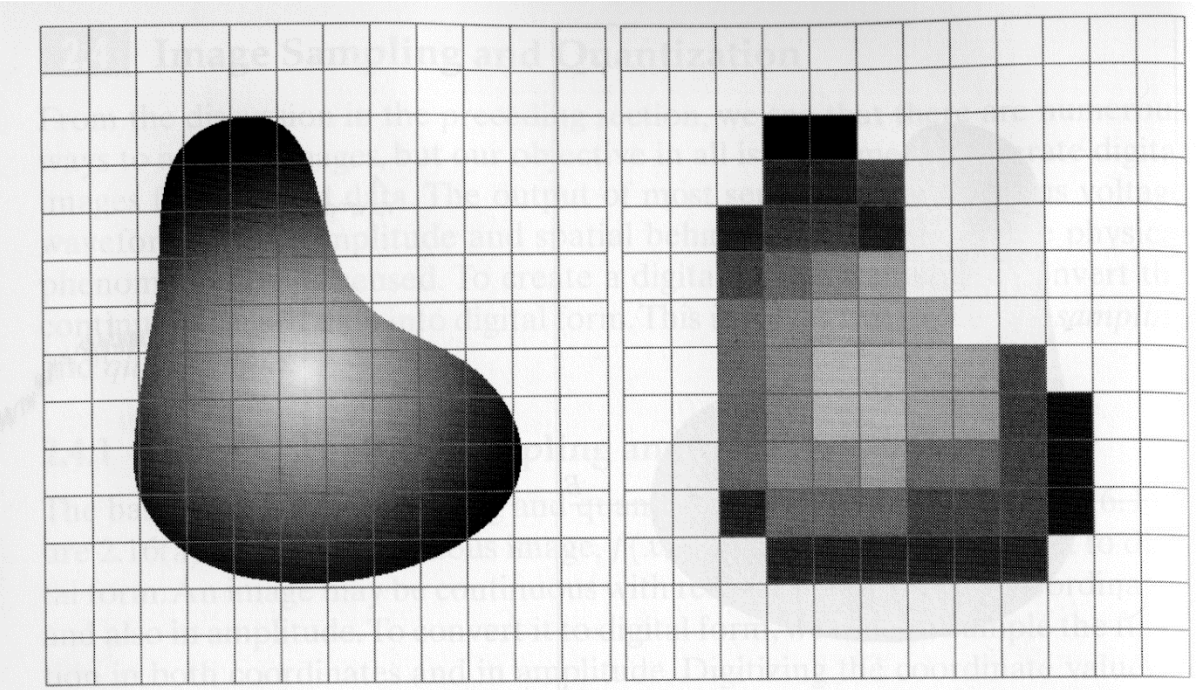


a b
c d

FIGURE 2.16 Generating a digital image. (a) Continuous image. (b) A scan line from A to B in the continuous image, used to illustrate the concepts of sampling and quantization. (c) Sampling and quantization. (d) Digital scan line.

Digital Image Processing 2nd Edition, Rafael Gonzalez and Richard Woods, Prentice Hall, 2002, Chapter 2, page 53.

Sampled and Quantized

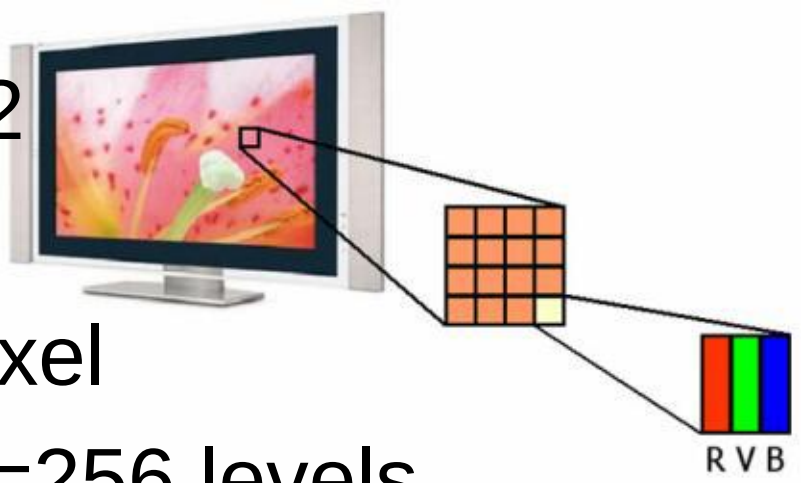


a b

FIGURE 2.17 (a) Continuos image projected onto a sensor array. (b) Result of image sampling and quantization.

Digital Image Processing 2nd Edition, Rafael Gonzalez and Richard Woods, Prentice Hall, 2002, Chapter 2, page 54.

Dynamic Range



- Levels usually power of 2
- $L=2^k$
- k is number of bits per pixel
- e.g. 8 bits per pixel $L=2^8=256$ levels
- Grey images – 1 byte per pixel
- Colour images – 3 bytes per pixel (1 byte for red, 1 for green, 1 for blue)
- Gives 256x256x256=~16.7million colours

Image source: Tom's Hardware Guide

High Dynamic Range

- Some monitors display 12 bit (e.g. some medical monitors displaying X-rays have 2^{12}=4096 grey levels)
- Some scanners scan at 30 bits (10 bits (2^{10}=1024) per colour channel = ~1 billion colours)

Storage Sizes

- 512x512x1 bit (Black and white image)=32kbytes
- 512x512x8 bits (grey scale)=256kbytes
- 512x512x12 bits (e.g. medical CT scan)=384kbytes
- 1920x1080x24 bit (e.g. 1080HD)~6MBytes
- (x25fps x 60 x 120 = 2 hour film)=1 Terabyte (uncompressed)

Images in memory

- unsigned char image[rows][cols][channels]
- (channels=3 for RGB=Red,Green,Blue)
- image[0][0][0], image[0][0][1], image[0][0][2] are the RGB channels of pixel (0,0)
- The next pixel (0,1) to the right is stored at image[0][1][0-2]
- The pixel below (0,0) is (1,0) and is stored at image[1][0][0-2]
- See coursework

Review

- These slides not available (you have photocopied notes which are superset of these slides)
- See notes for review of key concepts
- Know all this material – the next lecture will build upon it, and will also discuss the assignment