MSAI 495 Introduction to Computer Vision - Assignment 2
Sayantani Bhattacharya

Skin Color Detection

Algorithms Used:

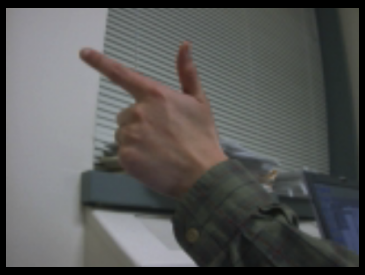
I. For training histogram:
   A. Load a training image.
   B. Let the user draw one or more rectangles (ROIs) over skin-only regions.
   C. For each selected ROI, Extract the R and G values (or H and S if using HSV) of all pixels inside the ROI.
   D. Combine all R–G or H–S pixel pairs from all ROIs.
   E. Build a 2D histogram where each bin counts how often a particular R–G (or H–S) combination appears.
   F. Normalize the histogram so that it becomes a probability distribution (sums to 1).

II. For K-Means thresholding:
   A. Flatten the 2D histogram into a 1D list of all bin values.
   B. Use K-means clustering to group the histogram values into k clusters (k=2 for skin and non-skin).
   C. Identify the cluster with higher values (assumed it corresponds to skin).
   D. Create a binary mask of the histogram:Mark bins in the "skin" cluster as 1 (or 255), and others as 0.
   E. Use this mask during detection to decide if a pixel's (R,G) value falls in the "skin" region.

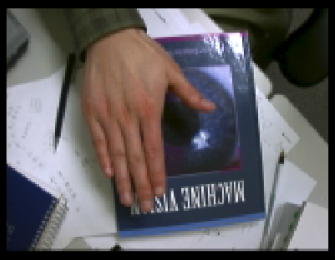
III. For Segmentation:
   A. Load the test image.
   B. Convert the image from BGR to HSV [or RGB] color space.
   C. For each pixel:
      - Extract the Hue (H) and Saturation (S) values.
      - Use (H, S) as an index into the precomputed histogram mask (a binary mask over H–S space).
      - If the (H, S) combination is marked as skin in the histogram, mark the pixel as skin.
   D. Create a binary mask where skin pixels are white (255), others are black (0).
   E. Apply the binary mask to the original image to extract only the skin regions.
   F. Save both i.e. the binary mask image (showing skin vs non-skin) and
      The final skin-only image (color).

Results:

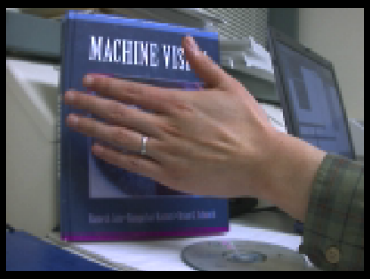
1. gun image masked and with skin:



2. joy image masked and with skin:



3. pointer image masked and with skin:



Also the results I got for HSV based filtering was visibly better than RGB, the above ones are the HSV based result.

The fresh tone training data used: