MIDDLE EAST TECHNICAL UNIVERSITY
NORTHERN CYPRUS CAMPUS

CNG 483 – INTRODUCTION TO COMPUTER VISION
SPRING 2020-2021

Assignment – Hand segmentation

Objectives: A typical Automatic Sign Language Recognition System (ASLRS) requires the implementation of a complete processing chain encompassing hand segmentation, feature encoding and the recognition steps. The main objective of this assignment is to implement the first stage of ASLRS.

Description: In this assignment, you need to implement a software to segment the hand region in the given images. Hand images are provided to you in the folder "Dataset". Your software should include following;

1) An algorithm to normalize all RGB images in the dataset as described below (code of this function should be written by you and named as *NormRGB*).

The common RGB representation of color images is not suitable for characterizing skin-color. In the RGB space, the components R, G and B represents not only color, but also *luminance*. Luminance may vary across skin due to the ambient lighting and is not a reliable measure in separating skin from non-skin regions. Luminance can be removed from the color representation in the normalized RGB space. Chromatic colors, also known as "pure" colors in the absence of luminance, are defined by the simple normalization process shown below:

$r = R/(R+G+B)$

$b = B/(R+G+B)$

Color green is redundant after the normalization because r+g+b=1 (no change in G component).

2) A basic K-Means Clustering algorithm which uses normalized RGB images in part 1 (code of this function should be written by you and named as *Kmeans*; i.e. do not use the K-Means built-in functions)

Your algorithm (your own code) should select the seeds and K intelligently from the image using its color histogram (you can use built-in functions for color histogram). Given the histogram, the seed and K selection should be automatic. One way to go is to find the peaks in the color histogram as candidates for seeds. Also, K is closely related to the number of peaks in the histogram. Not all the peaks are necessary as you want only the dominant ones, so you should pick the ones that occupies a certain portion of image in terms of pixels.

3) Implement simple algorithm to examine the clusters in a color-space histogram (can be by hand or automatic) and come up with a characterization for skin pixels. Then, set any other pixel rather than skin to zero. (code of this function should be written by you and named as *Masking*)

I/O of software: Input and output of your software should be as follows;

Input: The path of the database.

(Example input: C:\Users\Meryem\Desktop\CNG483\Assignment\Dataset)

Output: Folder named as "SegmentationResults" should be created in the database folder and segmented images should be saved.

(Based on the above input example, output path should be as follows: C:\Users\Meryem\Desktop\CNG483\Assignment\Dataset\ SegmentationResults)

Grading:

- *NormRGB* function
- *Kmeans* function
- *Masking* function
- Input/Output as requested
- Segmentation quality
- Good programming (comments, explanation, etc.)

Regulations:

1) **Programming Language:** You must code your program in MATLAB or in Python. You must use comments to explain what your code is doing step by step. You are expected make sure your code runs successfully.

2) **Implementation:** Please read the above description carefully, using not allowed built-functions will result as zero grade from the corresponding part of the assignment.

3) **Submission:** Submit only ONE file to ODTUCLASS. Your file name should be Name_Surname_StudentId. Submissions via email will not be accepted.

4) **Deadline:** 02/05/2021 23:55

5) **Late Submission:** Late submission is not allowed.

6) **Cheating:** Please read carefully cheating policy from the course syllabus.

Please note that failing to do any of the above regulations may result as zero grade.