Bilgisayarla Görü’de İleri Konular

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What is Computer Vision?

- **Trucco and Verri**
  –computing properties of the 3D world from one or more digital images

- **Stockman and Shapiro**
  –To make useful decisions about real physical objects and scenes based on sensed images

- **Ballard and Brown**
  –The construction of explicit, meaningful description of physical objects from images

- **Forsyth and Ponce**
  –Extracting descriptions of the world from pictures or sequences of pictures

Computer Vision vs. Graphics

Is Vision the "Inverse" of Graphics?

- Computer Graphics

–Produce "plausible" images

–You choose the models, conditions, imaging parameters, etc.

- Computer Vision

–Given real images with noise, sampling artifacts …

–Estimate physically quantities

–Ill-posed ----what is the minimum world knowledge we need?

Why study Computer Vision?

- An image is worth 1000 words

- Images and movies are everywhere;
- Fast-growing collection of useful applications
  - building representations of the 3D world from pictures
  - automated surveillance (who's doing what)
  - movie post-processing
  - face finding

- Greater understanding of human vision

- Challenge: To develop human-level capabilities for computers and robots

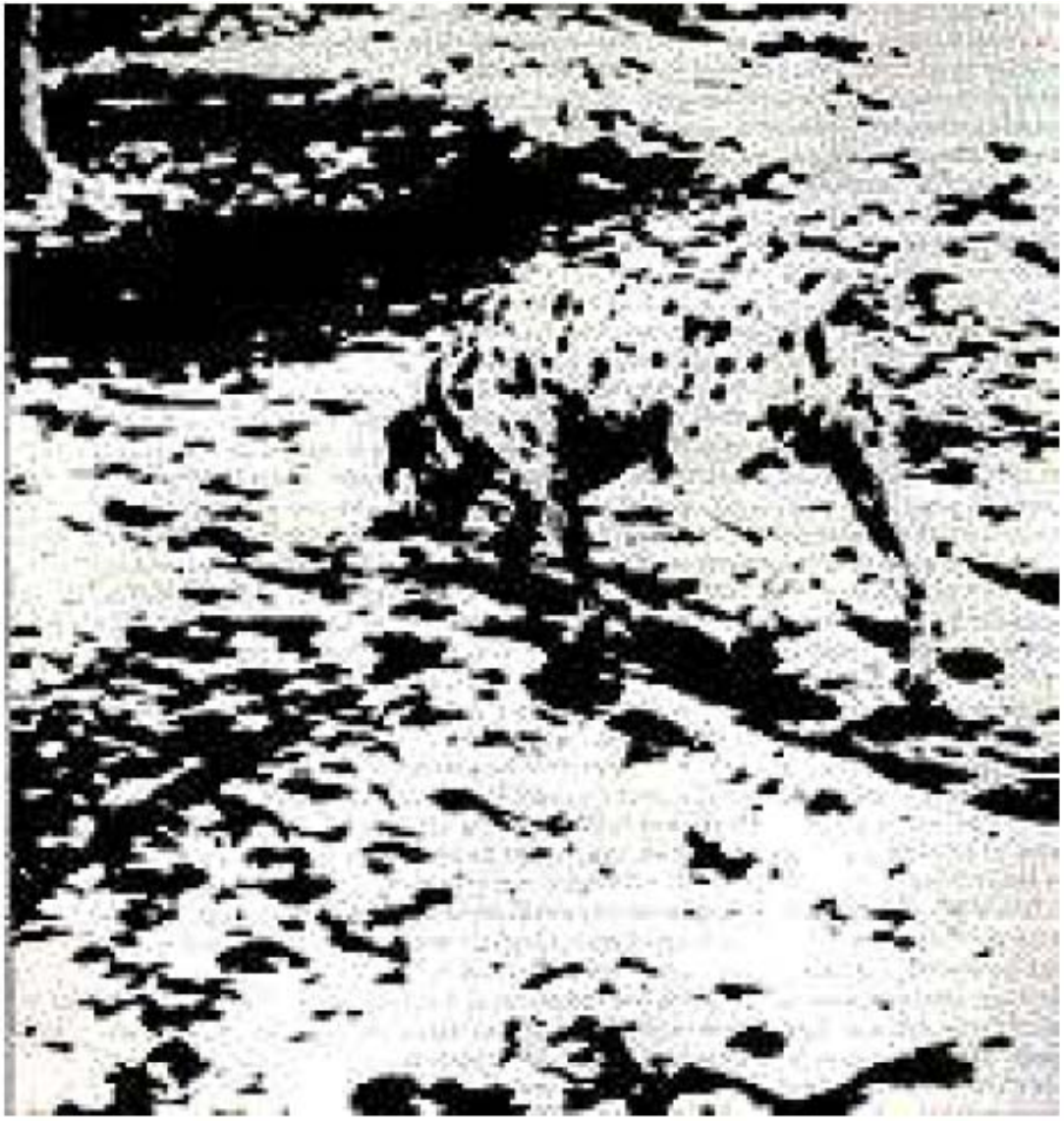
What do you see in the picture?

Black background
Two objects
  One teapot
  One toy
There is a light coming from right
One object is shiny the other is not

Toy:
Consists of 5 layers, in different colors
There is a text : Fisher Price
The layers are in donut shape
Layers are plastic
Bottom is wood

Teapot:
Consists of body and handle
Body is metal
Handle is ceramic
Handle: Dark blue on white
Body : golden
Reflection of toy on the body

