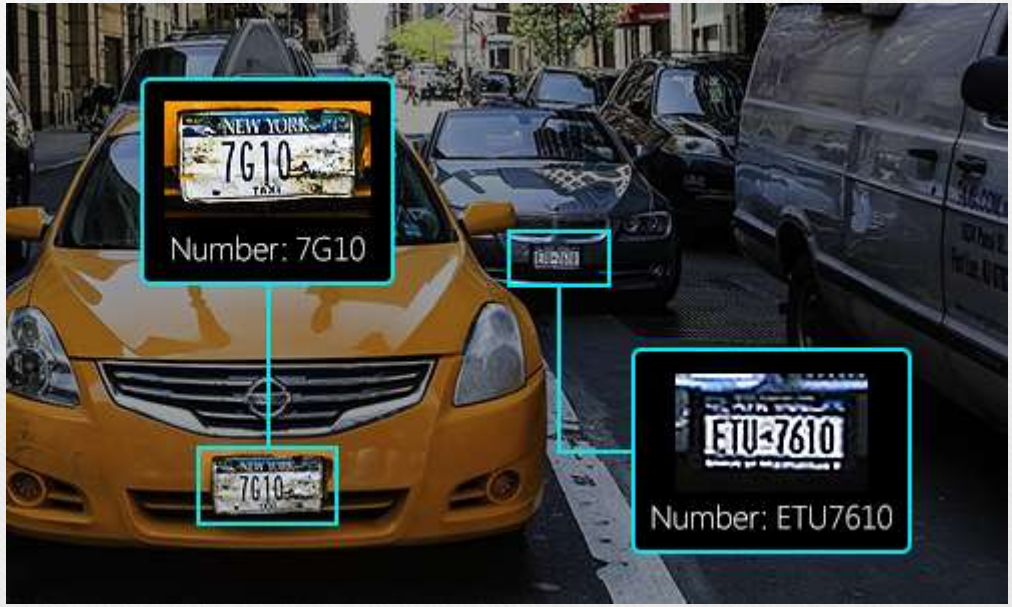
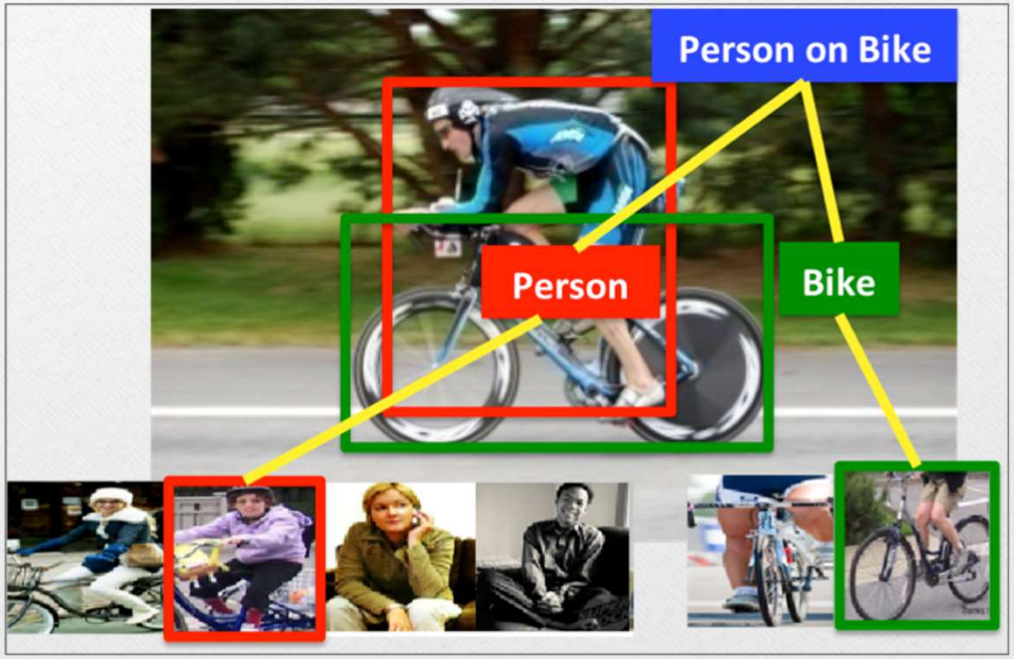
Introduction to Image Processing

