Introduction
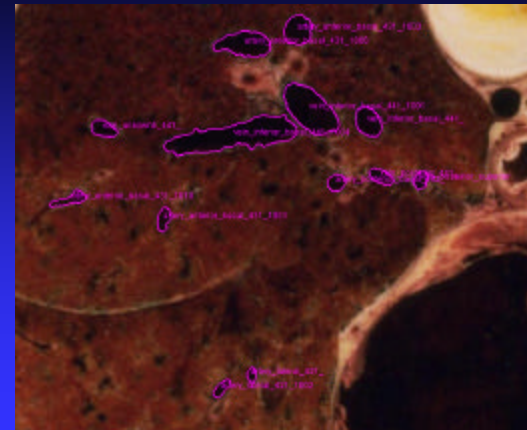
- What IS computer vision?

  the analysis of digital images by a computer

- Where do images come from?

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Applications

- Medical Imaging

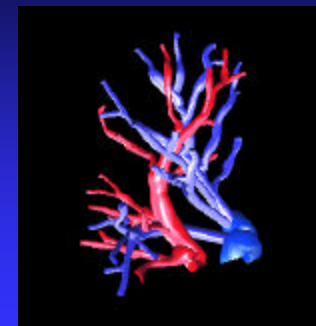CT image of a
patient's abdomen

liver

kidney   kidney
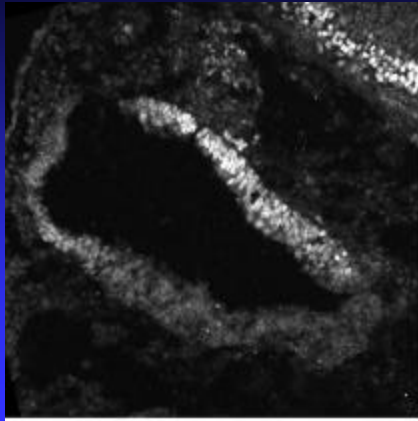
2

Visible Man Slice Through Lung

3

3D Reconstruction of the Blood Vessel Tree

4

Slice of a Chicken Embryo's Inner Ear

Image Databases:

Images from my Ground-Truth collection.

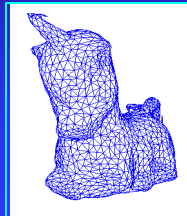What categories of real image databases exist today?

Robotics
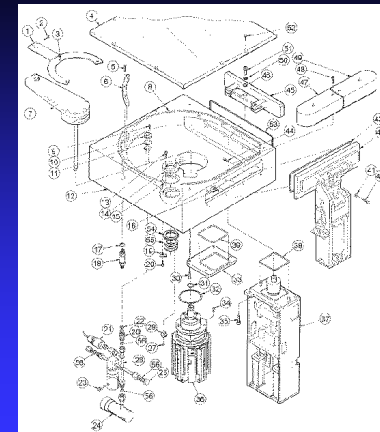
• 2D Gray-tone or Color Images
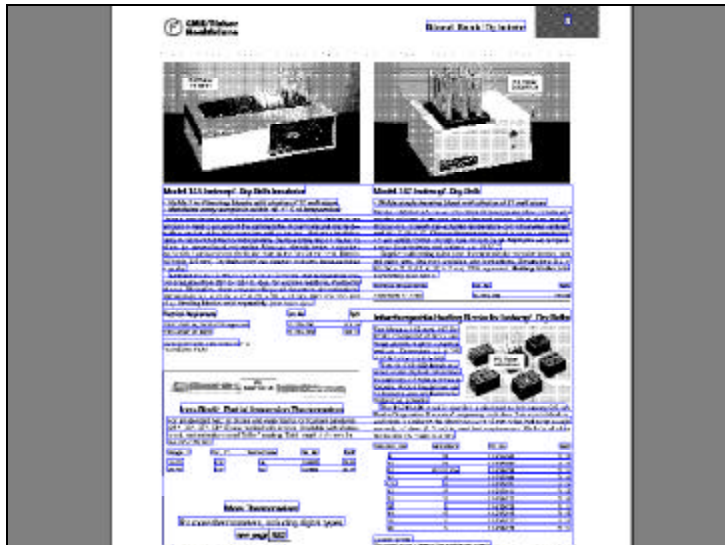

"Mars" rover

• 3D Range Images

What am I?

Documents:

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

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Digital Image Terminology:

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

pixel (with value 94)

its 3x3 neighborhood

region of medium intensity

resolution (7x7)

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

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•The Three Stages of Computer Vision

• low-level

image   ⟶   image

• mid-level

image   ⟶   features

• high-level

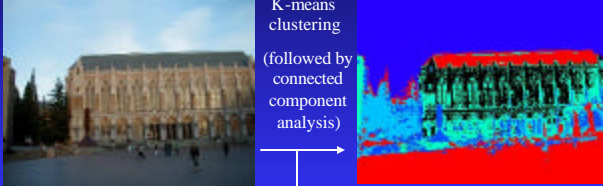features   ⟶   analysis

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Low-Level

sharpening

blurring

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Mid-level

K-means clustering

(followed by connected component analysis)

original color image

regions of homogeneous color

data structure

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Low-Level

Canny

original image

edge image

Mid-Level

ORT

data structure

edge image
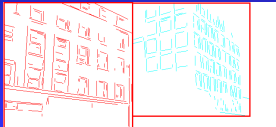
circular arcs and line segments

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Low- to High-Level

low-level → edge image

mid-level

consistent line clusters

high-level

Building Recognition

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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?

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