Workshop_1_Walkthrough

March 20, 2025

1 COMPSCI 3315 WORKSHOP

2 Green-screen point processing

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2.1 0 - Mount Google Drive to Google Colab (If you use Google Colab for the Workshop)

Give Google Colab the permission to explore and use our Google Drive

[1]:
```
# from google.colab import drive
# drive.mount('/content/drive')
```

Please upload the Workshop 1's images in the directory as shown below:
My Drive
- Colab Notebooks
  - workshop1_imgs

[2]:
```
IMG_PATH = "/content/drive/MyDrive/Colab Notebooks/workshop1_imgs"
```

If you use your own computer, please use this line below:

[3]:
```
IMG_PATH = "./imgs/"
```

2.2 1 - Load libraries

[4]:
```
# Matplotlib is for visualization
import matplotlib.pyplot as plt
# Numpy is for computation
import numpy as np
# OpenCV (cv2) is for Computer Vision tools
import cv2
# os is for manipulating paths
import os
```

3 Additional function to display image by using matplotlib

[5]:
```
def display(img, caption=''):
    # Show image using pyplot
    plt.figure()
    plt.imshow(img)
    plt.title(caption)
    plt.axis('off')
    plt.show()
```

[6]:
```
def display_with_figsize(img, figsize=(10,10), caption=''):
    # Show image using pyplot with chosen figsize
    plt.figure(figsize=figsize)
    # Convert from BGR to RGB
    plt.imshow(cv2.cvtColor(img, cv2.COLOR_BGR2RGB))
    plt.title(caption)
    plt.axis('off')
    plt.show()
```

3.1 2 - Load the given image

[7]:
```
img_name = "12.jpg"
img_file_path = os.path.join(IMG_PATH, img_name)
```

[8]:
```
img = cv2.imread(img_file_path)
display_with_figsize(img)
print(img.shape)
```

```
(480, 852, 3)
```

3.2 3 - Convert image from RGB format to HSV format.

Why we use HSV instead of RGB?
https://dsp.stackexchange.com/questions/2687/why-do-we-use-the-hsv-colour-space-so-often-in-vision-and-image-processing

[9]:
```
img_hsv = cv2.cvtColor(img, cv2.COLOR_BGR2HSV)
print(img_hsv[1,1,0])
```

```
45
```

Reference: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.ncl.ucar.edu%2FDocument%2FGraph

[10]:
```
mask1 = img_hsv[:,:,0] < 52 # the 3rd index in  img_hsv: 0 - hue, 1 -␣
↪saturation, 2 - value
print(mask1.sum())
```

```
364583
```

