Introduction

- What IS computer vision?
  the analysis of digital images by a computer

- Where do images come from?

Applications

- Medical Imaging
  CT image of a patient’s abdomen

Visible Man Slice Through Lung

3D Reconstruction of the Blood Vessel Tree

Slice of a Chicken Embryo’s Inner Ear

CBIR of Mouse Eye Images for Genetic Studies
Robotics

- 2D Gray-tone or Color Images
- 3D Range Images

“Mars” rover

What am I?

Image Databases:

Images from my Ground-Truth collection.

What categories of image databases exist today?

Abstract Regions for Object Recognition

Documents:

Insect Recognition for Ecology
Some Applications from WACV

- Face Detection / Skin Detection
- Face Recognition
- Gesture Recognition
- Eye Gaze Estimation
- Gender Classification
- People Tracking
- Group Behavior Recognition
- Visual Navigation
- Real-Time Precrash Vehicle Detection
- Augmented Reality
- Vehicle Inspection
- Video de-Abstraction (save money on wedding videos)
- Analysis of Auroral Appearance over Canada
- Video Endoscopy

Digital Image Terminology:

| 0 0 0 | 1 0 0 | 95 96 94 93 92 |
| 0 0 1 | 1 1 0 | 0 92 93 92 92 |
| 0 1 95| 96 94 93 92 |
| 0 0 92| 93 94 92 93 |
| 0 1 92| 93 93 93 93 |
| 0 0 94| 95 95 96 95 |

- binary image
- gray-scale (or gray-tone) image
- color image
- multi-spectral image
- range image
- labeled image

The Three Stages of Computer Vision

- low-level
  - image → image

- mid-level
  - image → features

- high-level
  - features → analysis

Goals of Image Analysis

- Segment the image into useful regions
- Perform measurements on certain areas
- Determine what object(s) are in the scene
- Calculate the precise location(s) of objects
- Visually inspect a manufactured object
- Construct a 3D model of the imaged object
Low-Level

- sharpening
- blurring

Mid-Level

- original image
- edge image
- ORT
- data structure
- circular arcs and line segments

Original color image

K-means clustering (followed by connected component analysis)

regions of homogeneous color

Data structure

Low- to High-Level

- low-level
- edge image
- mid-level
- high-level
- consistent line clusters

Difficulty of Computer Vision

- Computer vision is far from completely solved.
- There have been many successful systems used in real applications.
  
  Like what?

- There are lots of things that humans can do for which vision programs don’t come close to success.

  Can you name some?