Perception and grouping

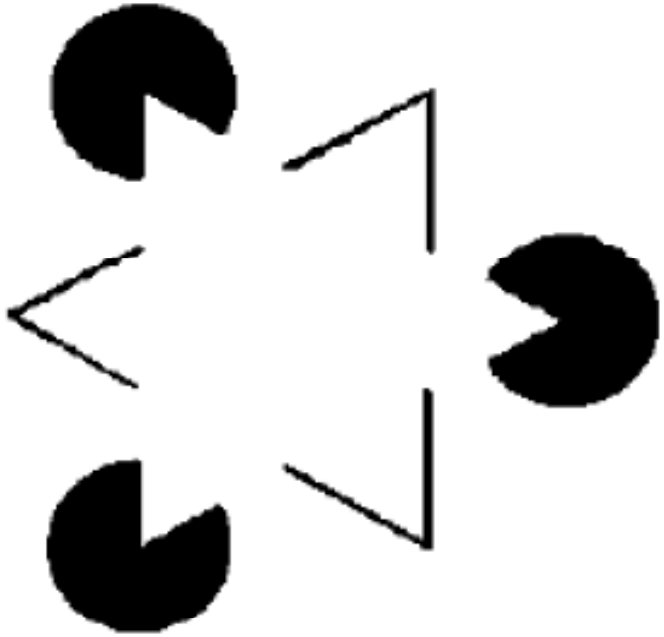


Subjective contours

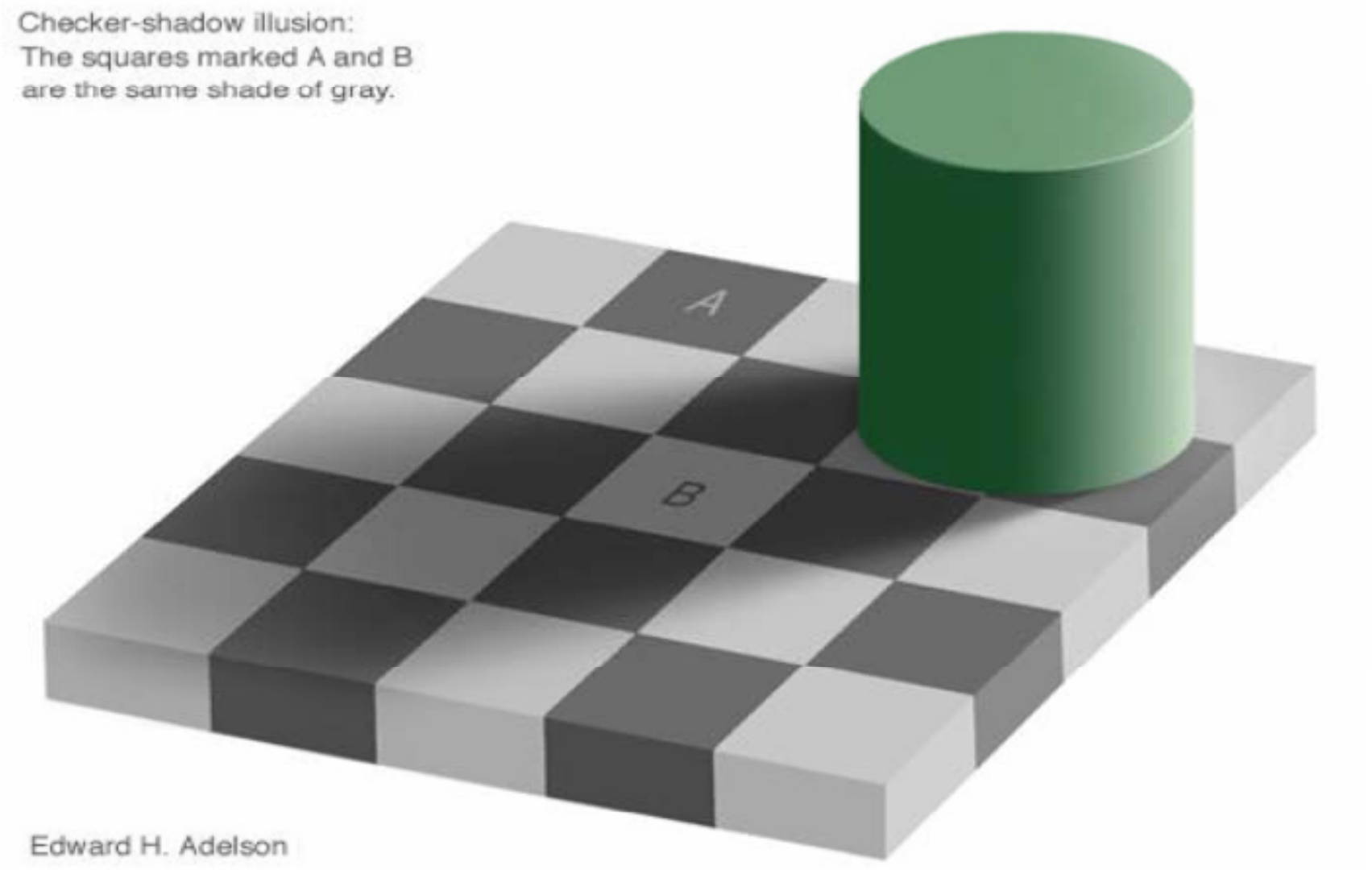
People draw distinctions between what is seen

Subjective contours

Kaniza triangle



Shading

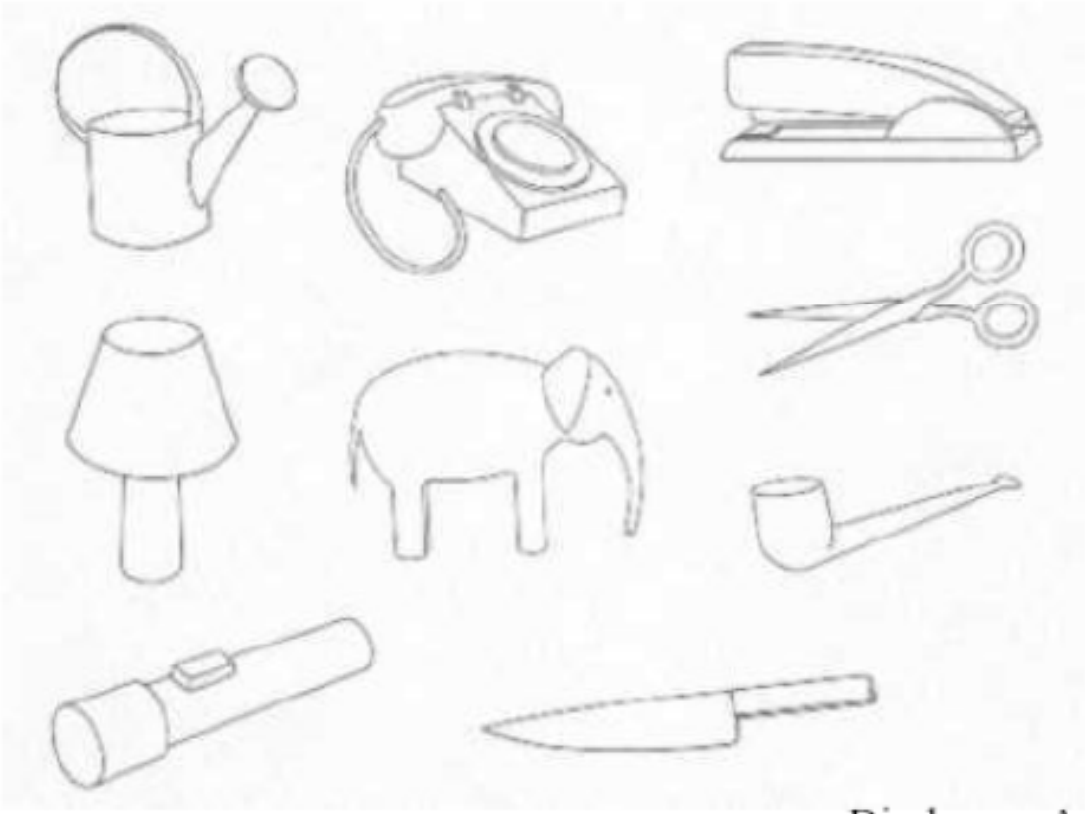

Checker-shadow illusion:
The squares marked A and B
are the same shade of gray.
A
B
Edward H. Adelson

Recognition

We need some sort of perceptual organization process that tells us what "low-level" measurements might "group" together

- Which bits of image should be recognised together?
  - Segmentation.