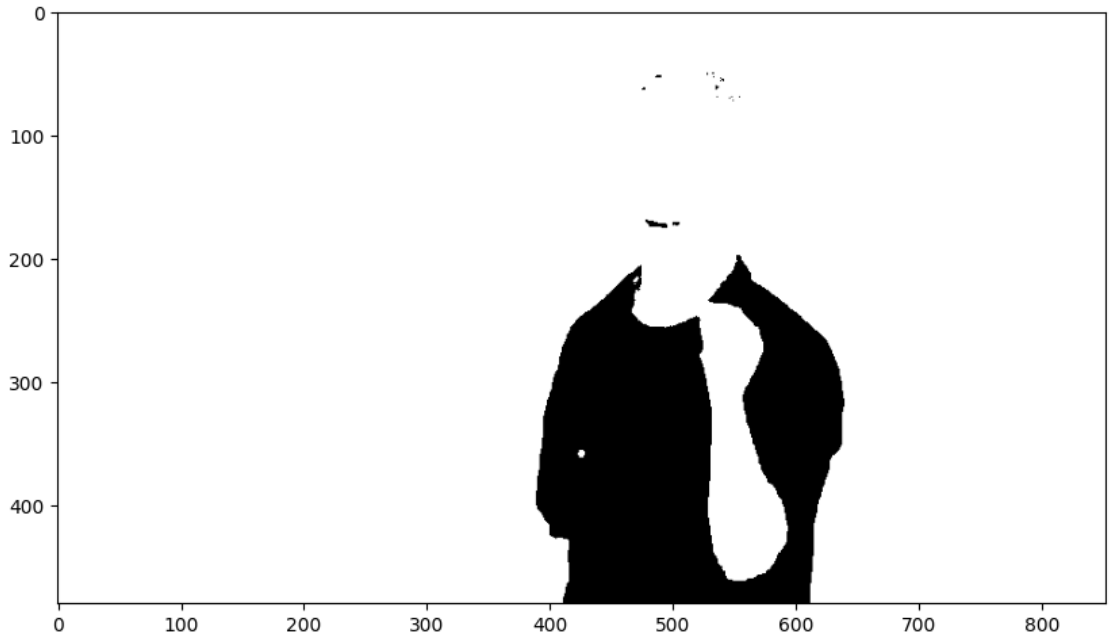
[11]:
```
mask1
```

[11]:
```
array([[ True,  True,  True, …,  True,  True,  True],
       [ True,  True,  True, …,  True,  True,  True],
```

```
       [ True,  True,  True, …,  True,  True,  True],
       …,
       [ True,  True,  True, …,  True,  True,  True],
       [ True,  True,  True, …,  True,  True,  True],
       [ True,  True,  True, …,  True,  True,  True]])
```