Image Processing

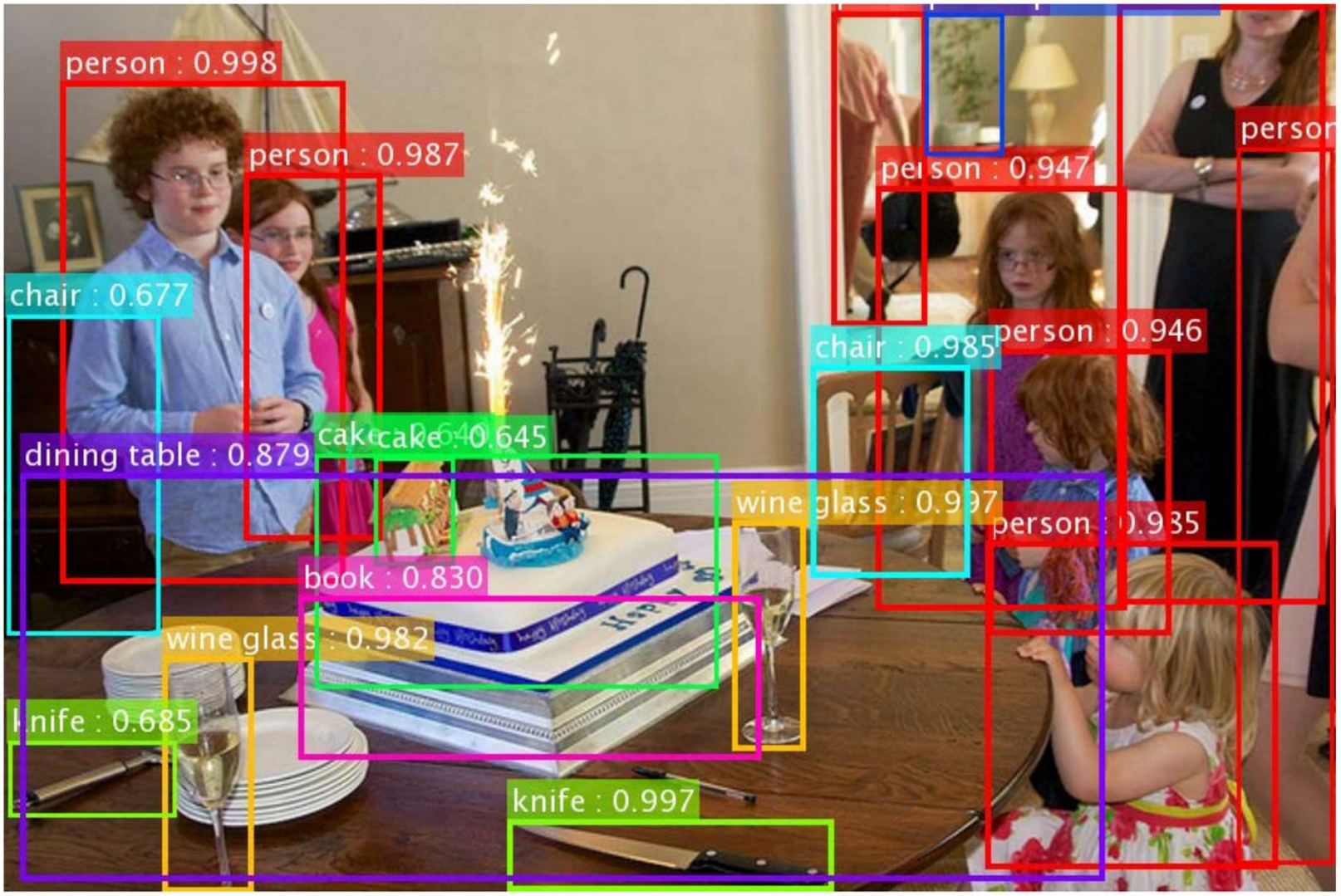


http://rnd.azoft.com/convolutional-neural-networks-object-detection/

Image Processing



http://cs.stanford.edu/~taranlan/



https://chaosmail.github.io/deeplearning/2016/10/22/intro-to-deep-learning-for-computer-vision/

