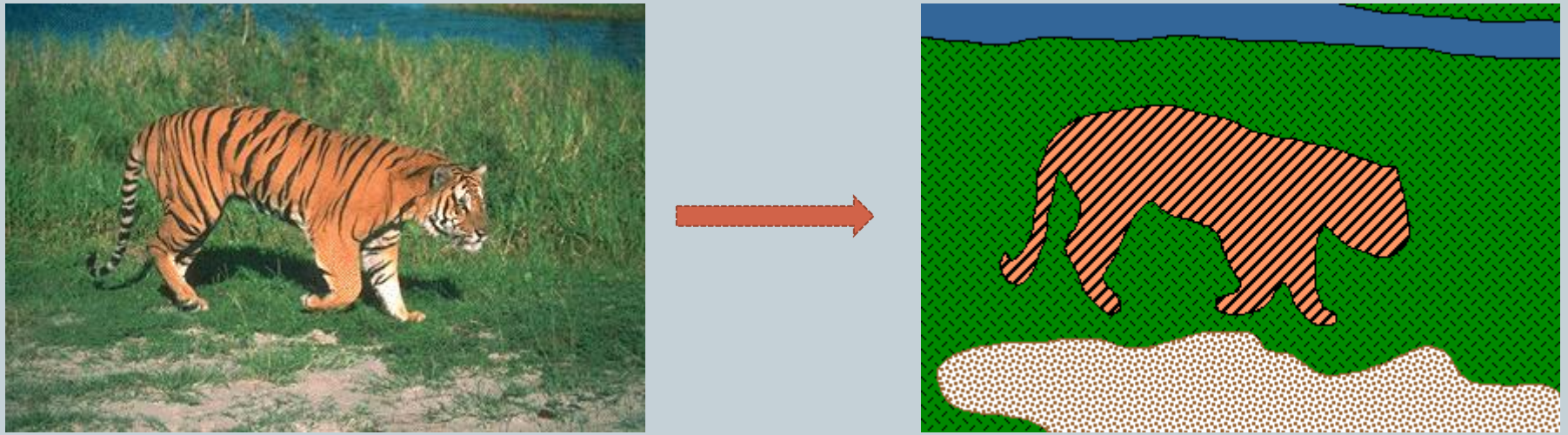
ELEC 474 – Machine Vision

SEGMENTATION



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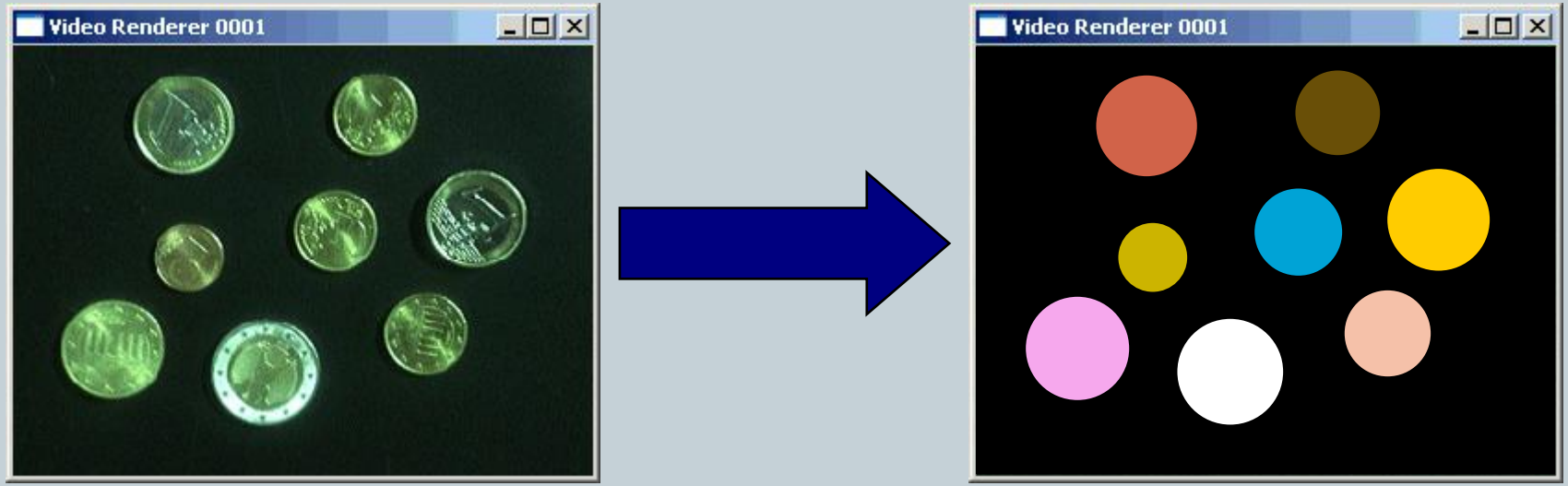
Segmentation

