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CS 3150

Homework3

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I began this homework with my usual comments outline, header, imports and helpful show method. Then since this week focused a lot on different color formats, I decided to check out all the different color conversion options that cv2 has to offer. With a quick list comprehension that I learned from realpython.com I produced this list:

COLOR\_RGBA2mRGBA

COLOR\_XYZ2BGR

COLOR\_XYZ2RGB

COLOR\_YCR\_CB2BGR

COLOR\_YCR\_CB2RGB

COLOR\_YCrCb2BGR

COLOR\_YCrCb2RGB

COLOR\_YUV2BGR

COLOR\_YUV2BGRA\_I420

COLOR\_YUV2BGRA\_IYUV

COLOR\_YUV2BGRA\_NV12

COLOR\_YUV2BGRA\_NV21

COLOR\_YUV2BGRA\_UYNV

COLOR\_YUV2BGRA\_UYVY

COLOR\_YUV2BGRA\_Y422

COLOR\_YUV2BGRA\_YUNV

COLOR\_YUV2BGRA\_YUY2

COLOR\_YUV2BGRA\_YUYV

COLOR\_YUV2BGRA\_YV12

COLOR\_YUV2BGRA\_YVYU

COLOR\_YUV2BGR\_I420

COLOR\_YUV2BGR\_IYUV

COLOR\_YUV2BGR\_NV12

COLOR\_YUV2BGR\_NV21

COLOR\_YUV2BGR\_UYNV

COLOR\_YUV2BGR\_UYVY

COLOR\_YUV2BGR\_Y422

COLOR\_YUV2BGR\_YUNV

COLOR\_YUV2BGR\_YUY2

COLOR\_YUV2BGR\_YUYV

COLOR\_YUV2BGR\_YV12

COLOR\_YUV2BGR\_YVYU

COLOR\_YUV2GRAY\_420

COLOR\_YUV2GRAY\_I420

COLOR\_YUV2GRAY\_IYUV

COLOR\_YUV2GRAY\_NV12

COLOR\_YUV2GRAY\_NV21

COLOR\_YUV2GRAY\_UYNV

COLOR\_YUV2GRAY\_UYVY

COLOR\_YUV2GRAY\_Y422

COLOR\_YUV2GRAY\_YUNV

COLOR\_YUV2GRAY\_YUY2

COLOR\_YUV2GRAY\_YUYV

COLOR\_YUV2GRAY\_YV12

COLOR\_YUV2GRAY\_YVYU

COLOR\_YUV2RGB

COLOR\_YUV2RGBA\_I420

COLOR\_YUV2RGBA\_IYUV

COLOR\_YUV2RGBA\_NV12

COLOR\_YUV2RGBA\_NV21

COLOR\_YUV2RGBA\_UYNV

COLOR\_YUV2RGBA\_UYVY

COLOR\_YUV2RGBA\_Y422

COLOR\_YUV2RGBA\_YUNV

COLOR\_YUV2RGBA\_YUY2

COLOR\_YUV2RGBA\_YUYV

COLOR\_YUV2RGBA\_YV12

COLOR\_YUV2RGBA\_YVYU

COLOR\_YUV2RGB\_I420

COLOR\_YUV2RGB\_IYUV

COLOR\_YUV2RGB\_NV12

COLOR\_YUV420SP2RGBA

COLOR\_YUV420p2BGR

COLOR\_YUV420p2BGRA

COLOR\_YUV420p2GRAY

COLOR\_YUV420p2RGB

COLOR\_HLS2RGB\_FULL

COLOR\_HSV2BGR

COLOR\_HSV2BGR\_FULL

COLOR\_HSV2RGB

COLOR\_HSV2RGB\_FULL

COLOR\_LAB2BGR

COLOR\_LAB2LBGR

COLOR\_LAB2LRGB

COLOR\_LAB2RGB

COLOR\_LBGR2LAB

COLOR\_LBGR2LUV

COLOR\_LBGR2Lab

COLOR\_LBGR2Luv

COLOR\_LRGB2LAB

COLOR\_LRGB2LUV

COLOR\_LRGB2Lab

COLOR\_LRGB2Luv

COLOR\_LUV2BGR

COLOR\_LUV2LBGR

COLOR\_LUV2LRGB

COLOR\_LUV2RGB

COLOR\_Lab2BGR

COLOR\_Lab2LBGR

COLOR\_Lab2LRGB

COLOR\_Lab2RGB

COLOR\_Luv2BGR

COLOR\_Luv2LBGR

COLOR\_Luv2LRGB

COLOR\_Luv2RGB

COLOR\_M\_RGBA2RGBA

COLOR\_RGB2BGR

COLOR\_RGB2BGR555

COLOR\_RGB2BGR565

COLOR\_RGB2BGRA

COLOR\_RGB2GRAY

COLOR\_RGB2HLS

COLOR\_RGB2HLS\_FULL

COLOR\_RGB2HSV

COLOR\_RGB2HSV\_FULL

COLOR\_RGB2LAB

COLOR\_RGB2LUV

COLOR\_RGB2Lab

COLOR\_RGB2Luv

COLOR\_RGB2RGBA

COLOR\_RGB2XYZ

COLOR\_RGB2YCR\_CB

COLOR\_RGB2YCrCb

COLOR\_RGB2YUV