Image Sampling and Quantization

Image Sampling and Quantization

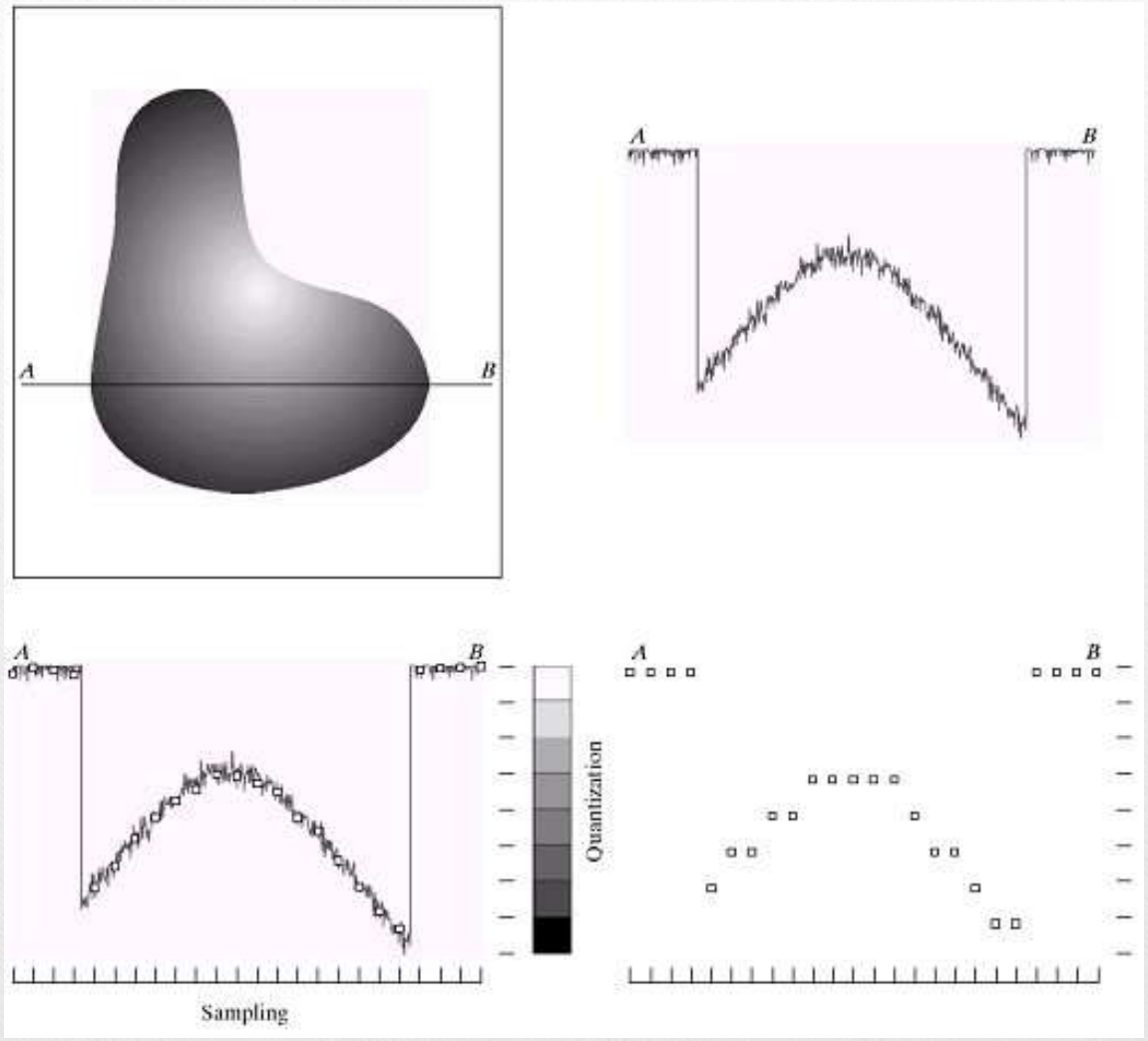
