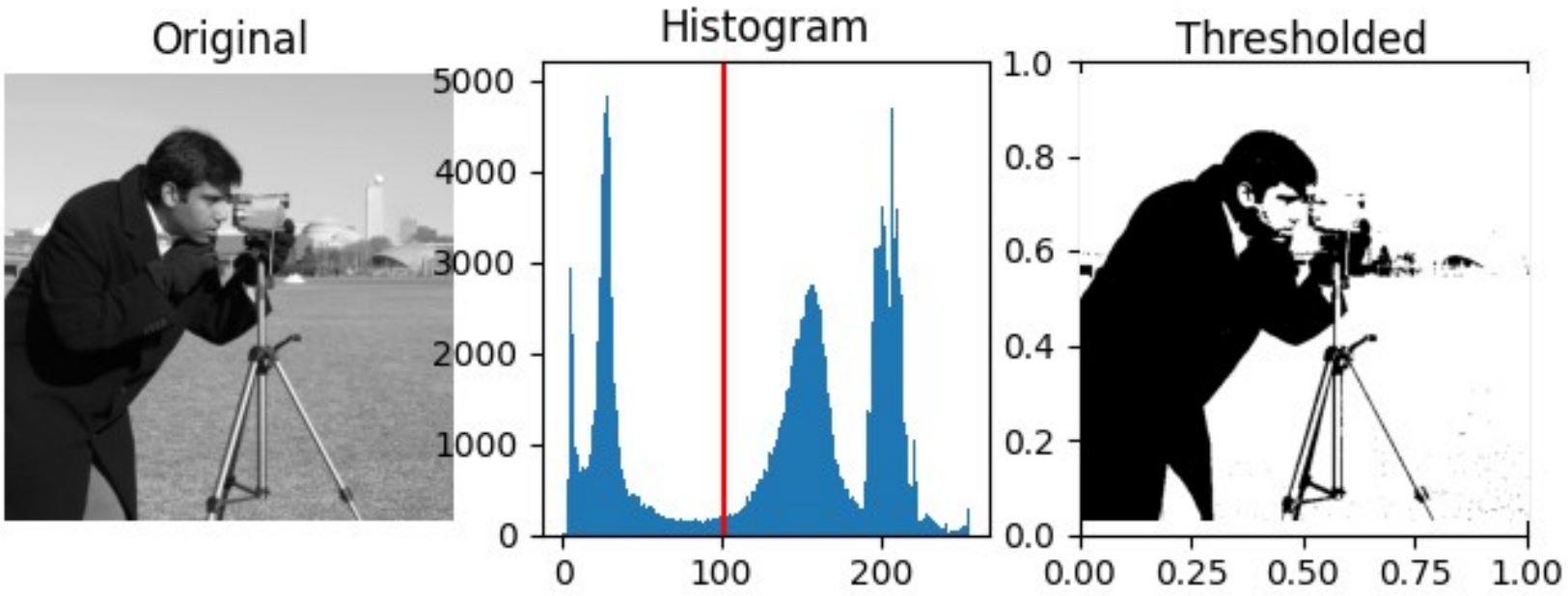
Thresholding

Tushar B. Kute,
http://tusharkute.com

Thresholding

- Thresholding is a fundamental technique in computer vision used to segment an image into foreground and background objects.
- It works by classifying each pixel in the image as either belonging to the object of interest (foreground) or the background based on their intensity values.

Thresholding



Thresholding : Process

- 1. Image Representation:
  - Images are typically represented as matrices, where each pixel has an intensity value (e.g., grayscale: 0-255).
- 2. Threshold Selection:
  - A threshold value is chosen. Pixels with intensity values greater than or equal to the threshold are classified as foreground, while those below are classified as background.
- 3. Binary Image Creation:
  - The resulting image becomes a binary image, containing only 0s (background) and 1s (foreground).

Thresholding : Process

- Types of Thresholding:
  - Global Thresholding: Uses a single threshold value for the entire image.
  - Local Thresholding: Adapts the threshold based on the local pixel neighborhood.
  - Adaptive Thresholding: Employs various strategies to dynamically adjust the threshold based on local image statistics.

Thresholding : Process

- Applications:
  - Object detection and segmentation: Isolating objects of interest from the background.
  - Feature extraction: Identifying specific features within objects.
  - Image analysis: Measuring object properties like size, shape, and texture.
  - Noise reduction: Simplifying images by removing irrelevant details.

Thresholding : Process

- Advantages:
  - Simple and computationally efficient.
  - Effective for segmenting high-contrast images with clear foreground-background separation.
- Disadvantages:
  - Sensitive to noise and uneven illumination.
  - May not perform well for complex images with subtle intensity variations.

Binary Thresholding

- Binary thresholding, as you already know, is a fundamental image processing technique that segments an image into foreground and background objects based on their intensity values.
- It achieves this by classifying each pixel as either belonging to the object of interest (foreground) or the background based on a chosen threshold value.

Binary Thresholding

- Key Concepts:
  - Image Representation: Images are typically represented as matrices, where each pixel has an intensity value (e.g., grayscale: 0-255).
  - Threshold Value: This value separates foreground (intensity ≥ threshold) from background pixels.
  - Binary Image: The resulting image contains only 0s (background) and 1s (foreground).

Binary Image

Inverse Binary Thresholding

- Inverse binary thresholding, also known as inverted thresholding, is a simple image processing technique that inverts the results of standard binary thresholding.
- Inverse binary thresholding takes the output of standard thresholding and simply flips the pixel values. This means:
  - Foreground pixels (white) become background (black).
  - Background pixels (black) become foreground (white).

Inverse Binary Thresholding

- Effect:
  - This inversion effectively swaps the roles of foreground and background in the image. Objects that were originally dark appear bright, and the background becomes dark.
- Applications:
  - Useful when the object of interest has lower intensity than the background (e.g., dark text on a white page).
  - Can be combined with other image processing techniques like edge detection for feature extraction.

Thresholding

- Practical

Otsu Thresholding

- Otsu's thresholding is a popular and effective automatic thresholding technique used in image processing to separate an image into foreground and background based on pixel intensity.
- It aims to find the threshold value that maximizes the between-class variance, essentially creating the best possible separation between the two classes (foreground and background).

Otsu Thresholding

- Histogram Analysis: Otsu's method analyzes the image's histogram, which represents the distribution of pixel intensities.
- Class Probabilities: The histogram is divided into two sections at each possible threshold value, calculating the probabilities of pixels belonging to each class (foreground and background).
- Within-Class Variance: For each threshold, the within-class variance for both foreground and background classes is calculated. This measures how spread out the pixels are within each class.
- Optimal Threshold: The threshold that minimizes the total within-class variance is chosen as the optimal threshold. This means the classes are most distinct at this threshold value.

Otsu Thresholding

- Step-by-step pdf

Otsu Thresholding

- Practical

Thank you

@mitu_skillologies

@mITuSkillologies

@mitu_group

@mitu-skillologies

@MITUSkillologies

kaggle

@mituskillolo
gies

Web Resources
https://mitu.co.in
http://tusharkute.com

@mituskillolo
gies

contact@mitu.co.in

tushar@tusharkute.com