COLOR\_RGB2YUV\_I420

COLOR\_RGB2YUV\_IYUV

COLOR\_RGB2YUV\_YV12

COLOR\_RGBA2BGR

COLOR\_RGBA2BGR555

COLOR\_RGBA2BGR565

COLOR\_RGBA2BGRA

COLOR\_RGBA2GRAY

COLOR\_RGBA2M\_RGBA

COLOR\_RGBA2RGB

COLOR\_RGBA2YUV\_I420

COLOR\_RGBA2YUV\_IYUV

COLOR\_RGBA2YUV\_YV12

COLOR\_BGR5552RGBA

COLOR\_BGR5652BGR

COLOR\_BGR5652BGRA

COLOR\_BGR5652GRAY

COLOR\_BGR5652RGB

COLOR\_BGR5652RGBA

COLOR\_BGRA2BGR

COLOR\_BGRA2BGR555

COLOR\_BGRA2BGR565

COLOR\_BGRA2GRAY

COLOR\_BGRA2RGB

COLOR\_BGRA2RGBA

COLOR\_BGRA2YUV\_I420

COLOR\_BGRA2YUV\_IYUV

COLOR\_BGRA2YUV\_YV12

COLOR\_BayerBG2BGR

COLOR\_BayerBG2BGRA

COLOR\_BayerBG2BGR\_EA

COLOR\_BayerBG2BGR\_VNG

COLOR\_BayerBG2GRAY

COLOR\_BayerBG2RGB

COLOR\_BayerBG2RGBA

COLOR\_BayerBG2RGB\_EA

COLOR\_BayerBG2RGB\_VNG

COLOR\_BayerGB2BGR

COLOR\_BayerGB2BGRA

COLOR\_BayerGB2BGR\_EA

COLOR\_BayerGB2BGR\_VNG

COLOR\_BayerGB2GRAY

COLOR\_BayerGB2RGB

COLOR\_BayerGB2RGBA

COLOR\_BayerGB2RGB\_EA

COLOR\_BayerGB2RGB\_VNG

COLOR\_BayerGR2BGR

COLOR\_BayerGR2BGRA

COLOR\_BayerGR2BGR\_EA

COLOR\_BayerGR2BGR\_VNG

COLOR\_BayerGR2GRAY

COLOR\_BayerGR2RGB

COLOR\_BayerGR2RGBA

COLOR\_BayerGR2RGB\_EA

COLOR\_BayerGR2RGB\_VNG

COLOR\_BayerRG2BGR

COLOR\_BayerRG2BGRA

COLOR\_BayerRG2BGR\_EA

COLOR\_BayerRG2BGR\_VNG

COLOR\_BayerRG2GRAY

COLOR\_BayerRG2RGB

COLOR\_BayerRG2RGBA

COLOR\_BayerRG2RGB\_EA

COLOR\_BayerRG2RGB\_VNG

COLOR\_COLORCVT\_MAX

COLOR\_GRAY2BGR

COLOR\_GRAY2BGR555

COLOR\_GRAY2BGR565

COLOR\_GRAY2BGRA

COLOR\_GRAY2RGB

COLOR\_GRAY2RGBA

COLOR\_HLS2BGR

COLOR\_HLS2BGR\_FULL

COLOR\_HLS2RGB

COLOR\_BAYER\_BG2BGR

COLOR\_BAYER\_BG2BGRA

COLOR\_BAYER\_BG2BGR\_EA

COLOR\_BAYER\_BG2BGR\_VNG

COLOR\_BAYER\_BG2GRAY

COLOR\_BAYER\_BG2RGB

COLOR\_BAYER\_BG2RGBA

COLOR\_BAYER\_BG2RGB\_EA

COLOR\_BAYER\_BG2RGB\_VNG

COLOR\_BAYER\_GB2BGR

COLOR\_BAYER\_GB2BGRA

COLOR\_BAYER\_GB2BGR\_EA

COLOR\_BAYER\_GB2BGR\_VNG

COLOR\_BAYER\_GB2GRAY

COLOR\_BAYER\_GB2RGB

COLOR\_BAYER\_GB2RGBA

COLOR\_BAYER\_GB2RGB\_EA

COLOR\_BAYER\_GB2RGB\_VNG

COLOR\_BAYER\_GR2BGR

COLOR\_BAYER\_GR2BGRA

COLOR\_BAYER\_GR2BGR\_EA

COLOR\_BAYER\_GR2BGR\_VNG

COLOR\_BAYER\_GR2GRAY

COLOR\_BAYER\_GR2RGB

COLOR\_BAYER\_GR2RGBA

COLOR\_BAYER\_GR2RGB\_EA

COLOR\_BAYER\_GR2RGB\_VNG

COLOR\_BAYER\_RG2BGR

COLOR\_BAYER\_RG2BGRA

COLOR\_BAYER\_RG2BGR\_EA

COLOR\_BAYER\_RG2BGR\_VNG

COLOR\_BAYER\_RG2GRAY

COLOR\_BAYER\_RG2RGB

COLOR\_BAYER\_RG2RGBA

COLOR\_BAYER\_RG2RGB\_EA

COLOR\_BAYER\_RG2RGB\_VNG

COLOR\_BGR2BGR555

COLOR\_BGR2BGR565

COLOR\_BGR2BGRA

COLOR\_BGR2GRAY

COLOR\_BGR2HLS

COLOR\_BGR2HLS\_FULL

COLOR\_BGR2HSV

COLOR\_BGR2HSV\_FULL

COLOR\_BGR2LAB

COLOR\_BGR2LUV

COLOR\_BGR2Lab

COLOR\_BGR2Luv

COLOR\_BGR2RGB

COLOR\_BGR2RGBA

COLOR\_BGR2XYZ

COLOR\_BGR2YCR\_CB

COLOR\_BGR2YCrCb