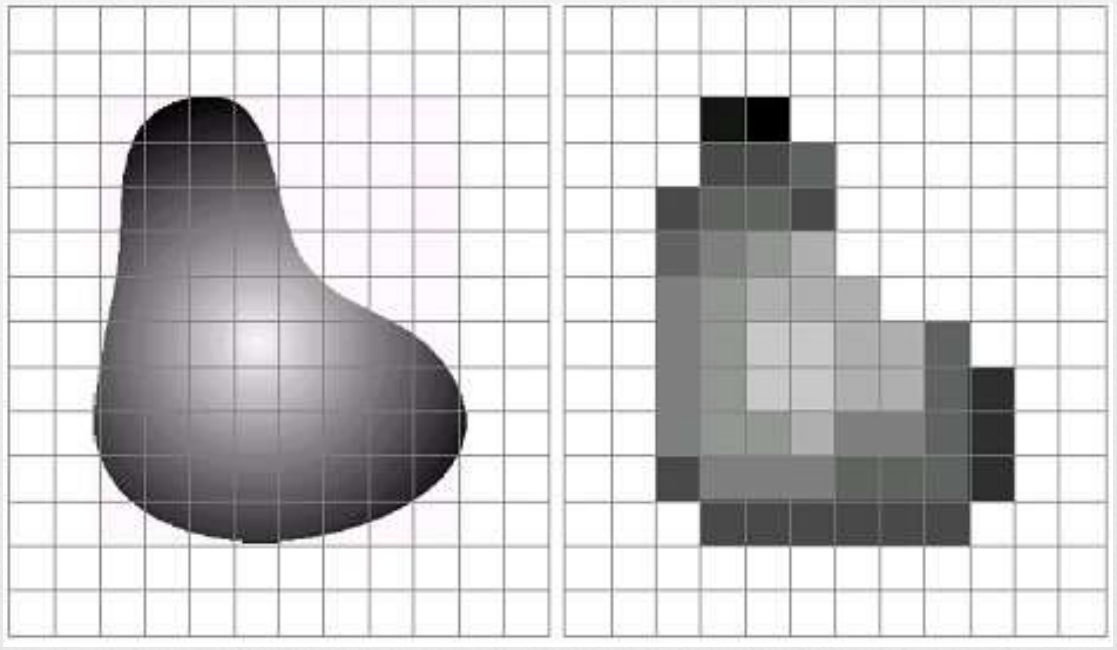
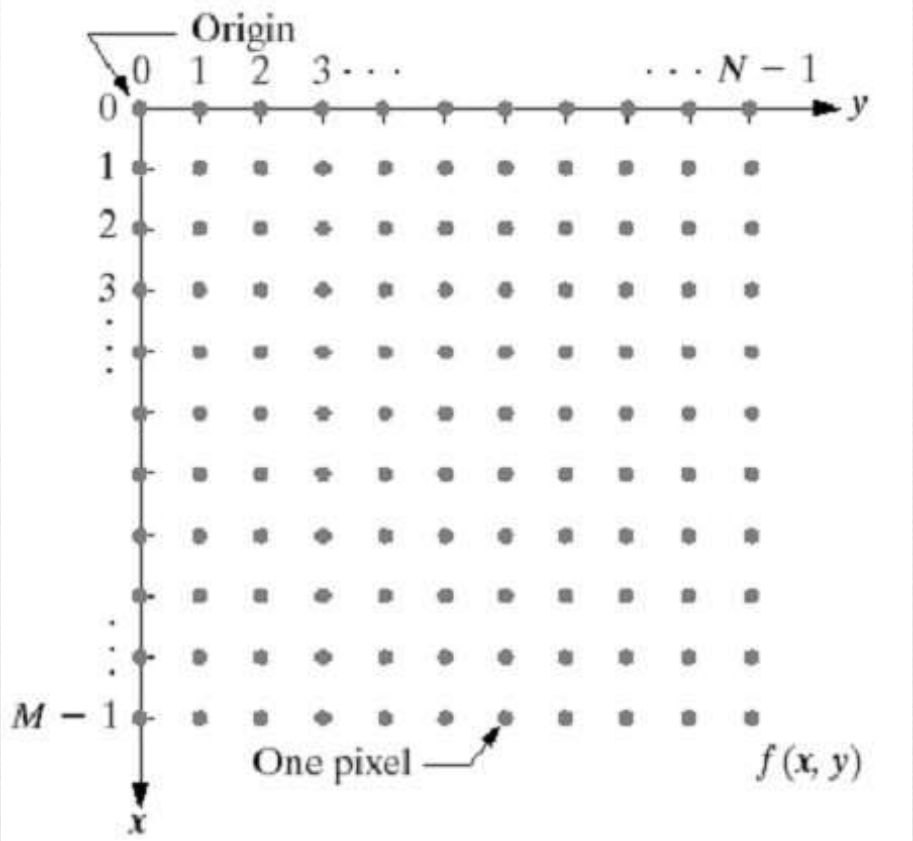