[12]:
```
plt.figure(figsize=(10, 10))
plt.imshow(mask1, cmap="gray")
```

[12]: <matplotlib.image.AxesImage at 0x7f082b351af0>

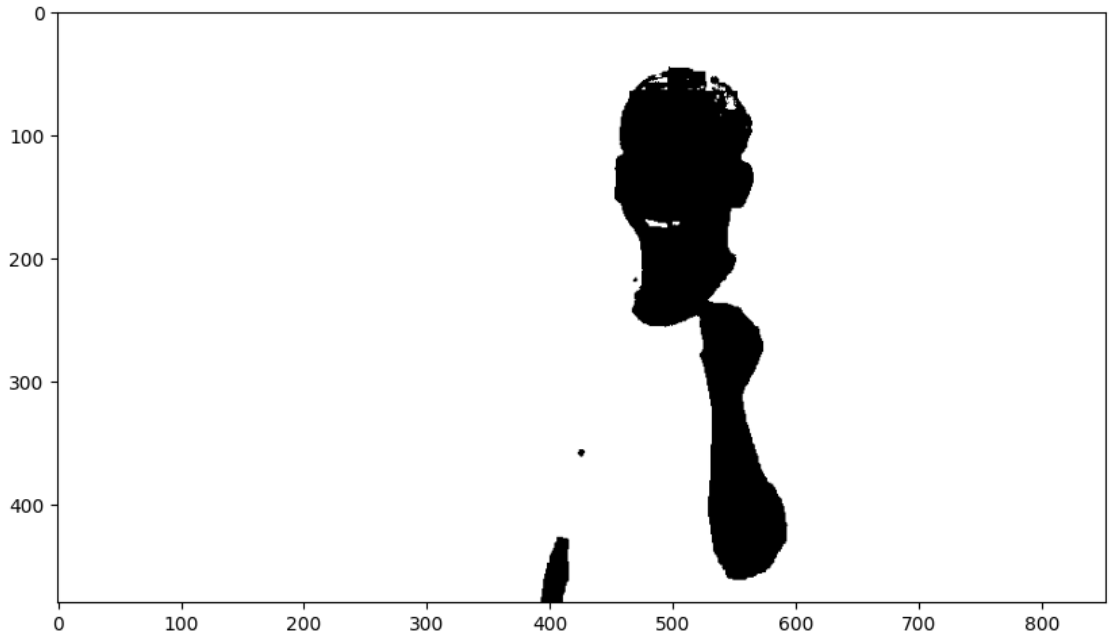


[13]:
```
mask2 = img_hsv[:,:,0] > 35
print(mask2.sum())
```

```
381265
```

[14]:
```
plt.figure(figsize=(10, 10))
plt.imshow(mask2, cmap="gray")
```

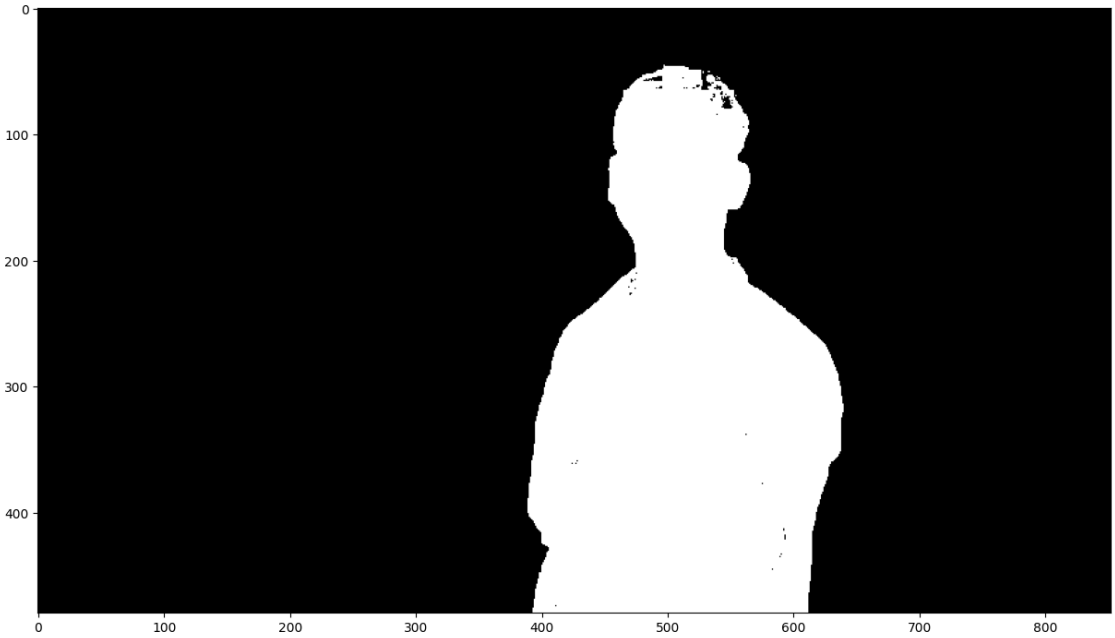
[14]: <matplotlib.image.AxesImage at 0x7f0804083fd0>



[15]:
```
mask = mask1.astype("int") + mask2.astype("int")
human_mask = mask < 2
```