- Segmentation subdivides an image to regions or objects
- Typically the first step in any automated computer vision application



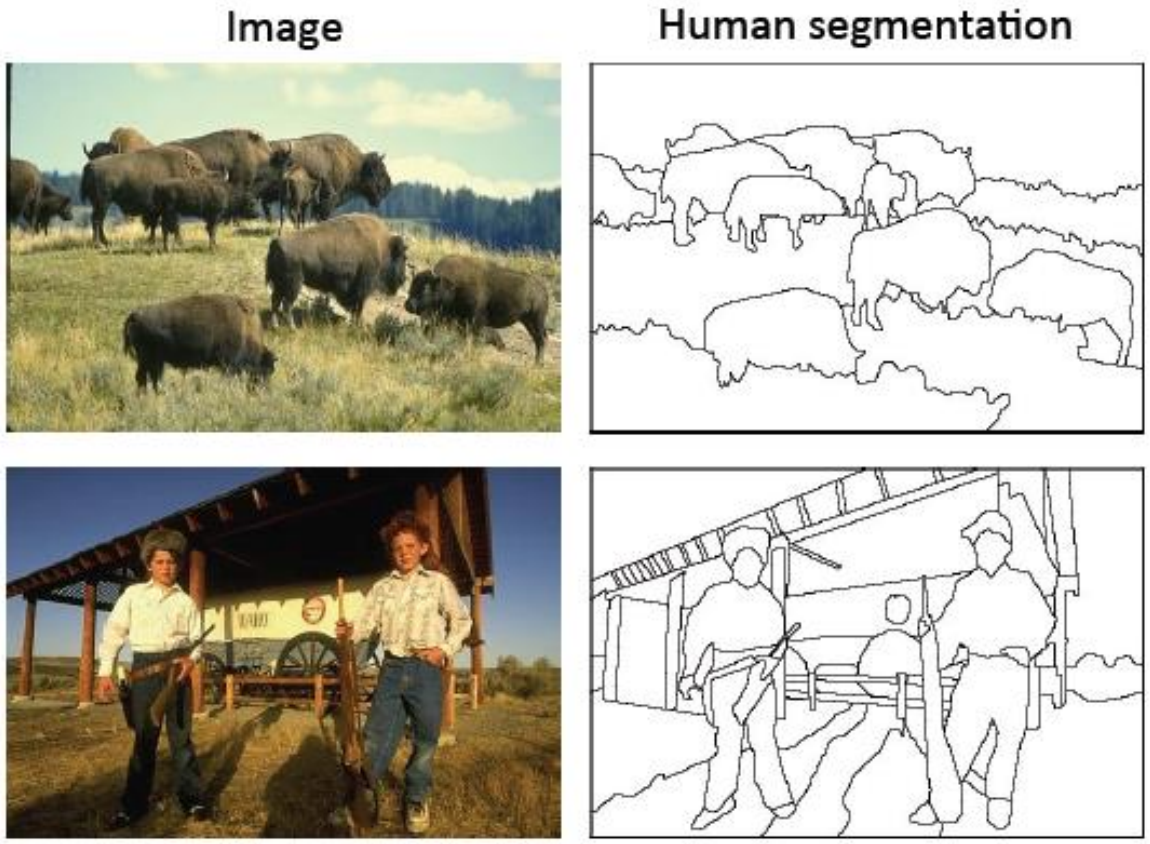
The Goal of Segmentation

https://www.intechopen.com/books/colorimetry-and-image-processing/image-segmentation-based-on-mathematical-morphological-operator