Image Sampling and Quantization

- Sampling: digitizing the 2-dimensional spatial coordinate values
- Quantization: digitizing the amplitude values (brightness level)



Representing Digital Images



Representing Digital Images--Examples

- PGM file

P2
320 240
255
200 215 25 …
55 25 25 …
25 55 255 …

- PPM file

P3
 # Created by Paint Shop Pro 5
320 240
255
200 215 25 200 215 25 …
55 25 25 55 25 25 …
25 55 255 25 55 255 …

https://en.wikipedia.org/wiki/Netpbm#File_formats

Types of Image File Formats--Examples

- **Types of image file formats:**

BMP : Microsoft Bitmap formal

JPEG : Joint Photographics Experts Group

PNG : Portable Network Graphics

TIFF : Tagged Image File Format

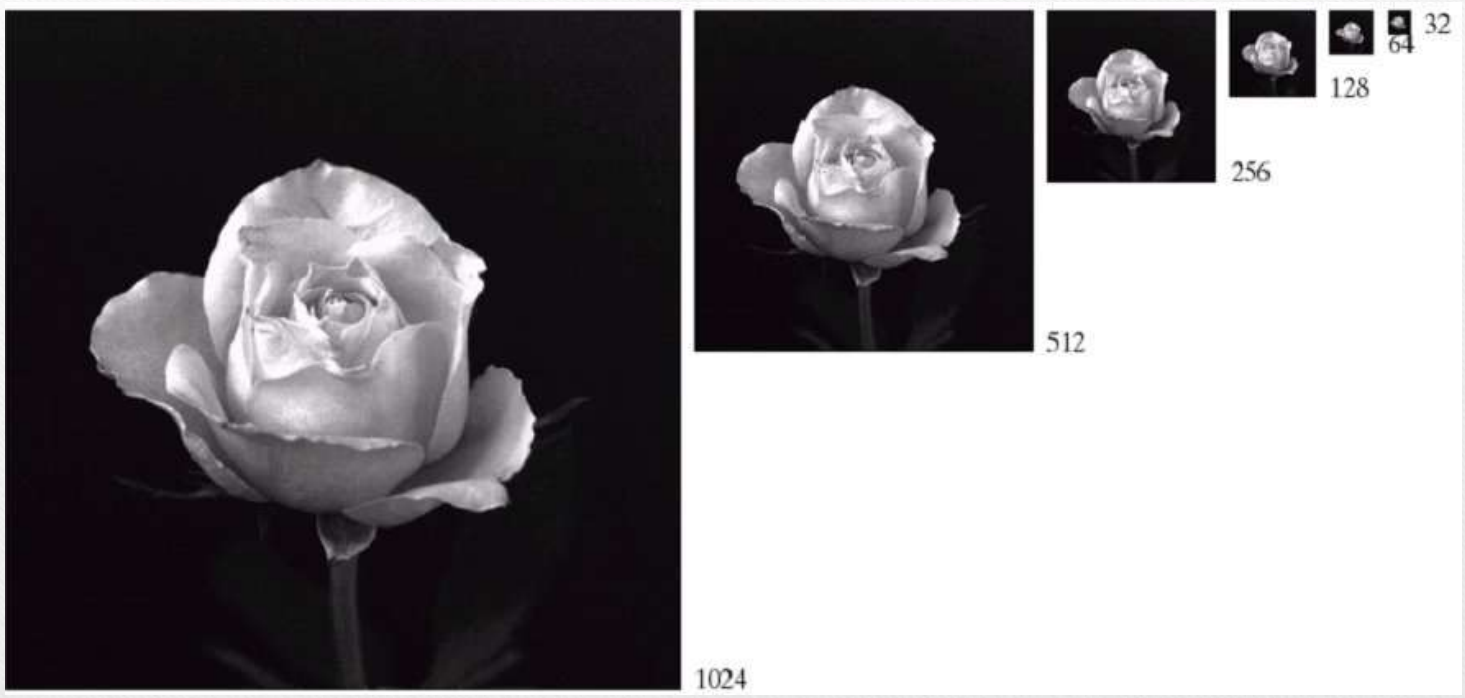
GIF : Graphics Interchange Format

HDF : Hierarchical Data Format

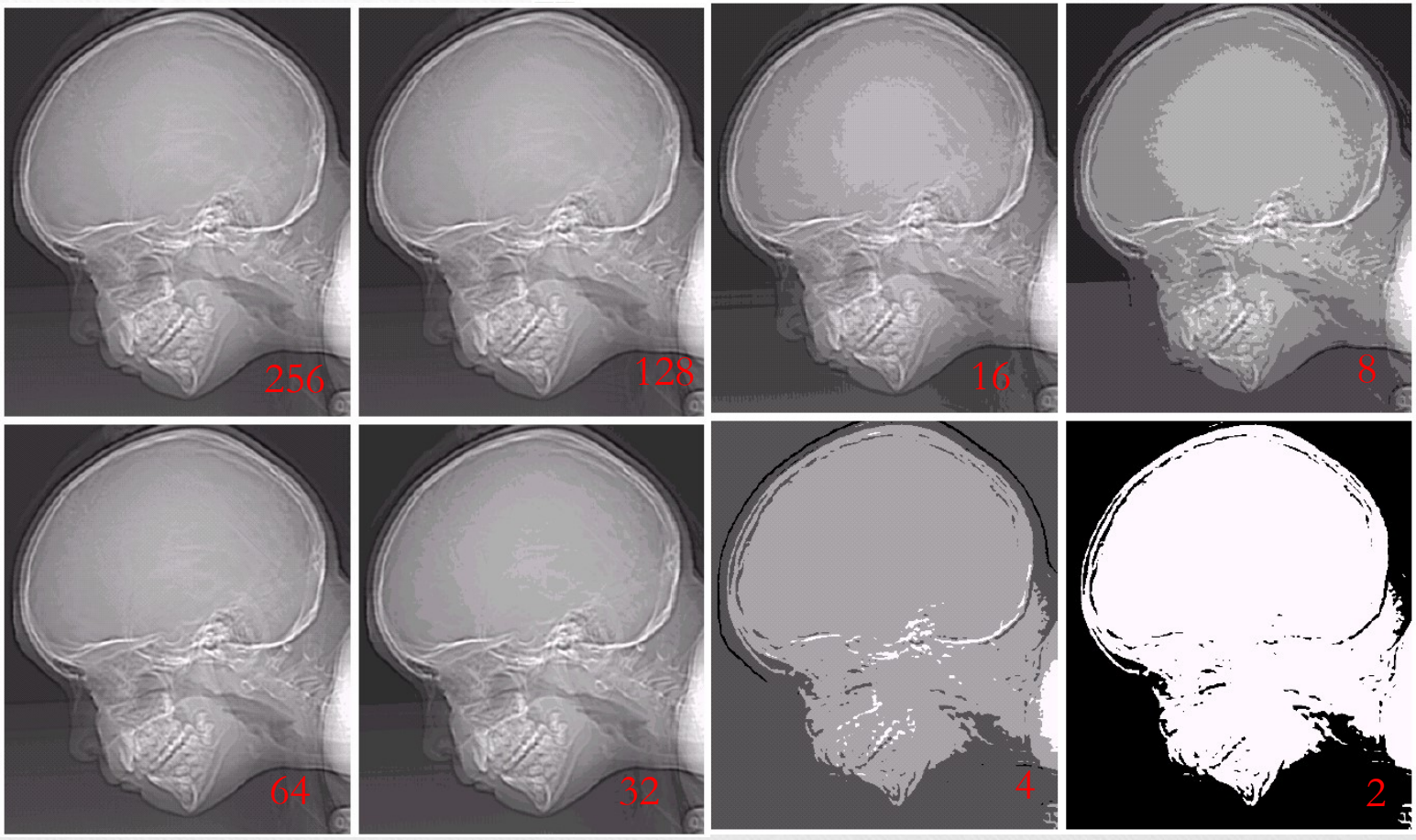
PCX : PC Paintbrush

…

Spatial Resolution



Gray-Level Resolution



Some Basic Relationships Between Pixels

- Pixel

  A pixel has a location (the spatial coordinate) and a value.

- Connected component of S

  The set of all pixels in S that are connected to a given pixel in S.

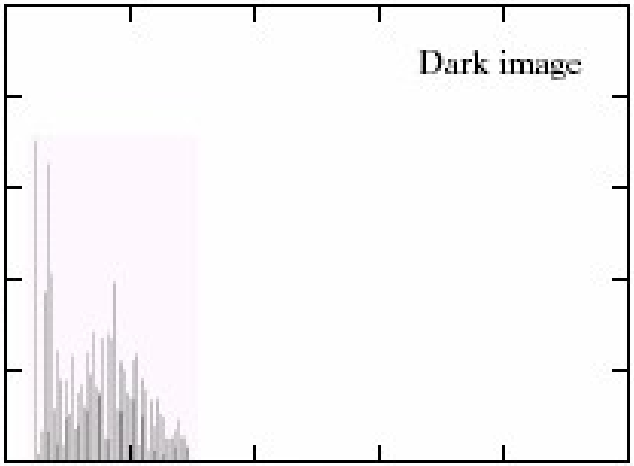
- Region of an image

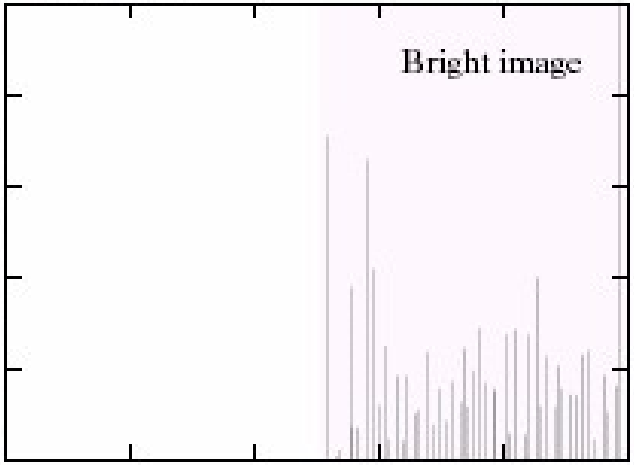
- Contour of a region

- Edge

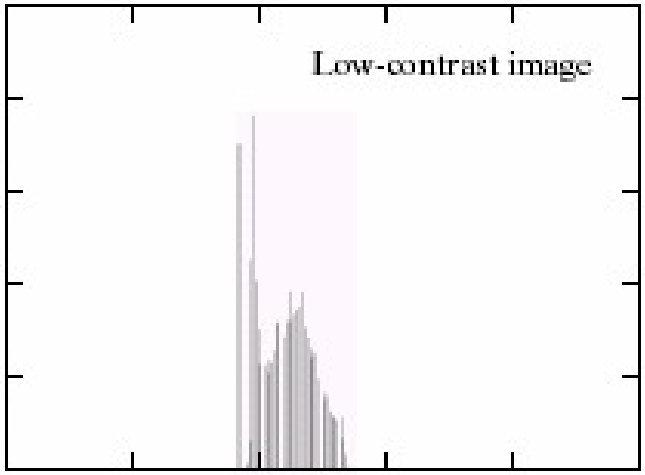
  Edge is a path of one or more pixels that separate two regions of significantly different gray levels.

