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MP4 Report
Computer Vision
April 20, 2023

Task

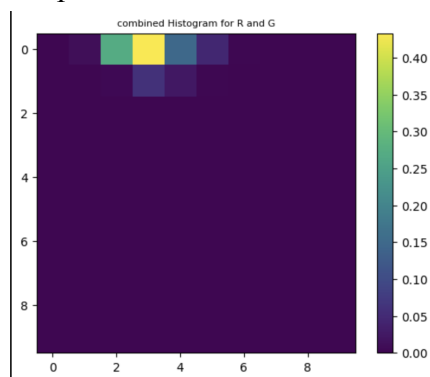
The task for this MP was to carry out histogram-based skin color segmentation of three given images. The idea behind how this works is that we create a histogram of the target color – in our case, the skin color – and use this to create a mask over the hands in the testing images by determining the probability of each pixel being in the target color. To do this, I started by collecting a few images of hands for making the reference histogram. I did this in the HSI color space, and created a 2D histogram based on the H and S values (hue and saturation). I made the histogram with 10 bins per value and normalized the histogram so all values in the histogram add to 1. Then, when creating the segmentation, I stepped through each pixel in the target image and determined the value of it in regards to the histogram. If this value was over a certain threshold, which I determined experimentally, then that pixel became part of the mask outlining the hand in the image.

Algorithms

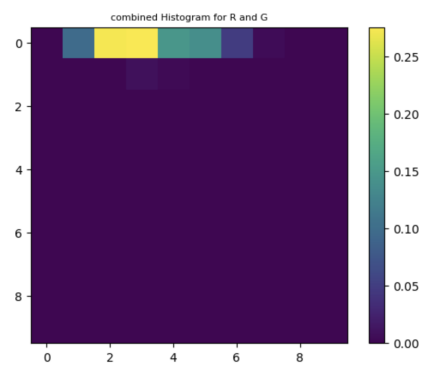
- Histogram creation: after isolating the H and S values for all of the sample images combined, I used `cv2.calcHist` to calculate a 2D histogram with 10 bins. I then normalized the histogram by dividing it by the sum of its values
- Image segmentation: stepping through each pixel, I determined if its bin value was greater than the threshold, and then created a binary mask for all pixels within the bin.

Results

I created two different histograms, the first being calculated from only the given images as samples:



And the second from a larger sample image set with 10 images total:



As you can see, there is a slight difference in the calculated histograms. When using only the 3 test images as samples for the skin color, these are the image segmentations created:



When using the larger pool of sample images, these are the image segmentations created:



There is a slight variation in results when a larger sample size was used. The segmentations became less exact, which follows from the histogram representing a larger range of values.