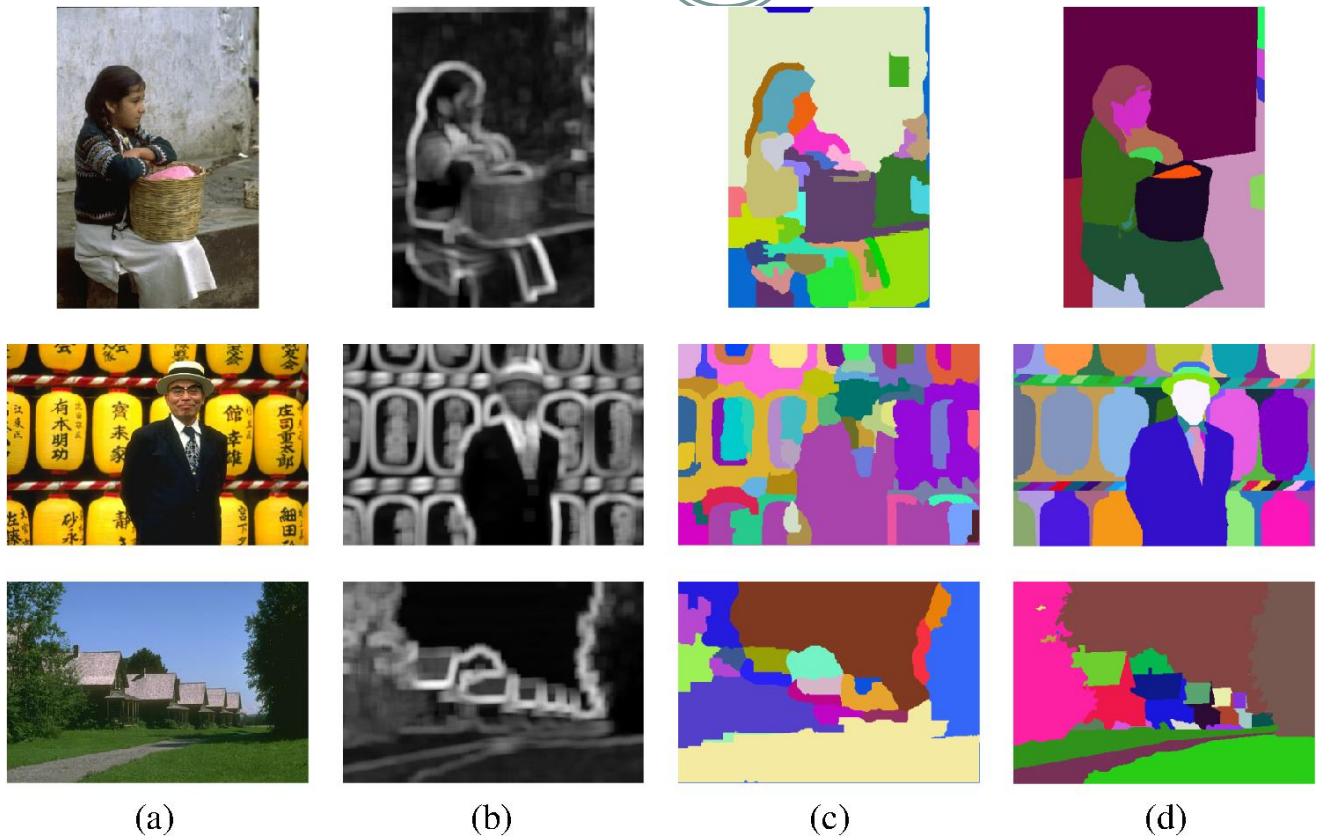
Figure 2.
An example for natural scene image segmentation (a) Original Image, (b) Grayscale Image, (c) Labeling Image for Homogeneous Regions.