Recognition

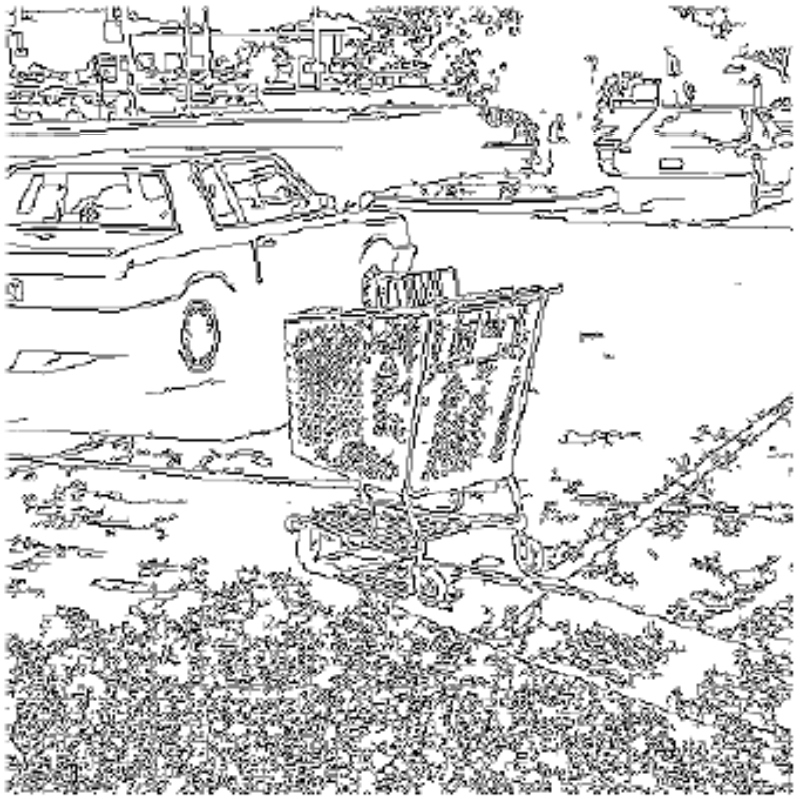


Biederman's Geons

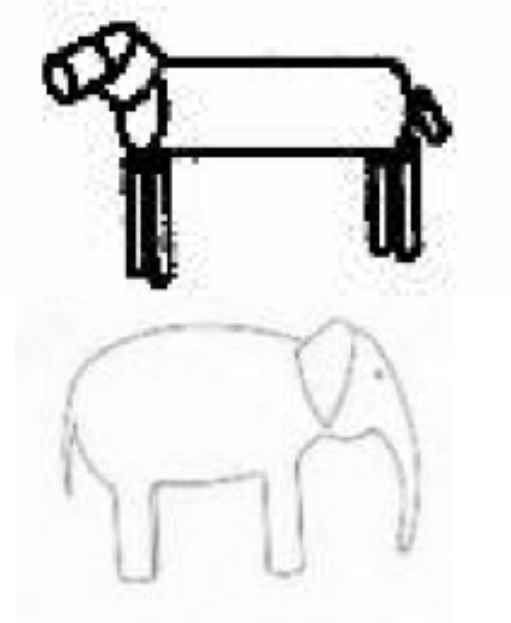
Possible approach: If line drawings are easy to recognize then maybe we should first find lines.

Recognition

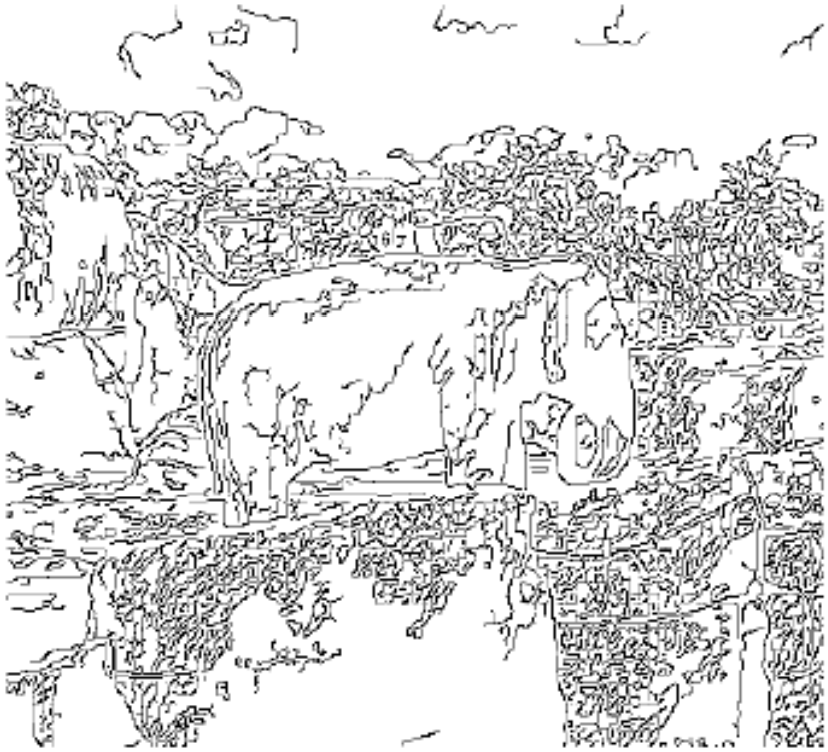
Edge detection - parameters



Recognition



Match “model” to measurements?



