COMSATS University Islamabad, Lahore Campus

Fall 2024 – Assignment 2

Course Title:	Computer Vision	Course Code:	CSC455	Credit Hours:	3(3,0)
Course Instructor/s:	Dr. Zulfiqar Habib, Professor	Programme Name:	BS Computer Science		
Topic	Segmentation Section:		Max Marks:	10	
Out Date:	12-10-24	**Due Date:**		**16-10-24**	
Student's Name:	**SHAFIN-UZ-ZAMAN**	Reg. No.	SP22-BCS-063		

Instructions:

1. You may use AI tools to help understand the concepts.
2. However, the answers must be in your own words and show your understanding of the topics.
3. Copying answers directly from any source, including AI tools, is not allowed.
4. Your assignment will be evaluated & graded through a leading Quiz

Submission Guidelines:

Submit your assignment on this sheet via Google Classroom.

Problem:

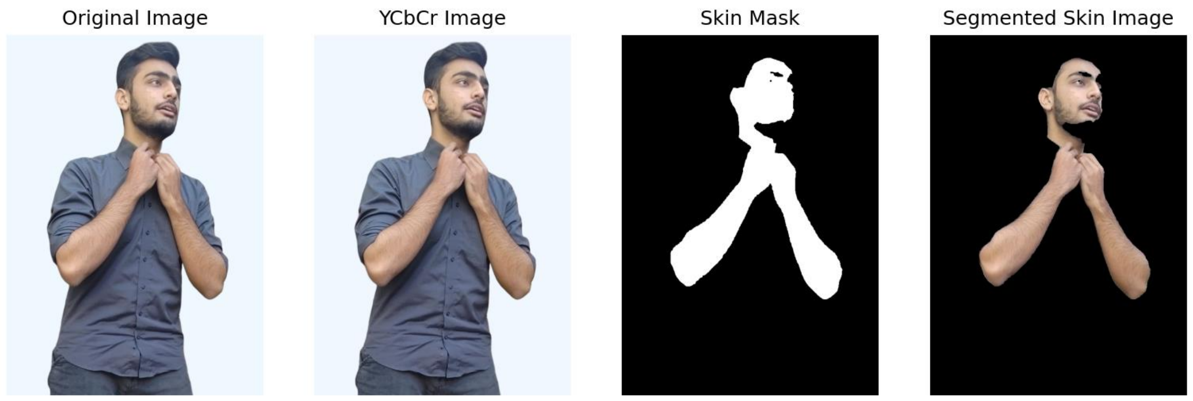
The goal of this assignment is to understand and implement skin segmentation techniques by using a personal image. Capture a picture of yourself with at least your hands clearly visible. Save the image as yourname_skin_image.jpg. You will use the YCbCr color space, which separates the luminance (Y) from the chrominance (Cb and Cr). Your task is to identify and segment the skin pixels from the image using predefined thresholds for the Cr and Cb channels.

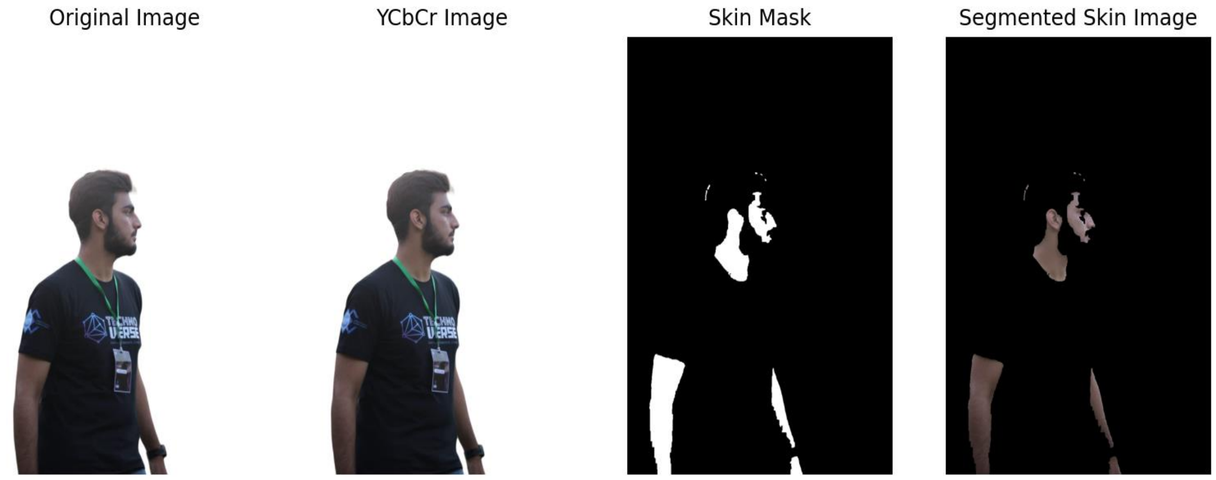
Program Code

```python
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Step 1: Load the image
img = cv2.imread("shafin_skinimage.png")

# Step 2: Convert the image from BGR to YCbCr color space
img_YCrCb = cv2.cvtColor(img, cv2.COLOR_BGR2YCrCb)

# Step 3: Define the skin color range in YCbCr color space
# Cr: 135-180, Cb: 85-135
lower_skin = np.array([0, 135, 85], dtype=np.uint8)  # Lower bound for skin color
upper_skin = np.array([255, 180, 135], dtype=np.uint8)  # Upper bound for skin color

# Step 4: Create a binary mask for skin colors
skin_mask = cv2.inRange(img_YCrCb, lower_skin, upper_skin)

# Step 5: Apply morphological operations to reduce noise
# Applying morphological opening to remove small noise in the mask
kernel = np.ones((3, 3), np.uint8)
skin_mask = cv2.morphologyEx(skin_mask, cv2.MORPH_OPEN, kernel)

# Step 6: Apply morphological closing to fill small holes
skin_mask = cv2.morphologyEx(skin_mask, cv2.MORPH_CLOSE, kernel)
```

```python
# Step 7: Segment the skin area from the original image using the mask
skin_segmented = cv2.bitwise_and(img, img, mask=skin_mask)

# Step 8: Convert the original BGR image to RGB for displaying with Matplotlib
img_rgb = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
img_YCrCb_rgb = cv2.cvtColor(img_YCrCb, cv2.COLOR_YCrCb2RGB)  # Convert YCbCr to RGB
skin_segmented_rgb = cv2.cvtColor(skin_segmented, cv2.COLOR_BGR2RGB)

# Step 9: Create subplots to display the original image, YCbCr image, mask, and
segmented skin image
fig, axs = plt.subplots(1, 4, figsize=(20, 5))

# Step 10: Display the original image
axs[0].imshow(img_rgb)
axs[0].set_title("Original Image")
axs[0].axis('off')  # Hide the axes for a cleaner look

# Step 11: Display the YCbCr image
axs[1].imshow(img_YCrCb_rgb)
axs[1].set_title("YCbCr Image")
axs[1].axis('off')

# Step 12: Display the skin mask result
axs[2].imshow(skin_mask, cmap='gray')  # Use a grayscale colormap
axs[2].set_title("Skin Mask")
axs[2].axis('off')

# Step 13: Display the segmented skin image
axs[3].imshow(skin_segmented_rgb)
axs[3].set_title("Segmented Skin Image")
axs[3].axis('off')

# Step 14: Show all plots
plt.show()
```

Output


Original Image
YCbCr Image
Skin Mask
Segmented Skin Image


Original Image
YCbCr Image
Skin Mask
Segmented Skin Image