COLOR\_BGR2YUV

COLOR\_BGR2YUV\_I420

COLOR\_BGR2YUV\_IYUV

COLOR\_BGR2YUV\_YV12

COLOR\_BGR5552BGR

COLOR\_BGR5552BGRA

COLOR\_BGR5552GRAY

COLOR\_BGR5552RGB

I had to leave some out because there where so many! I thought that was pretty interesting and it allowed me to browse some of the conversions that I may need for this project.

Next, I read in both of the images, converted them from BGR to RGB and displayed them:

A screen shot of a person

Description automatically generated

A screen shot of a person

Description automatically generated

Isolating the skin in the normal-light image was straightforward. I simply applied the provided code template that was derived from the Kakumanu paper. Importantly, I applied the transformation to the BGR version of the normal-light image and then converted it to RGB afterwards. This is the result:

A picture containing graphical user interface

Description automatically generated

It turned out fairly pixelated but exclusively focused on the skin area.

The low-light image took more effort to extract just the skin area. My first inkling was to see what the image looked like after converting it to LUV:

A picture containing graphical user interface

Description automatically generated

This image is actually the BGR image converted to LUV not RGB to LUV. From this point I decided to convert the pixels of the BGR image to lumens manually to collect them in a histogram. I extracted each value for blue, green and red individually and multiplied them by .299, .587 and .114 respectively before adding them together and collecting their frequency for a histogram. The histogram turned out like this:

Chart, histogram

Description automatically generated

Next, using a large two-dimensional mask to detect the largest valley of the histogram above I generated this graph:

Chart, line chart, histogram

Description automatically generated

The peek of this graph corresponds to valley at 150 of the histogram. This value also marks a threshold that separates the skin of the low-light image from the background. Using that value as a mask on the original BGR low-light image I created a new image where the back ground is just black and therefor will not be mistaken for skin:

A picture containing application

Description automatically generated

At this point isolating the skin becomes as simple as it was for the normal-light image. The final result looks like this:

A picture containing text

Description automatically generated

Once again, the image is a bit pixelated and there are some straggling outlines (the shadow, jacket and hair line) that, if I wanted to get rid of, could probably be removed with an averaging filter. But for now, I call this good enough.