Presentation #3

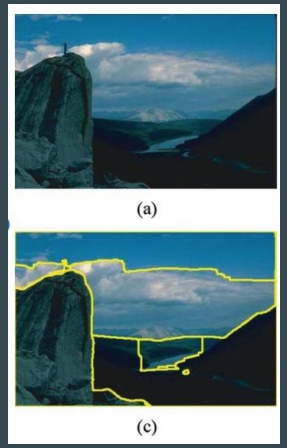
...

Video Collection

- Collected 220 images
  - 14 cities (Milan, Minneapolis, Montevideo, Montreal, Moscow, Mumbai, Nairobi, Nottingham, Oklahoma City, and Osaka)

Videos

- Image Segmentation
  - Creates segments of connected pixels by analyzing:
    - Intensity, Color, Texture, Histogram, Features
  - Grouping Regions
    - Coherent Objects
  - Low Level Features → High Level Inference
    - Forms Semantic Meaning in Image for Objects

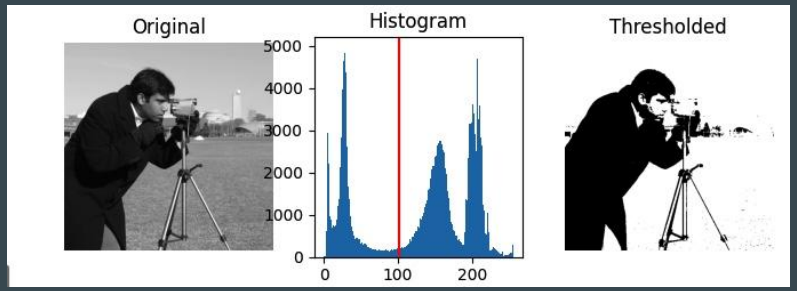


Videos

- Image Segmentation Methods
  - Thresholding
  - Machine Learning Based Methods
  - Energy Minimization Methods
  - Shape Based Methods
  - Graph Based Methods
  - Region Based Methods
  - Clustering
- Thresholding
  - Image Binarization
    - Applies a threshold T for mapping a scalar image I into a binary image
      - Each pixel has two values (background/foreground)
    - Threshold can be identified by creating large connected regions and reducing the small-sized regions known as artifacts
  - Histogram
    - Peak on the left of histogram are dark images (Darker Pixels); Peak on the right of histogram are bright images (brighter pixels)
      - Area where peak is at minimum in between peaks can set threshold value

Videos

- Pixels that are toward the right can be assigned a value of 1; Pixels toward the left can be assigned a value of 0
  - Can be used to find a threshold value between 0 and 1



Videos

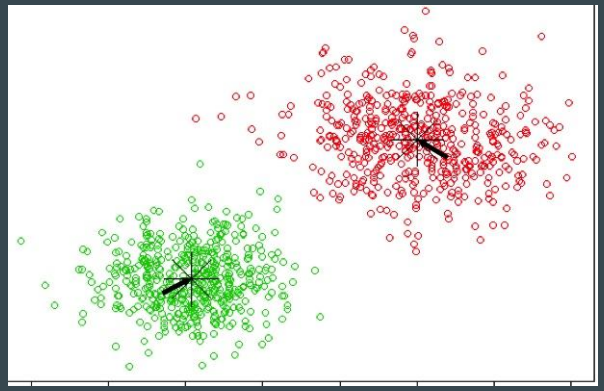
- Thresholding
  - Otsu
    - Uses grey-value histogram of input image and provides the best threshold
    - Otsu's Algorithm
      - Selects a threshold that maximizes the between-class variance: o_b^2
        - $o_b^2 = P_1(\mu_1-\mu)^2 + P_2(\mu_2-\mu)^2 = P_1 P_2(\mu_1-\mu_2)^2$
        - P_1 and P_2 are class probabilities, and μ is/are the means of the object and background classes
- Region Based Segmentation
  - Region
    - Group of connected pixels with similar properties
    - There are closed boundaries in the image
    - Regions are chosen based on similarity
    - Spatial Proximity; Similarity

Videos

- Merging/Region Growing
  - Algorithm
    - Absolute Intensity difference between candidate pixel and seed pixel must be within a particular range
    - Absolute Intensity difference between candidate pixel and running average intensity of growing region must be within a particular range
    - Difference between standard deviation in intensity over a specific local neighborhood of candidate pixel and that over a local neighborhood of the candidate pixel can't exceed a specific threshold
  - Seeded Segmentation
    - Choose the seed pixels; Add them to neighboring pixels to regions similar to the seed; Repeat for the newly added pixels until they can't be further added
- Region Splitting/Region Merging
  - Region Growing → Starts with set of seed points; Region Splitting → Starts with an image input as a single region and devides it into regions recursively
  - Region Merging → Opposite of Region Splitting; Starts with small regions which merge based on similar characteristics

Videos

- Clustering
  - Organizing data in class by
    - High Intra-Class Similarity
    - Low Inter-Class Similarity
  - Subjective
  - Similarity
    - Clustering by Features
  - K-Means
    - Start with Initial Cluster Centers
    - Extract Features from sample
      - Cluster samples to closest center
      - Calculate centers as means of points in cluster
    - Minimizes the loss function
      - Sum of squared distances from each point to the cluster center(s)



Videos

- Initializing Cluster Centers
  - Write a fixed number of iterations
  - Cluster Centers don’t change
- Mean-Shift Segmentation
  - Another form of iterative steepest-ascent method to find stationary points in a density function
  - Finds local maxima of density in feature space
  - Mean Shift Clustering