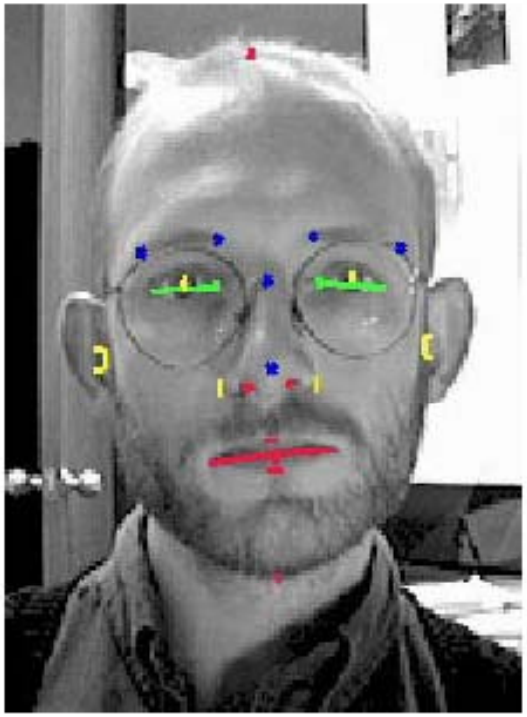
Matching templates

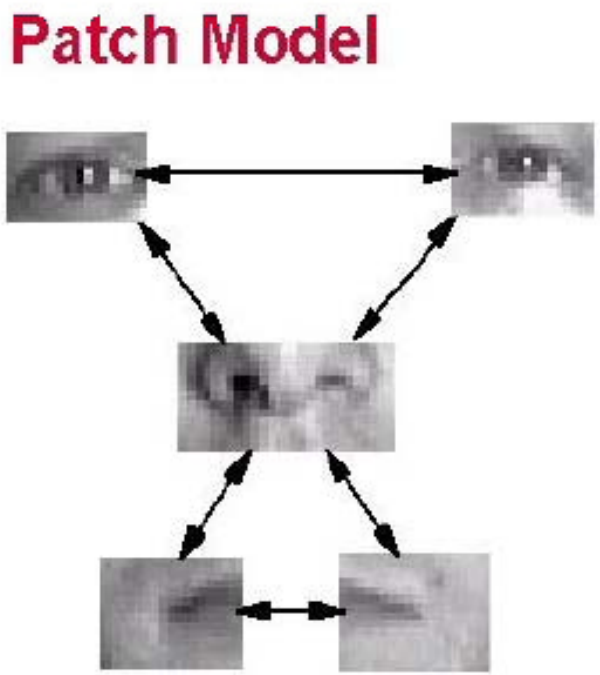
- Some objects are 2D patterns
  - e.g. faces

- Build an explicit pattern matcher
  - discount changes in illumination by using a parametric model
  - changes in background are hard
  - changes in pose are hard

Templates and relations

e.g. find faces by
– finding eyes, nose, mouth
– finding assembly of the three that has the "right" relations





http://www.research.ibm.com/ecvg/biom/facereco.html

Is it only about matching?

What are our "models"?

How good are they?

Problems

Inverse problems. Recover information that is lost. Make explicit information that is implicit.

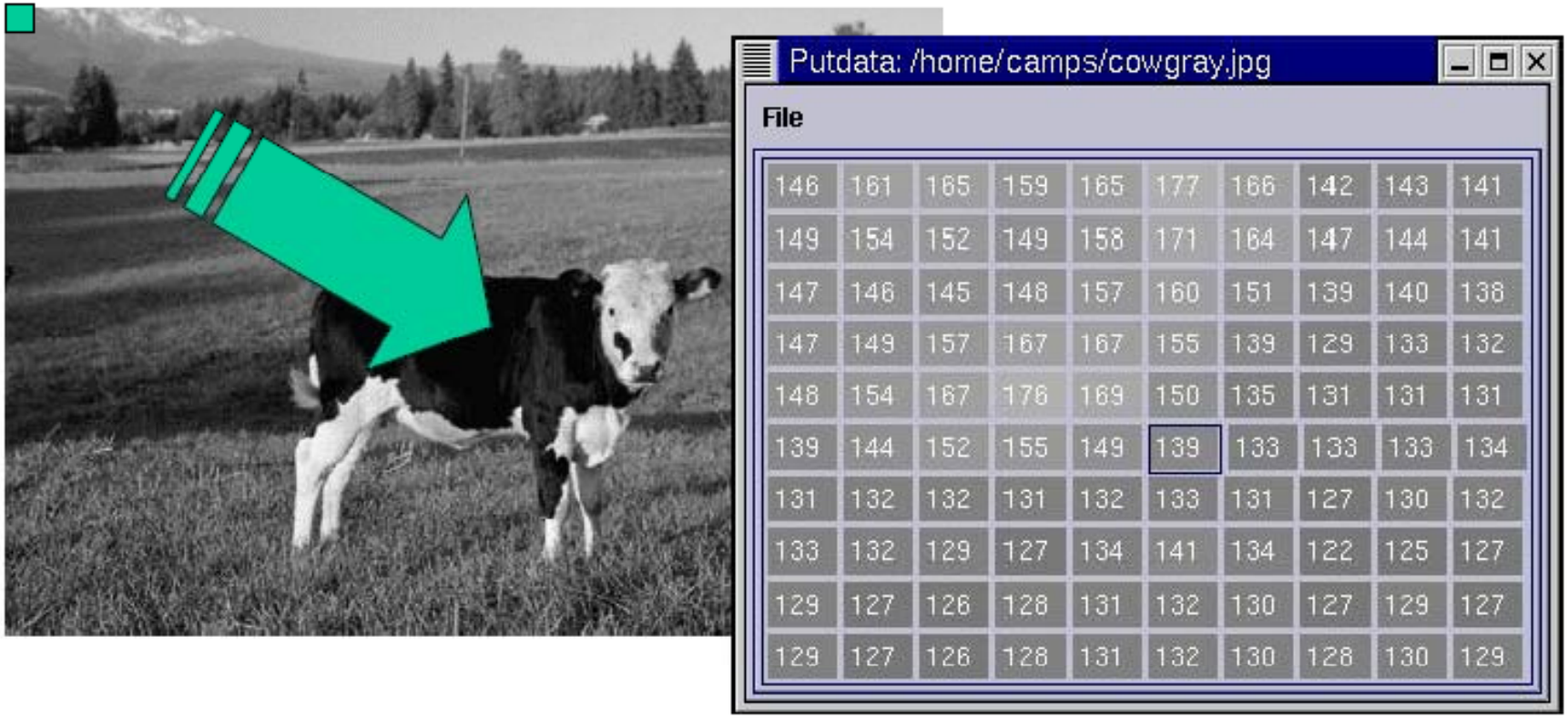
Understand geometry and physics of light and world.

Our measurements are always ambiguous. This means perception involves *inference*. We must use our prior information about the world and the combination of evidence from multiple cues to infer what is in the world.

Understand probabilistic inference.

Image Representation

- Digital Images are 2D arrays (matrices) of numbers
- Each pixel is a measure of the brightness (intensity of light)
  - that falls on an area of a sensor (typically a CCD chip)



Representation of Image Properties

What are the "informative" areas of an image and how do we detect them?

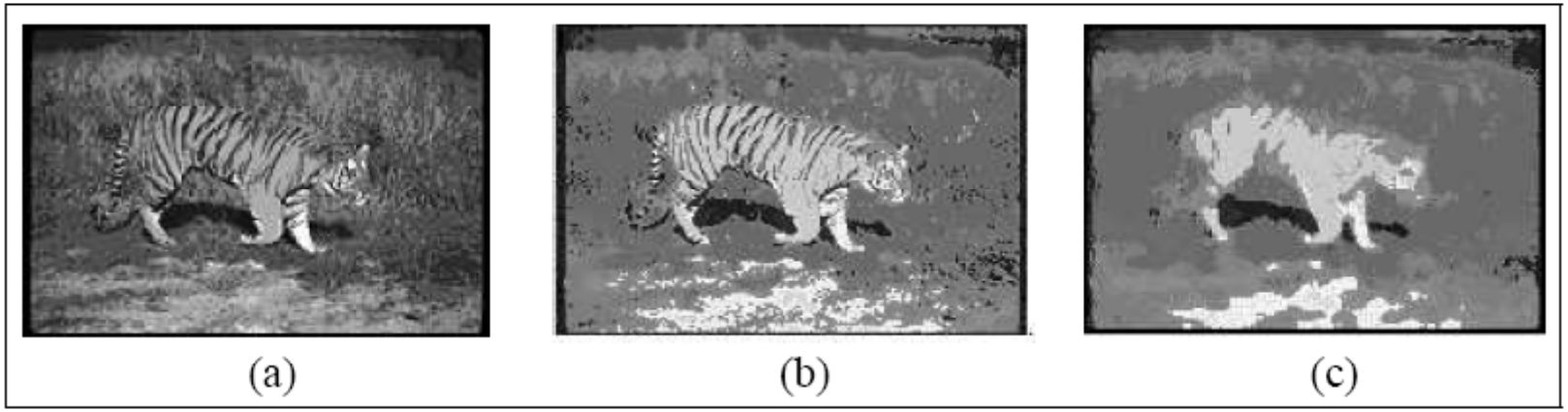


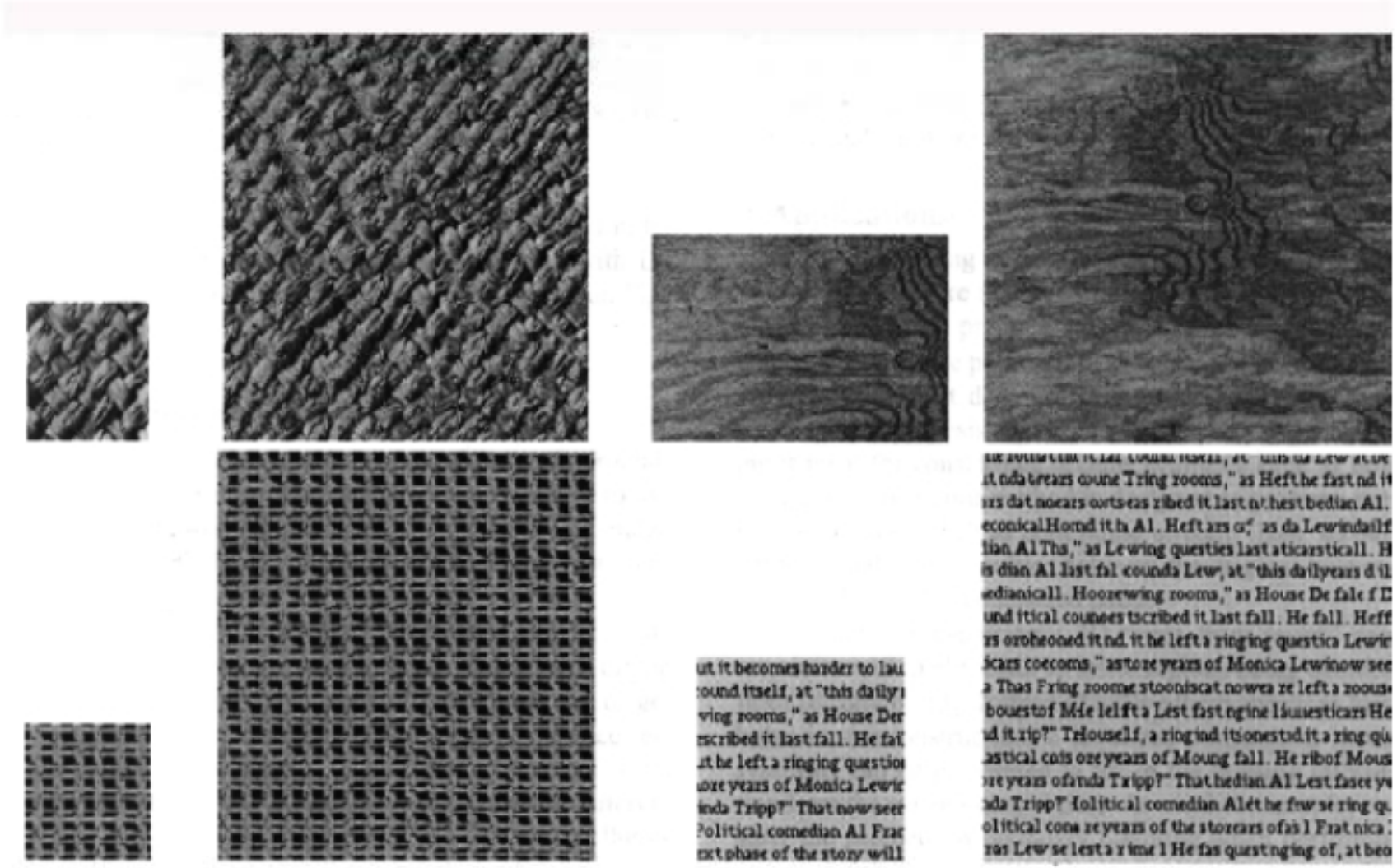
Figure 4.1: Transformation, quantization and color median filtering of an image. (a) Original image. (b) Image produced by applying RGB to HSV color transformation and quantization. (c) Image produced after applying color median filtering.