The Goal of Segmentation

- Separate image into coherent “objects”



The Goal of Segmentation



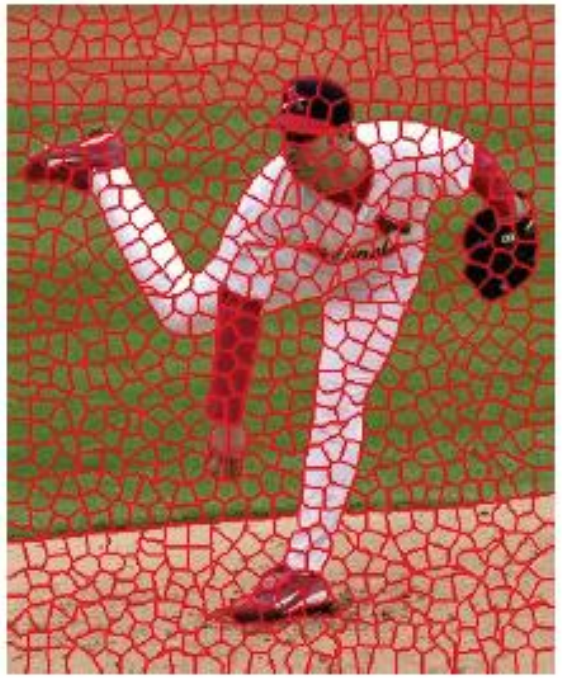
Example results: the input image (a), the SD image (b), the segmentation of the SD image using ISM (c), and a human-made reference segmentation (d)

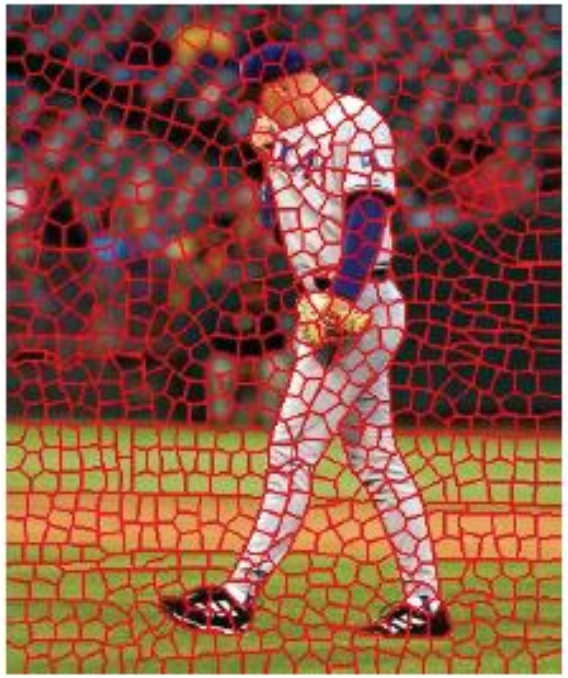
Fernando E. Correa-Tome, Raul E. Sanchez-Yanez "Integral split-and-merge methodology for real-time image segmentation", SPIE Digital Library, 7 January 2015

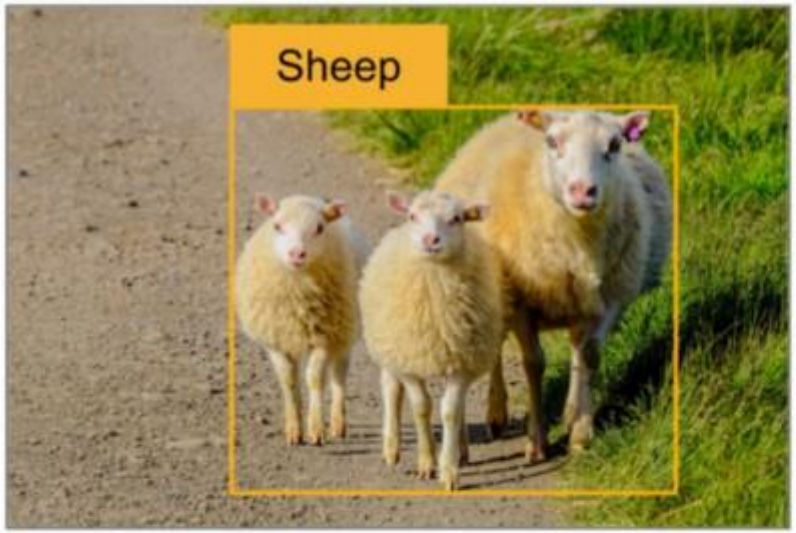
The Goal of Segmentation

- Separate image into coherent “objects”
- Group together similar-looking pixels for efficiency of further processing

