Digital Image Processing
Assignment 7

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1. Technical Description of Techniques:

Objective: By using pixel similarity, this method divides an image into many segments or clusters.

Techniques:
K-means Classifying: K is the number of clusters in this well-known clustering process. K cluster centers are first selected as random. Following then, based on a distance metric (generally Euclidean distances), pixels are assigned to the nearest cluster unit. Until integration the cluster focuses are updated continuously by calculating the mean of all the pixels assigned to that cluster.
Mean Shift: The number of clusters can be predetermined, in contrast with K-means. Up to integration, the center of the cluster focuses frequently on the region with the highest density of points of data.

Contour Detection:
Determining the boundaries of objects in an image is the primary objective of contour detection.
Methods:
Canny Edge Detection: This method consists of several steps: initially, the image is smoothed using Gaussian distorting and following, the gradient's direction and magnitude are determined minimal suppression is used to thin the edges and finally, hysteresis thresholding is performed to determine strong, weak and irrelevant edges. After that, the edges are tracked to create shapes.
Identify Contours: Algorithms such as the one provided by OpenCV's findContours() function can be used to identify contours following edge detection. It identifies boundaries and continuous curves that divide one object in the image from another.

Thresholding:

Global Thresholding: With this technique, a single threshold value is set. The background (object) pixels are defined as having intensity above this threshold, while background pixels are described as holding intensities below it. It's an easy method for segmenting items with uniform intensity that works effectively.
Adaptive Thresholding: This technique computes unique threshold values for various parts of the image, in contrast with global thresholding. When there are changes in brightness across the image, it is useful.

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Color Masking:

HSV Color Space Thresholding: For color segmentation, the HSV (Hue, Saturation, Value) color space is frequently used. Three values are used to represent each pixel in HSV: hue (color), saturation (color intensity), and value (brightness). A mask is used to identify pixels that fall inside the desired color's bottom and upper boundaries in HSV space. To extract the required color, this mask is then applied to the original image.

2. Design of Algorithms:

i. Select the number of clusters (K).
ii. Randomly initialize K cluster centers.
iii. Assign each pixel to the cluster center closest to it.
iv. Refresh cluster centers using the specified pixels' mean.
v. Continue steps 3–4 until they are reached.
vi. Create a grayscale image.
vii. Smooth the image with Gaussian blur.
viii. Make use of clever edge detection.
ix. Use the findContours function to locate contours.
x. Create a grayscale image.
xi. Select the cutoff point .
xii. Repeat for every pixel.
xiii. Set to foreground if pixel intensity above threshold; else, set to background.
xiv. Transform image into required color space (HSV, for example).
xv. Establish the target color's bottom and upper boundaries.
xvi. Use color bounds to trigger thresholding to create a mask.
xvii. Mask the original image.