Texture

Statistics of filter outputs

- Issues
  - description
  - segmentation
  - shape from texture
  - synthesis

Texture synthesis

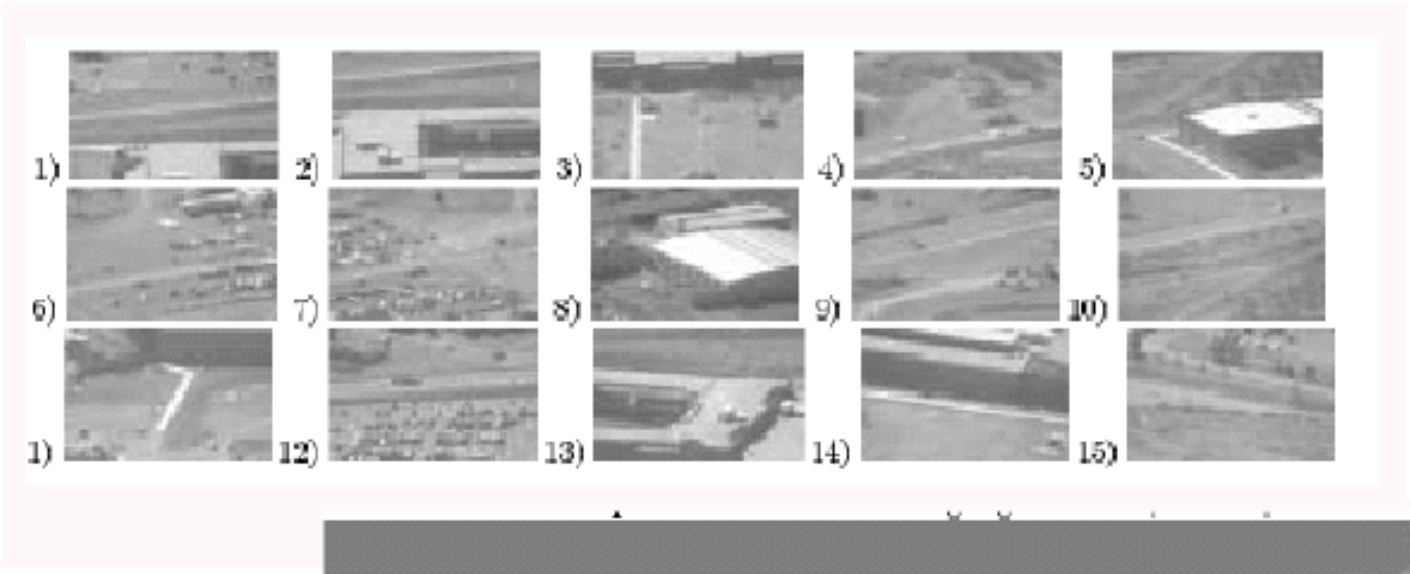


Segmentation

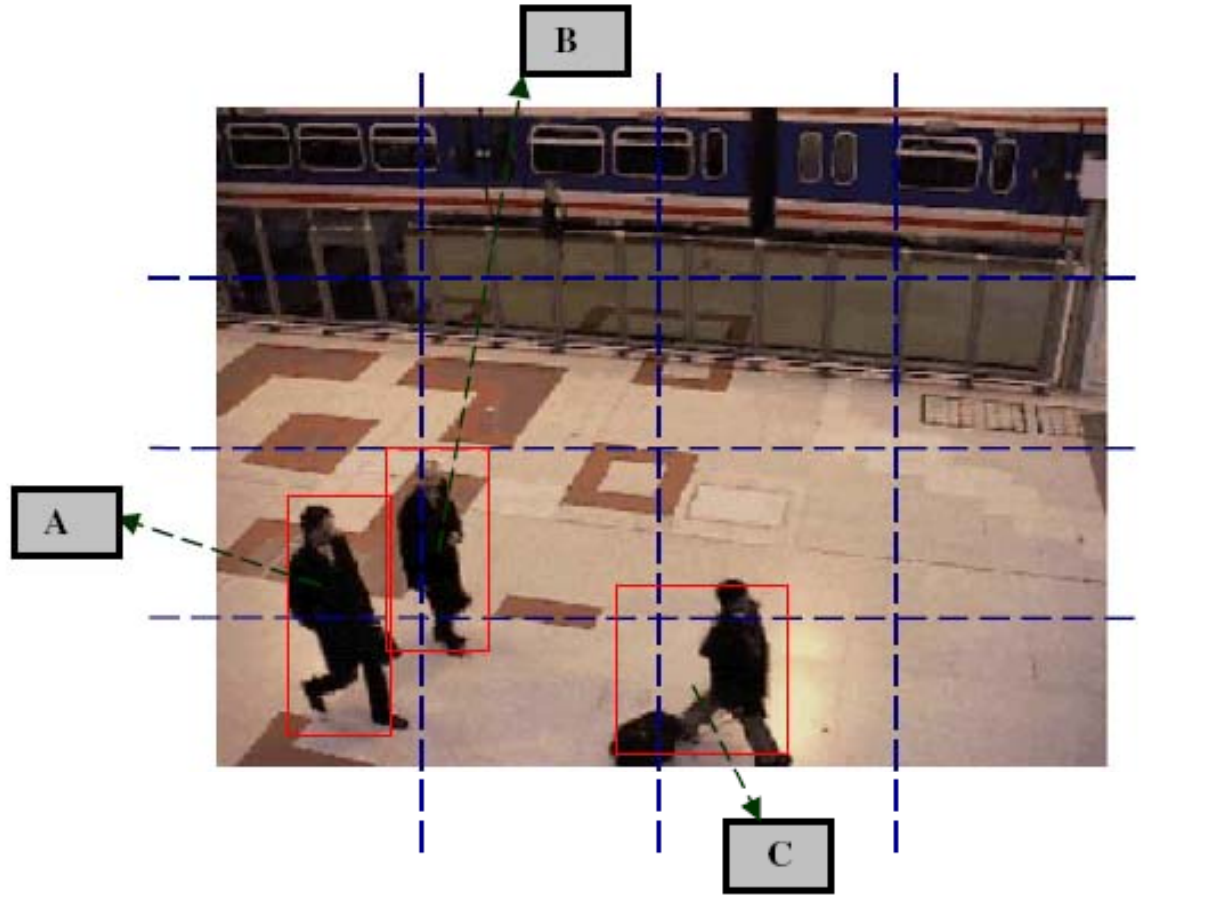
- Which image components “belong together”?
- Belong together = lie on the same object
- Cues
  - similar colour
  - similar texture

