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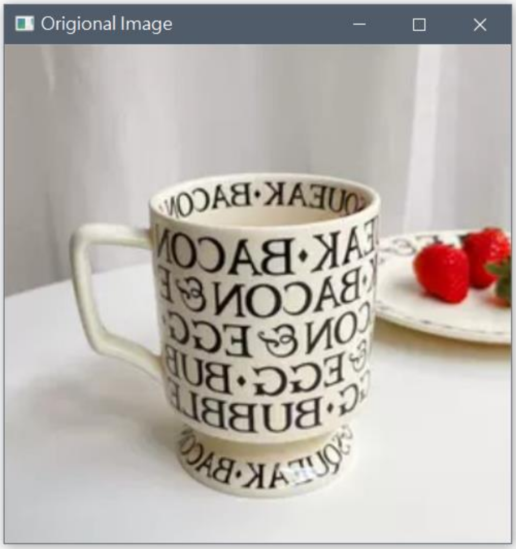
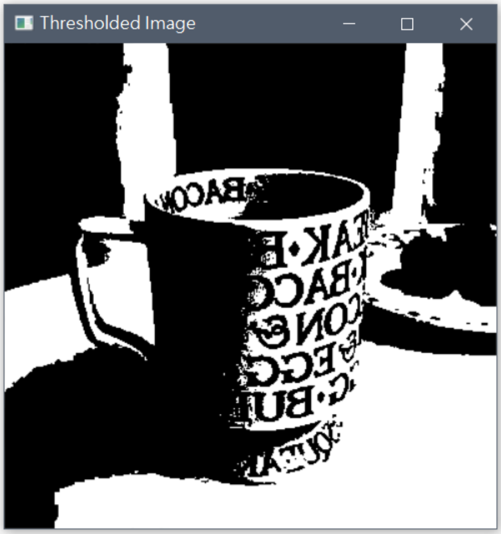
Homework 8 (Due: 4/27)

Implement Otsu’s thresholding method

input



output



Source code

```
import cv2
import numpy as np

def otsu_threshold(img):
  # Convert the image to grayscale
  gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

  # Compute the histogram of the grayscale image
  hist = cv2.calcHist([gray], [0], None, [256], [0, 256])

  # Calculate total number of pixels in the image
  total_pixels = gray.shape[0] * gray.shape[1]

  # Initialize variables
  max_var = 0
  threshold = 0
  sum_pix = 0
  sum_bright = 0

  # Loop through all possible threshold values
  for i in range(256):
    sum_pix += hist[i]
    sum_bright += i * hist[i]

    # Calculate the weight, mean, and variance of the background
    w_b = sum_pix / total_pixels
    mean_b = sum_bright / sum_pix if sum_pix > 0 else 0
    var_b = ((np.arange(i+1) - mean_b) ** 2 * hist[:i+1]).sum() / sum_pix if sum_pix > 0 else 0

    # Calculate the weight, mean, and variance of the foreground
    w_f = (total_pixels - sum_pix) / total_pixels
    mean_f = (sum_bright - sum_pix * mean_b) / (total_pixels - sum_pix) if sum_pix < total_pixels else 0
    var_f = ((np.arange(i+1, 256) - mean_f) ** 2 * hist[i+1:]).sum() / (total_pixels - sum_pix) if sum_pix < total_pixels else 0

    # Calculate the inter-class variance
    inter_var = w_b * w_f * (mean_b - mean_f) ** 2

    # Check if the inter-class variance is greater than the current maximum
    if inter_var > max_var:
      max_var = inter_var
      threshold = i

  # Apply the threshold to the grayscale image and return the result
  ret, thresh = cv2.threshold(gray, threshold, 255, cv2.THRESH_BINARY)
  return thresh

# Load the image
img = cv2.imread('image.jpg')
cv2.imshow('Origional Image', img)
cv2.waitKey(0)
cv2.destroyAllWindows()

# Apply Otsu's thresholding method
thresh = otsu_threshold(img)

# Display the thresholded image
cv2.imshow('Thresholded Image', thresh)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

Comments

I found that if the color of the image background is similar to the object we need, the result image will be hard to distinguish the main object.