Bilgisayarla Görü 
- Image Processing -

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Elements of Image

- Light reaches surfaces in 3D.
- Surfaces reflect.
- Sensor element receives light energy.
- Intensity is important.
- Angles are important.
- Material is important.
**FIGURE 2.15** An example of the digital image acquisition process. (a) Energy ("illumination") source. (b) An element of a scene. (c) Imaging system. (d) Projection of the scene onto the image plane. (e) Digitized image.
Sampling and Quantization
We can think of an image as a function, $f$, from $\mathbb{R}^2$ to $\mathbb{R}$:

- $f(x, y)$ gives the intensity at position $(x, y)$
  - Realistically, we expect the image only to be defined over a rectangle, with a finite range:
    - $f: [a,b] \times [c,d] \rightarrow [0,1]$

A color image is just three functions pasted together. We can write this as a “vector-valued” function:

$$f(x, y) = [r(x, y), g(x, y), b(x, y)]$$

### Table

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To Extract Blobs

What are “blobs”?
- Regions of an image that are somehow coherent

Why?
- Object extraction, object removal, compositing, etc.
- …but are “blobs” objects?
- No, not in general

Simplest way to define blob coherence is as similarity in brightness or color:
Thresholding (Eşikleme)

Basic segmentation operation:

\[ \text{mask}(x,y) = 1 \text{ if } \text{im}(x,y) > T \]
\[ \text{mask}(x,y) = 0 \text{ if } \text{im}(x,y) < T \]

T is threshold
  - User-defined
  - Or automatic

Same as histogram partitioning:
Threshold to Detect Edges
Need Adaptive Thresholding

FIGURE 10.30
(a) Original image. (b) Result of global thresholding. (c) Image subdivided into individual subimages. (d) Result of adaptive thresholding.
Region Growing

- Start with initial set of pixels $K$
- Add to $K$ any neighbors, if they are within similarity threshold
- Repeat until nothing changes

Also called “seed points”

K pixels having value 255
Threshold between 225-255

Threshold between 195-255

Noise or variation of intensity may result in holes or over-segmentation

Shading??
Mean-Shift Algorithm

At the high level, we can specify **Mean Shift** as follows:

1. Fix a window/circle around each pixel.
2. Compute the mean within the window/circle.
3. Shift the window/circle to the mean and repeat till convergence (stop when pixel = mean).
Segmentation ??

• Blob extraction
  – Thresholding
  – Adaptive Thresholding
  – Region Growing
  – Mean-Shift
  – ...

• Problem is OBJECT is not equal to BLOB !!!