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To study the Object segmentation
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Aim: To study the Object segmentation

Objective: To study Object segmentation using the Watershed and GrabCut algorithms Example of foreground detection with GrabCut, Image segmentation with the Watershed algorithm

Theory: Object segmentation using the Watershed and GrabCut algorithms. Calculating a disparity map can be very useful to detect the foreground of an image, but StereoSGBM is not the only algorithm available to accomplish this, and in fact, StereoSGBM is more about gathering 3D information from 2D pictures, than anything else. GrabCut, however, is a perfect tool for this purpose. The

GrabCut algorithm follows a precise sequence of steps:

1. A rectangle including the subject(s) of the picture is defined

2. The area lying outside the rectangle is automatically defined as a background.

3. The data contained in the background is used as a reference to distinguish

background areas from foreground areas within the user-defined rectangle.

4. A Gaussians Mixture Model (GMM) models the foreground and back dabela undefined pixels as probable background and foregrounds.

5. Each pixel in the image is virtually connected to the surrounding pixels through virtu edges, and each edge gets a probability of being foreground or background, based on how similar it is in color to the pixels surrounding it.

6. Each pixel (or node as it is conceptualized in the algorithm) is connected to either a foreground or a background node.

7. after the nodes have been connected to either terminal (background or foreground, also called a source and sink), the edges between nodes belonging to

different terminals are cut (the famous cut part of the algorithm), which enables the separation of the parts of the image

Image segmentation with the Watershed algorithm :- Finally, we take a quick look at the Watershed algorithm. The algorithm is called Watershed, because its conceptualization involves water. Imagine areas with low density (little to no change) in an image as valleys, and areas with high density (lots of change) as peaks. Start filling the valleys with water to the point where water from two different valleys is about to merge. To prevent the merging of water from different valleys, you build a barrier to keep them separated. The resulting barrier is the image segmentation.

Code:-

```
import cv2
import numpy as np
from IPython.display import Image, display
from matplotlib import pyplot as plt
# Plot the image
def imshow(img, ax=None):
    if ax is None:
        ret, encoded = cv2.imencode(".jpg", img)
        display(Image(encoded))
    else:
        ax.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
        ax.axis('off')
```

```
#Image loading
img = cv2.imread("/content/download.jpg")


#image grayscale conversion
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
# Show image
imshow(img)
```

```
ret, bin_img = cv2.threshold(gray,0, 255, cv2.THRESH_BINARY_INV + cv2.THRESH_OTSU)
imshow(bin_img)
```

```
# noise removal
kernel = cv2.getStructuringElement(cv2.MORPH_RECT, (3, 3))
bin_img = cv2.morphologyEx(bin_img, cv2.MORPH_OPEN,kernel,iterations=2)
imshow(bin_img)
# Create subplots with 1 row and 2 columns
fig, axes = plt.subplots(nrows=2, ncols=2, figsize=(8, 8))
# sure background area
sure_bg = cv2.dilate(bin_img, kernel, iterations=3)
imshow(sure_bg, axes[0,0])
axes[0, 0].set_title('Sure Background')


# Distance transform
dist = cv2.distanceTransform(bin_img, cv2.DIST_L2, 5)
imshow(dist, axes[0,1])
axes[0, 1].set_title('Distance Transform')


#foreground area
ret, sure_fg = cv2.threshold(dist, 0.5 * dist.max(), 255, cv2.THRESH_BINARY)
sure_fg = sure_fg.astype(np.uint8)
imshow(sure_fg, axes[1,0])
axes[1, 0].set_title('Sure Foreground')
# unknown area
```

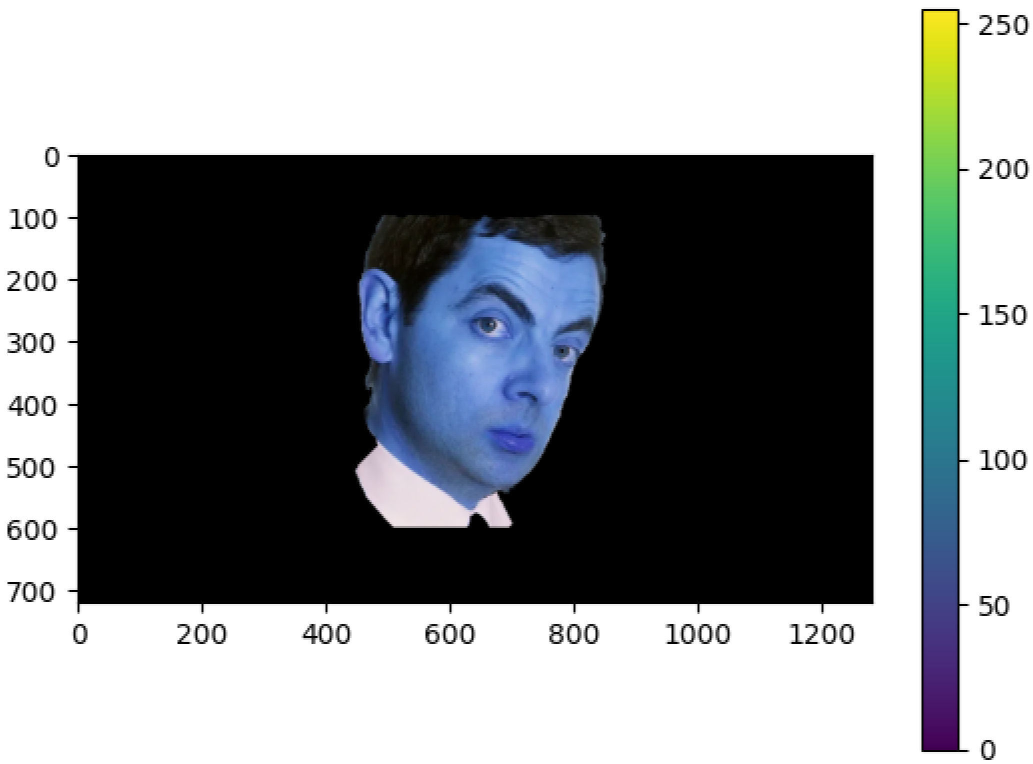
```
unknown = cv2.subtract(sure_bg, sure_fg)

imshow(unknown, axes[1,1])

axes[1, 1].set_title('Unknown')

plt.show()
```

OutPut:-

Code For GrabCut:-

```
import numpy as np

import cv2

from matplotlib import pyplot as plt

image = cv2.imread('MB.jpg')

mask = np.zeros(image.shape[:2], np.uint8)

backgroundModel = np.zeros((1, 65), np.float64)

foregroundModel = np.zeros((1, 65), np.float64)

rectangle = (400, 100, 500, 500)

cv2.grabCut(image, mask, rectangle,

      backgroundModel, foregroundModel,

      3, cv2.GC_INIT_WITH_RECT)

mask2 = np.where((mask == 2)|(mask == 0), 0, 1).astype('uint8')

image = image * mask2[:, :, np.newaxis]

plt.imshow(image)

plt.colorbar()

plt.show()
```

OutPut:-



Conclusion: In summary, image segmentation using the Watershed and GrabCut algorithms are two prominent techniques in computer vision. Watershed segmentation relies on the topographic analogy to segment regions based on gradient information, making it suitable for separating objects with well-defined boundaries. In contrast, GrabCut utilizes interactive user inputs to iteratively refine object segmentation, making it valuable for applications like image editing. Both methods have their strengths and weaknesses, and their choice depends on the specific requirements of the task at hand.