Image Processing and Computer Vision 1

Introduction – Image Representation in Memory – week 1

Martin Weisenhorn

HS 2023

1 Exercises from the Book

1.1 Book by Gonzalez and Woods, 2.11

A common measure of transmission for digital data is the *baud rate*, defined as symbolds (bits in our case) per second. As a minimum, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following:

(a) How many seconds would it take to transmit a sequence of 500 images of size 1024×1024 pixels with 256 intensity levels using a 3 M-baud (10^6 bits/sec) baud model? (This is a representative medium speed for a DSL (Digital Subscriber Line) residential line.)

(b) What would the time be using a 30 G-baud (10^9 bits/sec) modem? (This is a representative medium speed for a commercial line.)

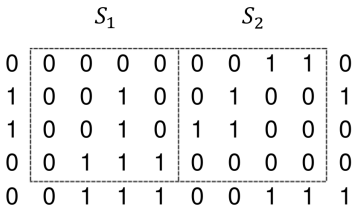
1.2 Book by Gonzalez and Woods, 2.16

Consider the two image subsets S_1 and S_2, shown in the following figure. For $V = \{1\}$, determine whether these two subsets are

(a) 4-adjacent

(b) 8-adjacent

(c) m-adjacent



1.3 Book by Gonzalez and Woods, 2.17

Develop an algorithm for converting a one-pixel thick 8-path to a 4-path.

1.4 Book by Gonzalez and Woods, 2.20

Consider the image segment shown.

(a) Let $V = \{0, 1\}$ be the set of intensity values used to define adjacency. Compute the lengths of the shortest 4-, 8-, and m-path between p and q. If a particular path does not exist between these two points, explain why.

$$
\begin{array}{cccccc}
 & 3 & 1 & 2 & 1 & (q) \\
 & 2 & 2 & 0 & 2 & \\
 & 1 & 2 & 1 & 1 & \\
(p) & 1 & 0 & 1 & 2 &
\end{array}
$$

1.5 Book by Gonzalez and Woods, 2.21

Consider two points p and q

(a) State the condition(s) under which the D_4 distance between two points p and q is equal to the shortest 4-path between these points.

(b) Is this path unique?

2 Practical Exercise

Find out how to load and display images with Python using the `matplotlib` or `OpenCV` package or with MATLAB using the Image Processing Toolbox. Python is the recommendet tool as it is standard in industry and academia.

Additional Task

Get images from the camera.

1. Use the script `Python/webcam01.py` or `Matlab/webcam01.m`
2. Check if you get an image from the webcam (remove cover from lens!).
3. Setup camera
   (a) MATLAB
      i. You can access the camera settings through the object `src`.
      ii. Try to change the cameras exposure and gain (`src.ExposureTime` and `src.Gain`).
   (b) Python
      i. Make your camera settings with the application *wxPropView*
      (Don't forget to release the camera after you have made your settings).
      ii. Run script `../utilities/get_settings.py` and select the folder where `webcam01.py` is.
      iii. Uncomment line 21 `settings = 'settings.txt'`.
      iv. Run `webcam01.py` again.
4. Play also with iris and focus of the camera. Try to get a sharp and bright image with as little noise as possible.
   - Brighter image: open, iris, larger gain, longer exposure time
   - Less noise: open iris, longer exposure time
   - Sharper image: close iris, set focus on object

Figure 1: Camera setup in the lab