

Report of MP4

1. Color based Segmentation

Group or segment pixels in an image into different regions based on color information. There are threshold methods, histogram-based method, Gaussian method. Threshold All pixels below this threshold may be assigned to a category (for example, set to black), while Pixels above this threshold are assigned to another category (e.g. set to white).

On top of the threshold, the histogram method is a method to determine the optimal threshold based on the pixel value distribution of the image. Compared with the threshold method, the threshold can be determined automatically and does not need to be set manually. In addition, it depends on the model. Use Gaussian Mixture Model (GMM) Complex, but can handle multi-modal images, that is, the histogram of the image has multiple peaks.

2. Algorithm Implementation

1. **Global Variable**:

- `Skin_H`: A dictionary that will store the frequency of skin tones detected.

2. **Functions**:

- `train(path, mode="HSV")`: This function takes an image path and a color mode as input. It allows the user to select a region in the image using the mouse. The selected region is then processed based on the color mode (RGB, nRGB, or HSV) to populate the `Skin_H` dictionary with skin tone data.

- `process_rgb(crop)`, `process_nrgb(crop)`, and `process_hsv(crop)`: These functions process the cropped region of the image based on the specified color mode. They update the `Skin_H` dictionary with the frequency of skin tones and generate a 2D histogram for visualization.

- `create_histogram(graph_x, graph_y, mode)`: This function creates a 2D histogram based on the provided data and saves it as an image.

- `normalize_histogram(m)`: This function normalizes the values in the `Skin_H` dictionary based on the maximum frequency.

- `test(path, threshold=0.05, mode='', title='')`: This function tests the skin tone detection on a new image. It uses the data in `Skin_H` to detect skin regions in the image based on the specified threshold and color mode. The result is displayed and saved as an image.

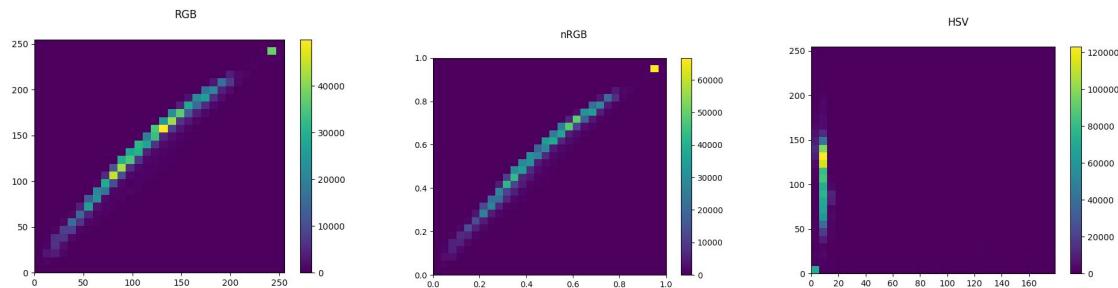
3. Result analysis

I select a face image from google as fresh tone data, as asked, use a interface to select the area, then get the data set to train, then based on the RGB, nRGB, HSV three color space, we draw histograms.

3.1 test image



3.2 3 histograms



3.3 training result

HSV/HSI



nrgb



rgb



From the result, we can see **HSI color space get best performance**. RGB is the worst, nRGB also have many noise.