

0. Introduction

♣ A Digital Image System

- A 2D digital image is nothing but a mapping from a rectangular region to a matrix (vector).
- A Digital Image Processing System consists of
 1. *Acquisition* - scanner, CCD camera, VCR, satellite, infrared, NMR, mobile phone, \dots
 2. *Storage* - magnetic tape, (3.5, 5.25)-inch diskette, (MBs, GBs, TBs, ZBs) hard disk, videotape, CD, DVD, FlashArray//X, \dots
 3. *Processing* - PC, Sun Workstation, Nvidia DGX-1, \dots
 4. *Communication* - voice-grade telephone, cable, wireless, \dots
 5. *Display* - PC monitor, thermal printer, laser printer, \dots

♣ Sampling and Quantization

- Digitation of the spatial coordinates (x,y) in an image function $f(x,y)$ is called *sampling*.
- Digitation of the amplitude of an image function $f(x,y)$ is called *quantization*.

♣ Image Data Representation

- A gray level image is usually represented by an $M \times N$ matrix whose elements are all integers in $\{0, 1, 2, \dots, 255\}$ corresponding to brightness scales.
- A color image is usually represented by 3 $M \times N$ matrices whose elements are all integers in $\{0, 1, 2, \dots, 255\}$ corresponding to 3 primary primitives of colors.

♣ Image Transforms - has 3 major applications

- Feature extraction - find all ellipses in an image
- Bandwidth Reduction - eliminate the low contrast "coefficients"
- Data Reduction - eliminate insignificant coefficients of DCT

♣ Image Enhancement

The goal is to accentuate certain features for subsequent analysis or image display. The enhancement process is usually done interactively.

♣ Image Restoration

The restoration is a process that attempts to reconstruct or recover an image that has been degraded by using some known phenomenon.

♣ Image Segmentation and Edge Detection

Segmentation is basically a process of picture classification: the picture is segmented into subsets by assigning the individual pixels into classes.

♣ Thinning and Contour Tracing

Thinning is good for OCR, contour tracing is good for shape analysis.

♣ Image Data Compression

The purpose is to save storage space and to reduce the transmission time of information. Note that it requires 2 mega bits to store a 512×512 gray level image. It takes around 40 seconds to transfer such an image via a wire line of 56 kbps,

Image Display

- Via a color or B/W monitor
- Via a thermal printer
- Via a laser (laser-jet) printer (dithering)
- Via character symbols

Image Printing

♣ From ascii to PostScript generator for image data.

To compile raw2ps.c gcc raw2ps.c -lm -o raw2ps

Syntax raw2ps imagefile rows cols dx dy sizex sizey | lpr [-Plw]

For multiple images:

- raw2ps file1 rows1 cols1 dx1 dy1 sizex1 sizey1 + > tmp
- raw2ps file2 rows2 cols2 dx2 dy2 sizex2 sizey2 + >>tmp
- ⋮
- raw2ps filen rowsn colsn dxn dyn sizexn sizeyn >>tmp
- lpr [-Plw] tmp

Description

raw2ps is a program which converts a free-form ascii file of unsigned characters (pixel values between 0 and 255) into a PostScript program which produces a printed image when printed on a PostScript printer such as an HP LaserJet. The user has a complete control over picture placement and size. By default, gray levels near zero print darkly, and gray levels near 255 are light. The user can also specify the PostScript code not to include a print command (this is useful if multiple pictures on one page are desired).

Input Parameters

rowsj number of rows in the image matrix (no default)

colsj number of columns in the image matrix (no default)

dxj horizontal position of lower left corner of image wrt. lower left corner of page (current point in TeX mode) (in inches)

dyj vertical position of lower left corner of image wrt. lower left corner of page (current point in TeX mode) (in inches)

sizexj horizontal size of the printed image

sizeyj vertical size of the printed image

♣ Note

This program expects *only* unsigned characters (pixel values) in the input file. Any header information should be stripped off of the image file. If the gray values are in binary format, they should be converted. This restriction was imposed to keep things as general as possible.

Source Code <http://www.cs.nthu.edu.tw/~cchen/CS4520/raw2ps.c>