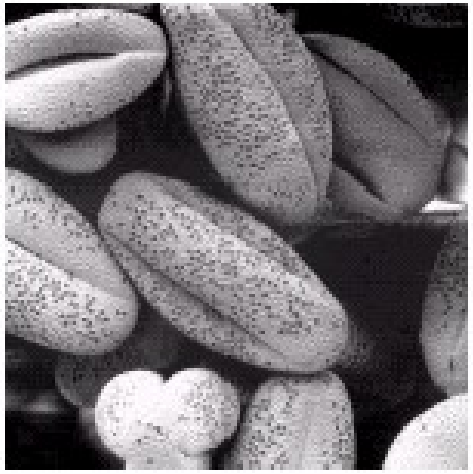
Histogram

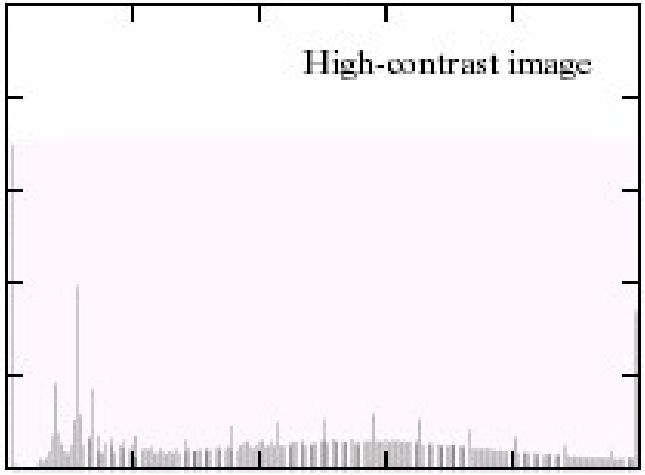




Histogram







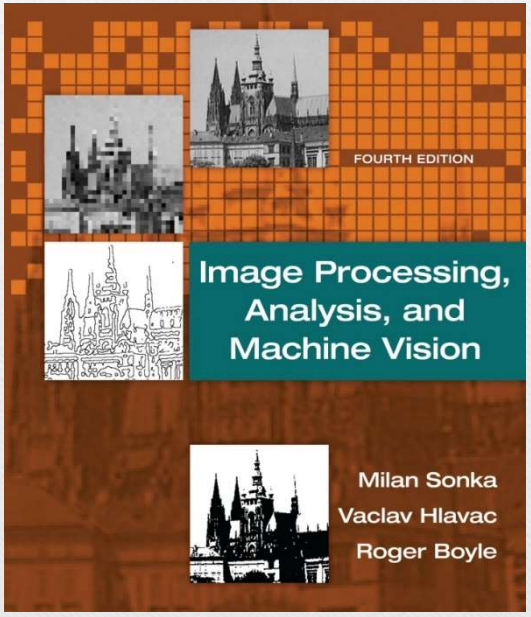
Textbook

- Textbook

  Image processing Analysis, and Machine Vision, 4th edition

  Milan Sonka, Vaclav Hlavac, Roger Boyle

  2015



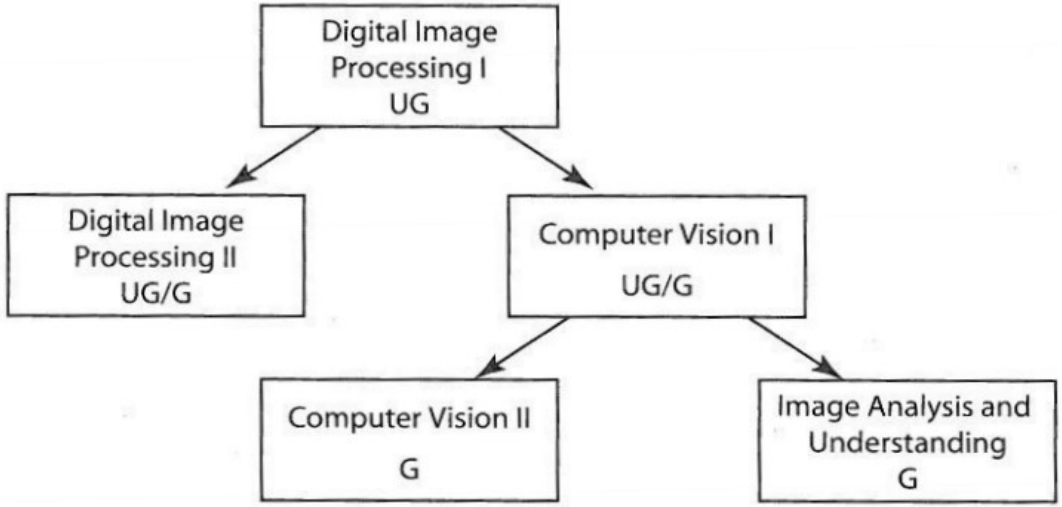


Figure 1: Pre-requisite dependencies of the proposed five courses. UG = undergraduate course, G = graduate course. © *Cengage Learning 2015.*

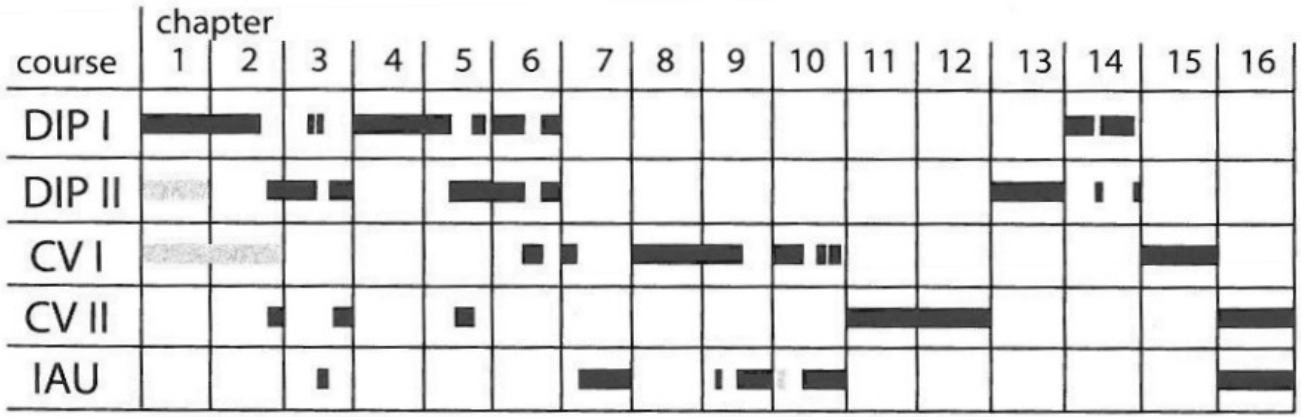


Figure 2: Mapping between the proposed course outlines and material covered in individual chapters and sections. See course outlines for details. © *Cengage Learning 2015.*

Outline

- Chapter 1 Introduction
- Chapter 2 The image, its representations and properties
  - Image digitization, digital image properties, color images, cameras
- Chapter 3 The image, its mathematical and physical background
  - Linear integral transforms, images as stochastic processes, image formation physics
- Chapter 4 Data structures for image analysis
  - Levels of image data representation, traditional image data structures, hierarchical data structures
- Chapter 5 Image pre-processing
  - Pixel brightness transformations, geometric transformations, local pre-processing, image restoration
- Chapter 6 Segmentation I
  - Thresholding, edge-based segmentation, region-based segmentation, matching, evaluation issues in segmentation

Assignment

- Term Project Topics
  - Face region detection
  - Skin color detection
  - Vehicle detection
  - Obstacle detection
  - Road sign detection
  - Lane detection
  - Object detection…

（甲狀腺）