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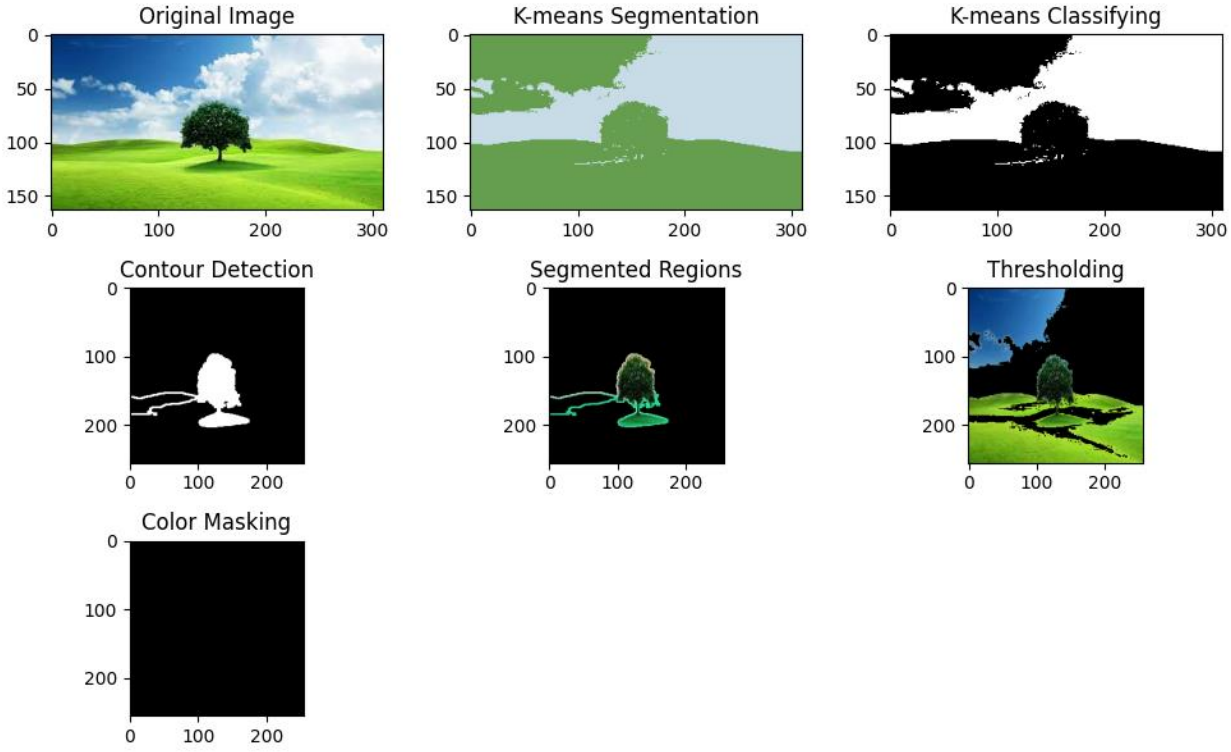
3. Analysis of Results:

The efficiency of each method for separating objects from images will be compared in these.

Output Images:



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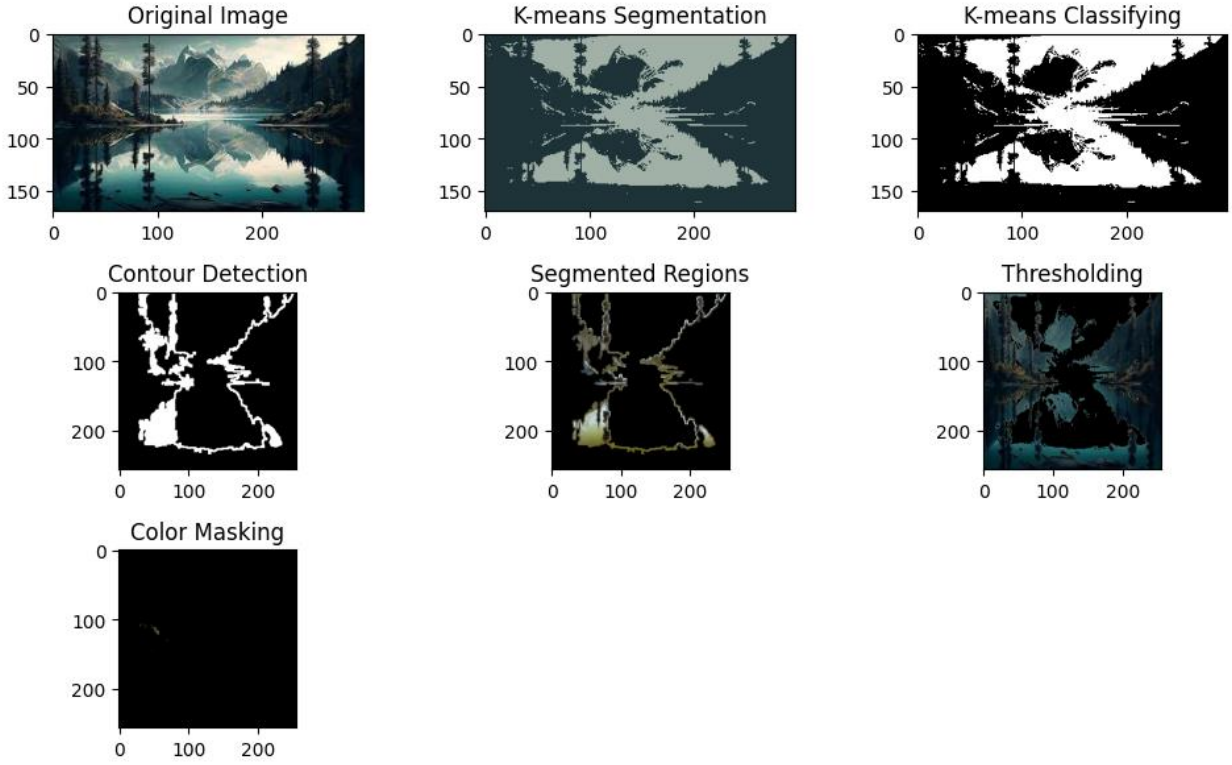