Mosaicking

Mosaicking

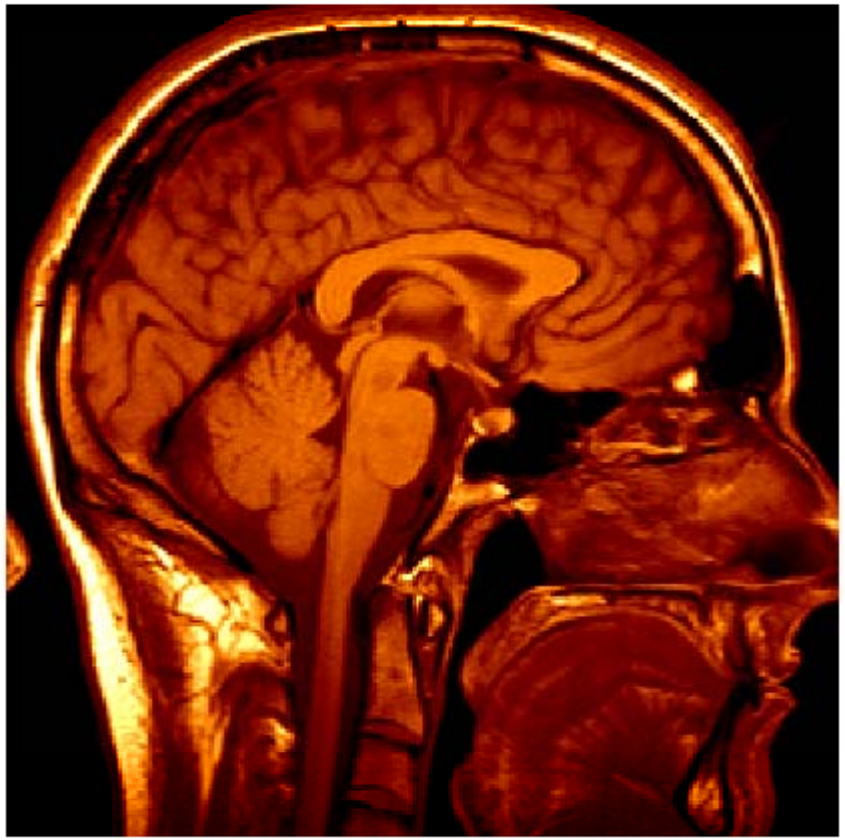


Tracking

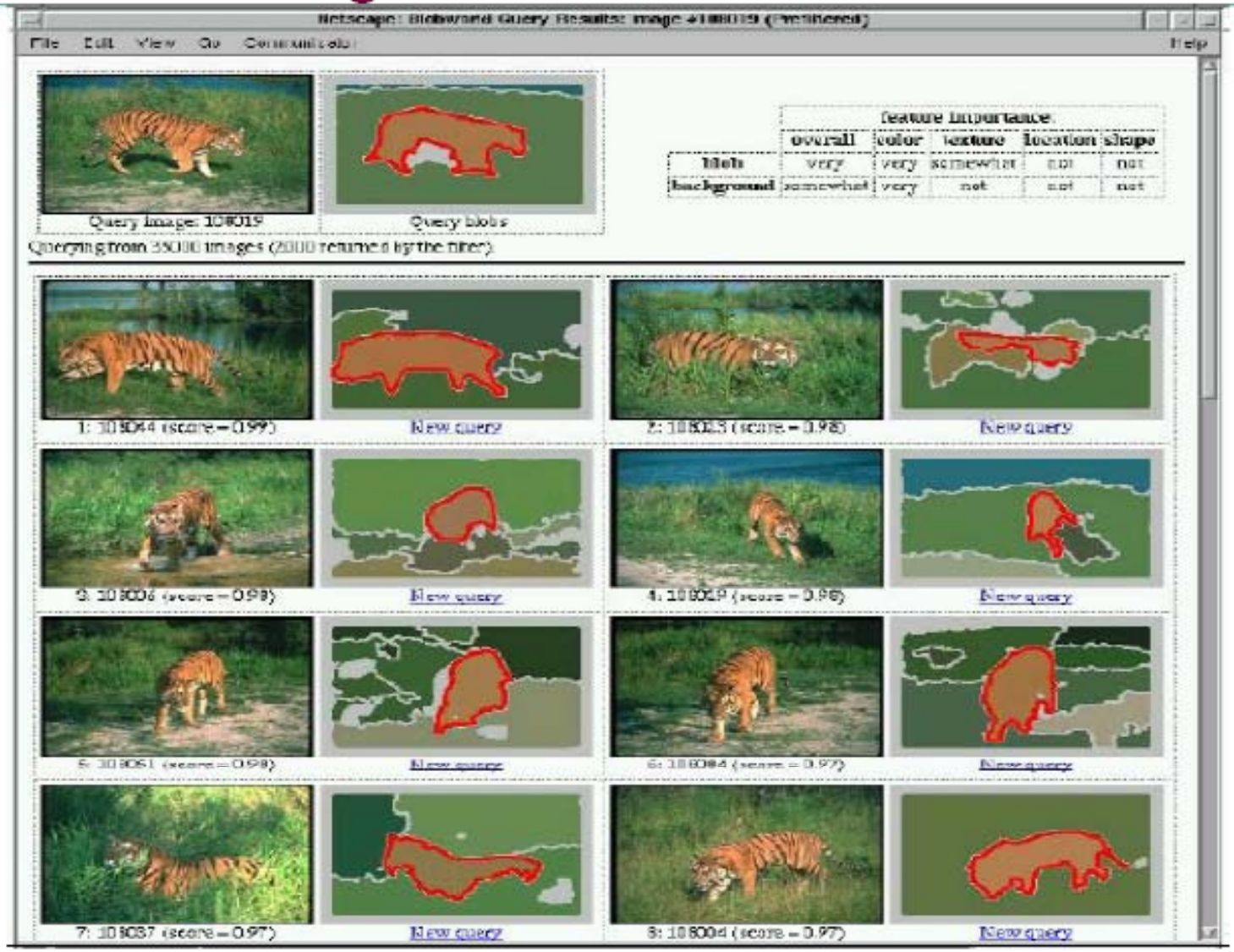

B
A
C
Raw Video Data
Moving Regions
Classified Objects
Annotated Actions
Conceptual Predicates

Applications

- Industrial inspection, quality control
- Surveillance and security
- Assisted living
- Human-computer interfaces
- Medical image analysis
- Reverse engineering
- Image databases