[16]:
```
plt.figure(figsize=(15, 15))
plt.imshow(human_mask, cmap="gray")
```

[16]: <matplotlib.image.AxesImage at 0x7f07f67ccc10>



3.3 4 - Morphopology

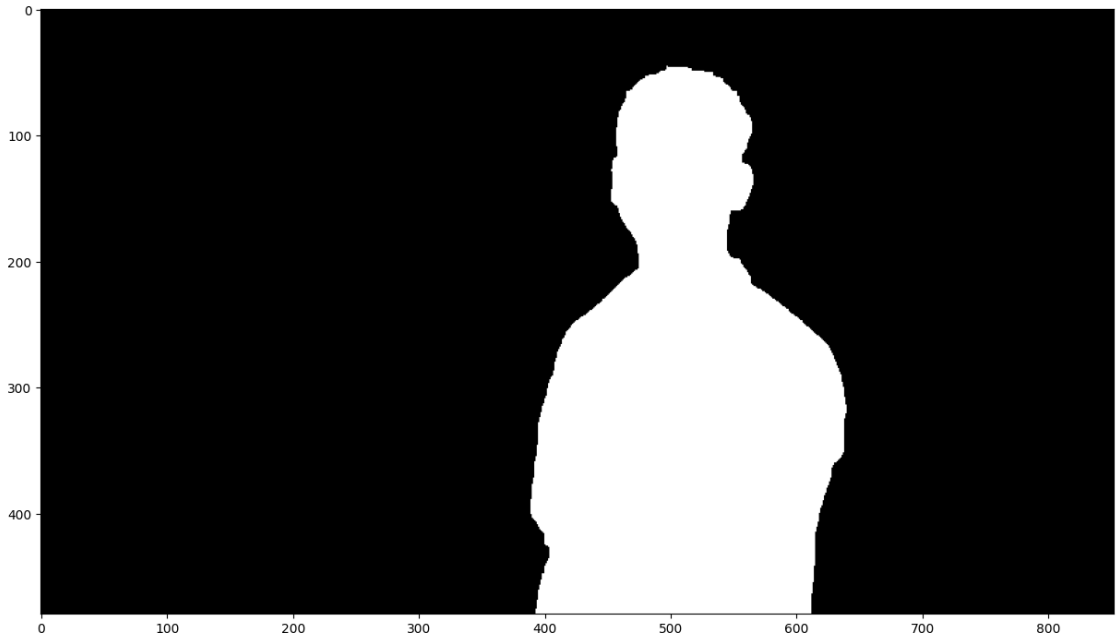
3.3.1 Closing

Section 3.3.3 in Richard Szeliski's Computer Vision: Algorithms and Applications, 2nd edition.

Reference: https://www.google.com/url?sa=i&url=https%3A%2F%2Fpyimagesearch.com%2F2021%2F04%2F28%
morphological-operations%2F&psig=AOvVaw2w2e-NjT0Q48AjrsVMBmLL&ust=1678865495349000&source=ima

[17]:
```
kernel = np.ones((7, 7), dtype=np.uint8)
closing = cv2.morphologyEx(np.float32(human_mask), cv2.MORPH_CLOSE, kernel)
closing = closing.astype(np.uint8)
# display(closing * 255,"mask")
plt.figure(figsize=(15, 15))
plt.imshow(closing, cmap="gray")
```

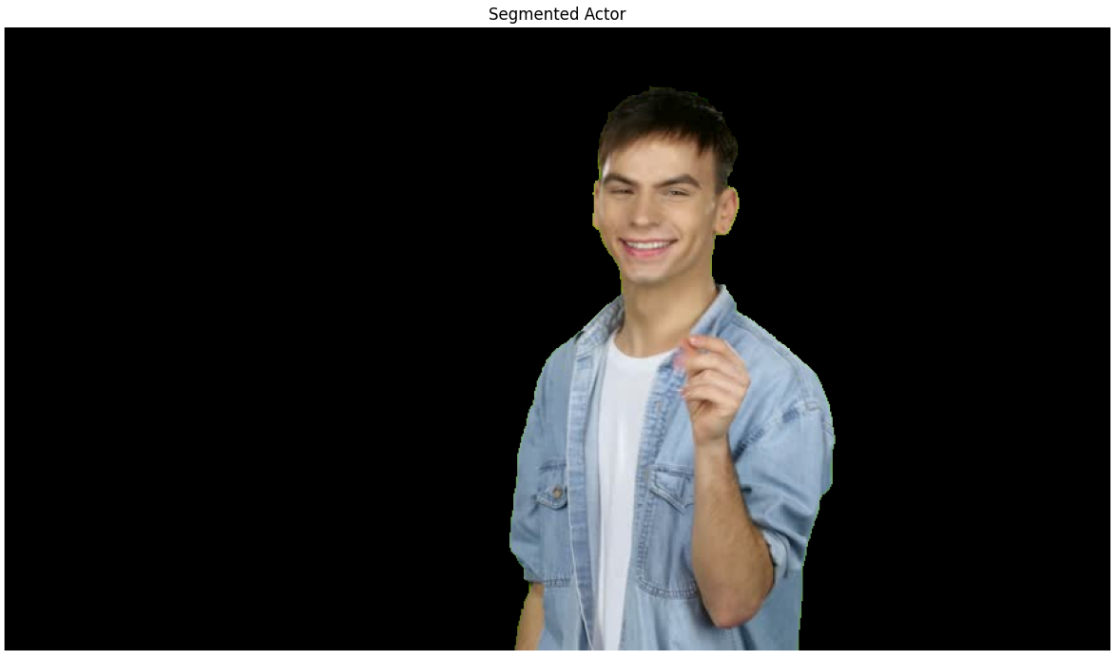
[17]:
```
<matplotlib.image.AxesImage at 0x7f07f674dd30>
```