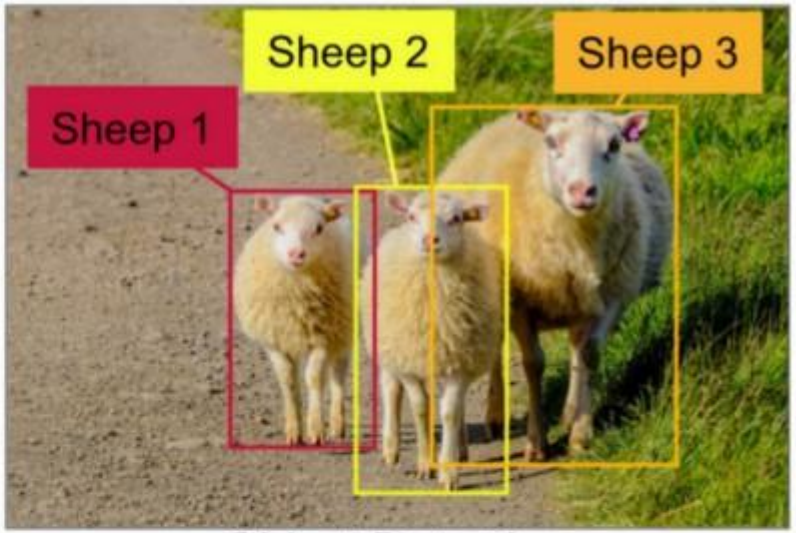
“superpixels”



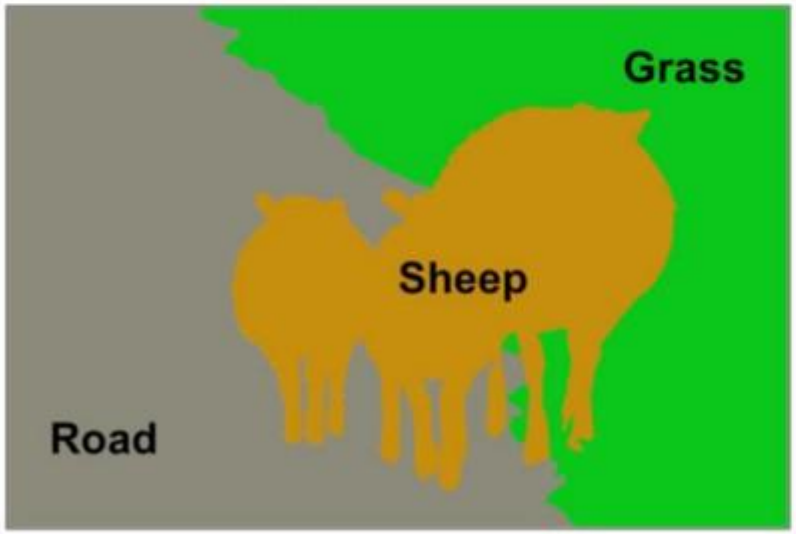




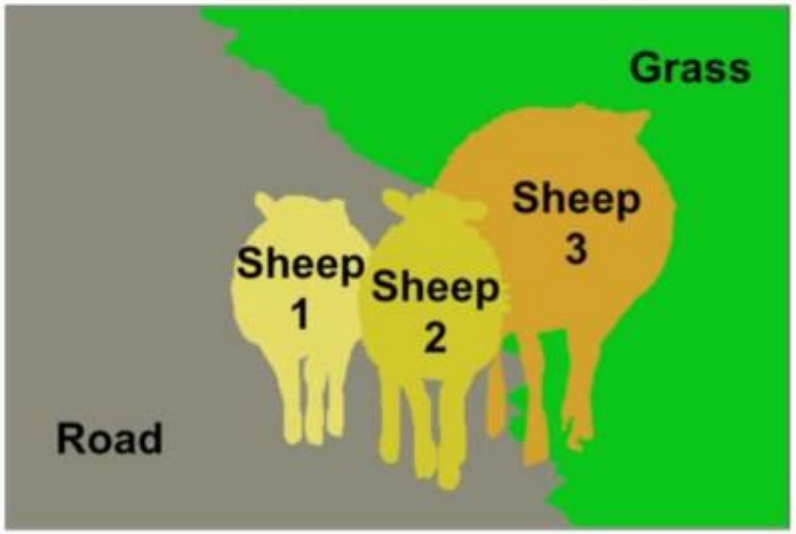
Classification + Localization



Object Detection



Semantic Segmentation



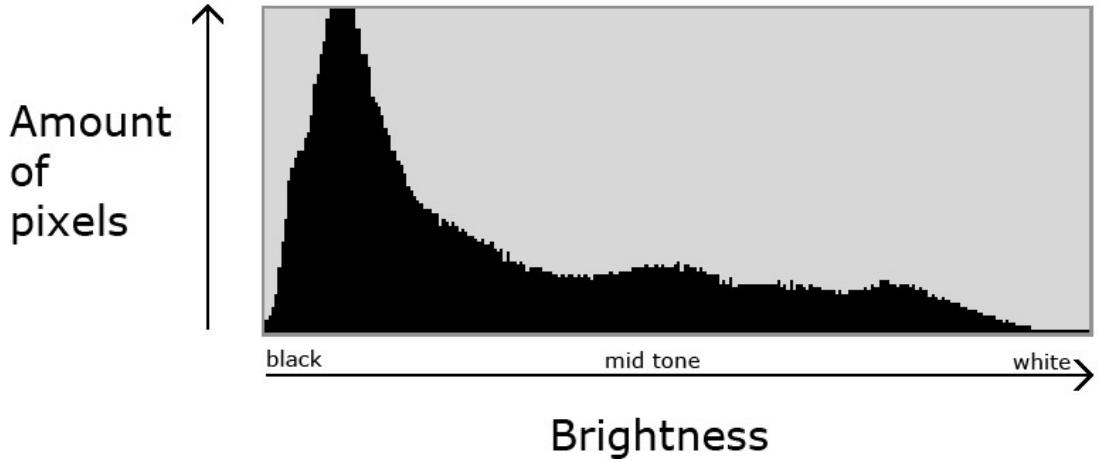
Instance Segmentation

Contents

- Introduction
- Histogram Thresholding
- Region-Based Segmentation
  - Region growing
  - Region splitting and merging
- K-Means Clustering

Histogram

- Histogram is the simplest form of processing
- It is based on
  - Pixels values
  - Independent of spatial distribution & neighbourhood
- A histogram is a discrete function:



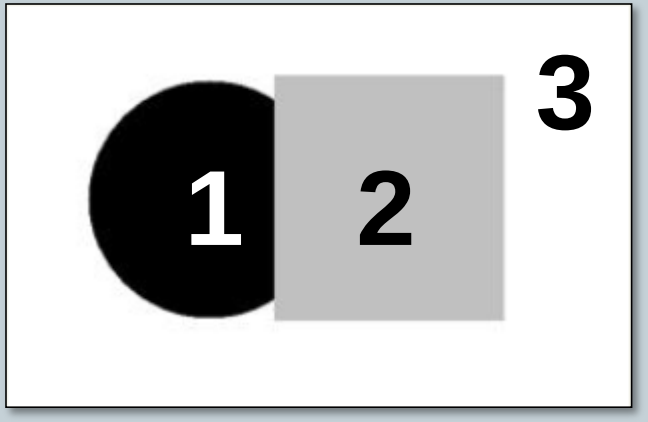
$$h[i_k] = n_k, \quad k = 0 \ldots L-1$$

where i_k is the k^{th} intensity value (e.g. $L = 256$),
and n_k is the number of pixels with intensity value i_k.