Applications : Image Retrieval

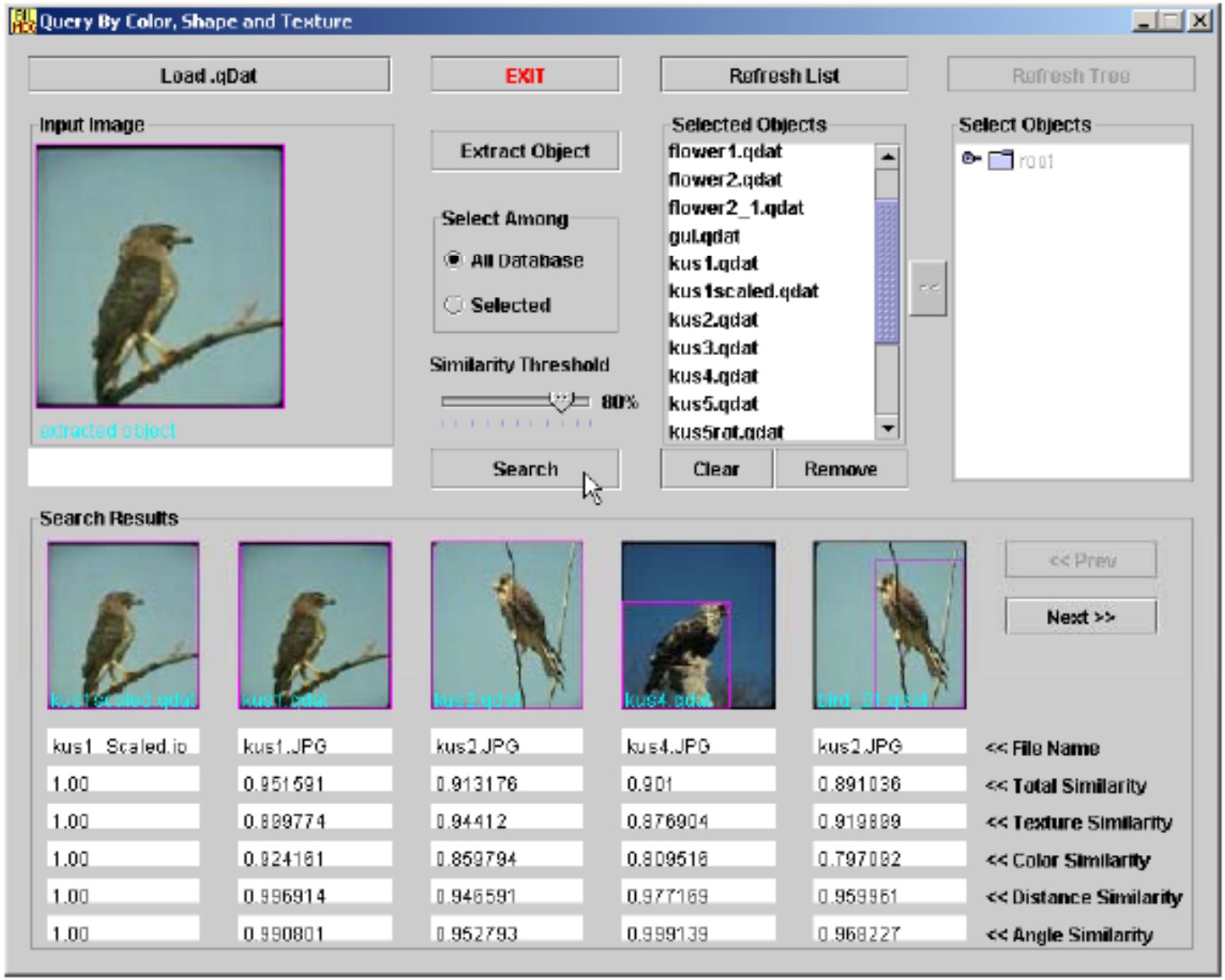


Journal Publications (SCI and SCI-Expanded):

1. E. Saykol, M. Baştan, U. Gudukbay, O. Ulusoy, **A Keyframe Labeling Technique for Surveillance Event Classification**, Optical Engineering, Vol. 49, No. 11, Article no. 117203, 12 pages, November 2010.
2. E. Saykol, U. Gudukbay, O. Ulusoy, **Scenario-Based Query Processing for Video Surveillance Archives**, Engineering Applications of Artificial Intelligence, Vol. 23, No. 3, pp. 331-345, April 2010.
3. E. Saykol, U. Gudukbay, O. Ulusoy, **A Histogram-Based Approach for Object-Based Query-by-Shape-and-Color in Image and Video Databases**, Image and Vision Computing, Vol. 23, No. 13, pp. 1170-1180, November 2005.
4. M.E. Donderler, E. Saykol, U. Arslan, O. Ulusoy, U. Gudukbay, **BilVideo: Design and Implementation of a Video Database Management System**, Multimedia Tools and Applications, Vol. 27, pp. 79-104, September 2005.
5. E. Saykol, A.K. Sinop, U. Gudukbay, O. Ulusoy, E. Cetin. **Content-Based Retrieval of Historical Ottoman Documents Stored as Textual Images**, IEEE Transactions on Image Processing, Vol.13, No. 3, pp. 314-325, March 2004.
6. M.E. Donderler, E. Saykol, O. Ulusoy, U. Gudukbay, **BilVideo: A Video Database Management System**, IEEE Multimedia, Vol. 10, No. 1, pp. 66-70, January/March 2003.

Conference Publications (Proceedings):

5. I.S. Altingovde, E. Saykol, O. Ulusoy, U. Gudukbay, A.E. Cetin, M. Gocmen, **Content-Based Retrieval System for Ottoman Archives**, In SIU 2006, IEEE Sinyal Isleme ve Uygulamalari Kurultayı, Antalya, Turkey, April 2006.
6. E. Saykol, U. Gudukbay, O. Ulusoy, **A Database Model for Querying Visual Surveillance by Integrating Semantic and Low-Level Features**, in Lecture Notes in Computer Science (LNCS), (*Proc. of 11th International Workshop on Multimedia Information Systems (MIS'05)*), Vol. 3665, pp. 163-176, Edited by K. S. Candan and A. Celentano, Sorrento, Italy, September 2005.
8. E. Saykol, U. Gudukbay, O. Ulusoy, **Integrated Querying of Images by Color, Shape, and Texture Content of Salient Objects**, in Lecture Notes in Computer Science (LNCS), Vol. 3261, *Proc. of Advances in Information Sciences (ADVIS'2004)*, Edited by T. Yakhno, pp. 363-371, Springer-Verlag, October 2004.
10. U. Arslan, M.E. Donderler, E. Saykol, O Ulusoy, U. Gudukbay, **A Semi-Automatic Semantic Annotation Tool for Video Databases**, In SOFSEM 2002, Workshop on Multimedia Semantics, Milovy, Czech Republic, November 2002.
11. E. Saykol, G. Gulesir, U. Gudukbay, O. Ulusoy, **KiMPA: A Kinematics-Based Method for Polygon Approximation**, Lecture Notes in Computer Science (LNCS), Vol. 2457, *Proc. of Advances in Information Sciences (ADVIS'2002)*, Edited by T. Yakhno, pp. 186-194, Springer-Verlag, October 2002.
12. E. Saykol, U. Gudukbay, O. Ulusoy, **A Semi-automatic Object Extraction Tool for Querying in Multimedia Databases**, In Proceedings of 7th Workshop on Multimedia Information Systems MIS'01, Capri, Italy, pp. 11-20, November 2001.



E. Saykol, U. Gudukbay, O. Ulusoy, **Integrated Querying of Images by Color, Shape, and Texture Content of Salient Objects**, in Lecture Notes in Computer Science (LNCS), Vol. 3261, *Proc. of Advances in Information Sciences (ADVIS'2004)*, Edited by T. Yakhno, pp. 363-371, Springer-Verlag, October 2004.