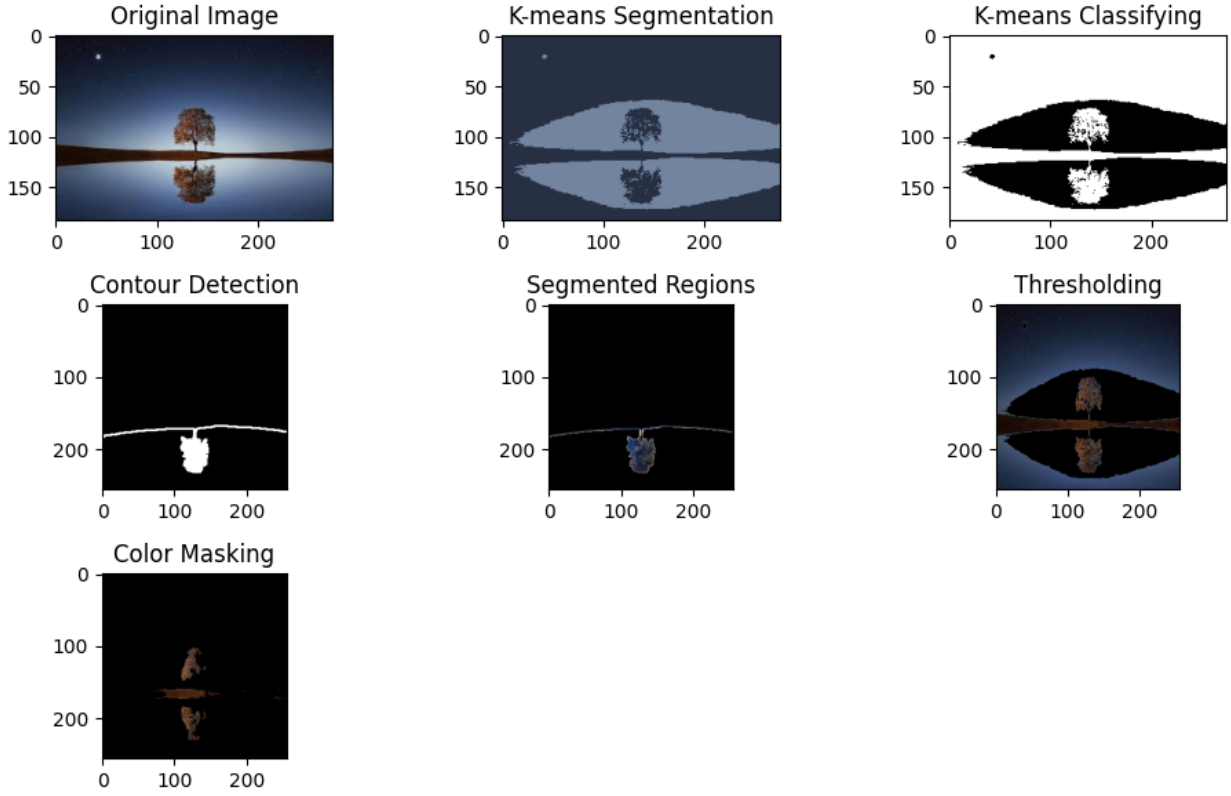

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