[18]:
```
closing_mask = np.repeat(closing[:, :, np.newaxis], 3, axis=2)
print(closing_mask.shape)
```

```
(480, 852, 3)
```

[19]:
```
segmented_actor = img * closing_mask
display_with_figsize(segmented_actor, figsize=(15, 15), caption="Segmented␣
↪Actor")
```



[20]:
```
segmented_actor.shape
```

[20]:
```
(480, 852, 3)
```

3.4 5 - Compositing (The fun part)

[21]:
```
img_name = "underwater.png"
background = cv2.imread(os.path.join(IMG_PATH, img_name))
resized_background = cv2.resize(background, (852, 480))
display_with_figsize(resized_background, figsize=(15, 15))
resized_background.shape
```

[21]:
```
(480, 852, 3)
```

[22]:
```
segmented_background = (1 - closing_mask) * resized_background
display_with_figsize(segmented_background, figsize=(15, 15))
```

[23]:
```
result = segmented_actor + segmented_background
display_with_figsize(result, figsize=(15, 15))
```

3.5 Extra parts - Post-processing

The result looks kind of lame, right? How about we use Gaussian filter to make it better.

[24]:
```
blurred_result = cv2.GaussianBlur(result, (3,3), 0)
display_with_figsize(blurred_result, figsize=(15, 15))
```

4 Some fun results

Note: To make result imaged look good, the original background image should have the same aspect ratio (w:h) as the foreground image (852:480). For example: (852:480), (1278:720), (1704:960), etc. You can use Paint to crop the background images first and use them in this notebook.

[25]:
```
def blend(segmented_actor, background, ksize=(3,3), figsize=(10, 10)):
    resized_background = cv2.resize(background, (852, 480))
    segmented_background = (1 - closing_mask) * resized_background
    result = segmented_actor + segmented_background
    blurred_result = cv2.GaussianBlur(result, ksize, 0)
    display_with_figsize(blurred_result, figsize)
```

[26]:
```
img_name = "underwater.png"
background = cv2.imread(os.path.join(IMG_PATH, img_name))
bg = cv2.imread(os.path.join(IMG_PATH, img_name))
blend(segmented_actor, bg, ksize=(3,3), figsize=(15, 15))
```

5 Results from previous courses

[27]:
```
# bg = cv2.imread('bts.jpg')
# blend(segmented_actor, bg, ksize=(3,3), figsize=(10, 10))
```

[28]:
```
# bg = cv2.imread('avenger.jpg')
# blend(segmented_actor, bg, ksize=(3,3), figsize=(10, 10))
```

[29]:
```
# bg = cv2.imread('yourname.jpg')
# blend(segmented_actor, bg, ksize=(5,5), figsize=(10, 10))
```

[30]:
```
# bg = cv2.imread('yibo.jpg')
# blend(segmented_actor, bg, ksize=(3,3), figsize=(10, 10))
```

6 It's your turn to play with this notebook!

You can find funny foregrounds by searching on Google: "green screen character", "green screen actor", "green screen anime", etc.