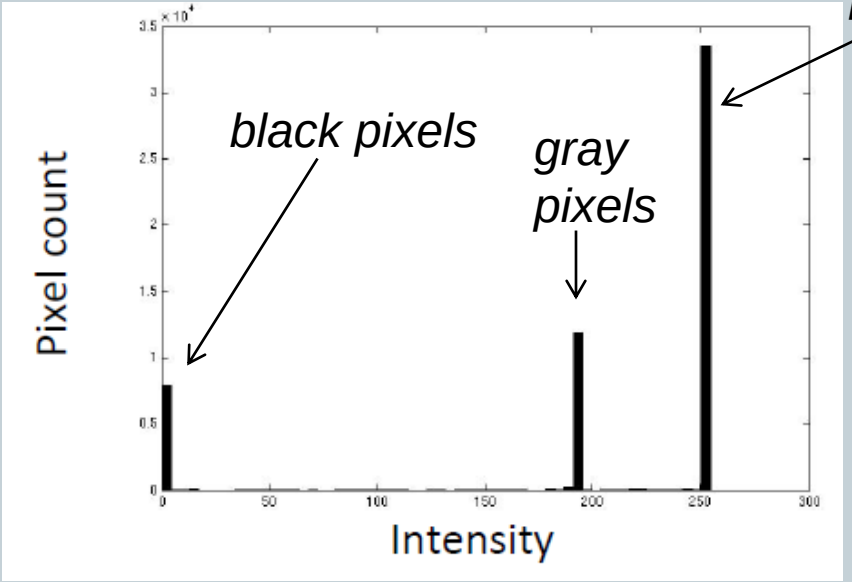
- Histograms are normalized as: $h[i_k] = \frac{n_k}{N}, \quad N = \sum_{j=1}^{K} n_j$

Segmentation by Histogram

- How can we segment this image?
  - Based on the intensity value of the pixel
- How many groups can this image be segmented into?

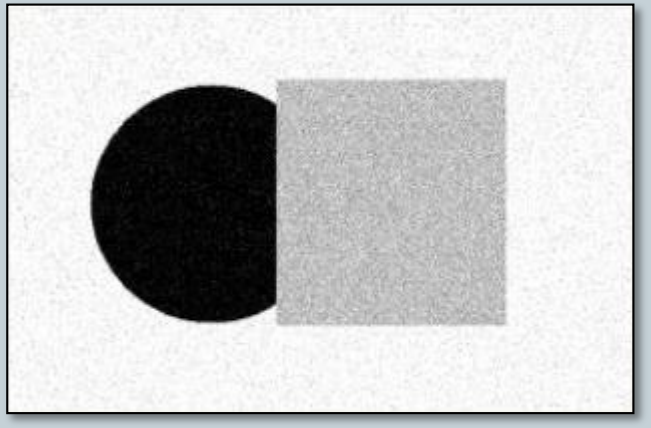


Input Image

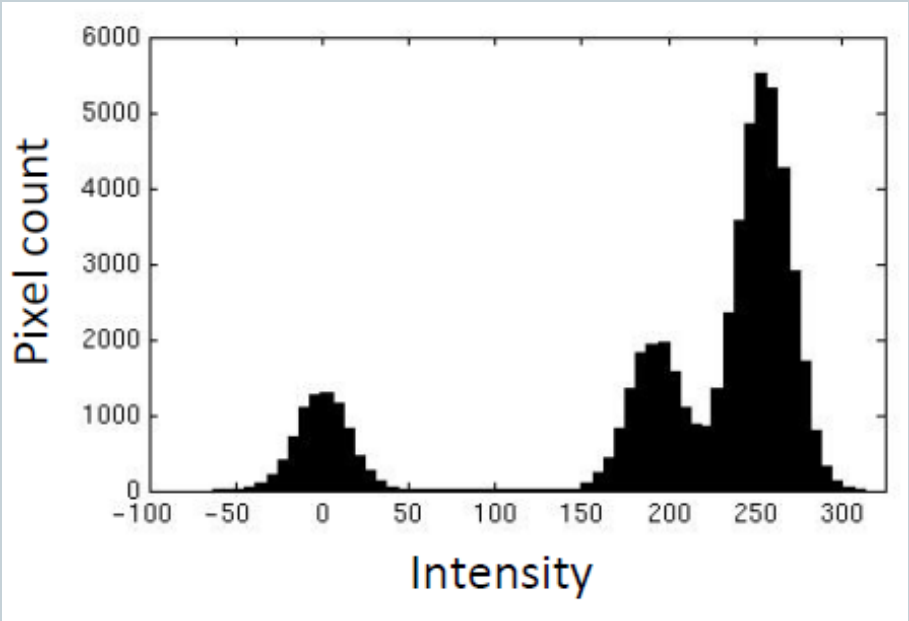


Segmentation by Histogram

- What if we had something that looked like this instead?



Input image



Segmentation by Histogram Thresholding