**CSE 468/568: Robot Algorithms**

**Lab 3: Colorizing the Prokudin-Gorskii photo**

**Collection**

Note: color\*-jpg are in colorimages, while the SSD and CNN are in their own respectively name folder. I did it that way to avoid conflict when main is searching for image file the same folder.

Sum of Squared Differences (SSD):

1. Method: For Sum of Squared Differences method, I separate the 3 different color channel into back

into their intensity 2D-map. From there I took the Blue channel as the base image while

using a loop that iterate over all the image size of all Blue channel, all the while searching

for the smallest sum of squared differences between the Red and Green channel compared

to the Blue channel. After determining the smallest sum of squared differences and them

respective alignment shift. I use shift array circularly on the Red and Green channel to

rotate the pixel to best fit the Blue channel to create the complete RGB image.

1. Alignment Shift Calculated:

* The alignment of image1 Red Channel is circularly shifted by : 10 pixel using SSD.
* The alignment of image1 Green Channel is circularly shifted by : 6 pixel using SSD.
* The alignment of image2 Red Channel is circularly shifted by : 9 pixel using SSD.
* The alignment of image2 Green Channel is circularly shifted by : 4 pixel using SSD.
* The alignment of image3 Red Channel is circularly shifted by : 11 pixel using SSD.
* The alignment of image3 Green Channel is circularly shifted by : 338 pixel using SSD.
* The alignment of image4 Red Channel is circularly shifted by : 13 pixel using SSD.
* The alignment of image4 Green Channel is circularly shifted by : 4 pixel using SSD.
* The alignment of image5 Red Channel is circularly shifted by : 8 pixel using SSD.
* The alignment of image5 Green Channel is circularly shifted by : 7 pixel using SSD.
* The alignment of image6 Red Channel is circularly shifted by : 237 pixel using SSD.
* The alignment of image6 Green Channel is circularly shifted by : 0 pixel using SSD.

Normalized Cross-Correlation (NCC):

1. Method: For normalized cross-correlation method, I first did the same as SSD which split the image

into their own respective color channel in the form of a 2D intensity map. I then proceed

to calculated the normalized cross-correlation of Red and Green channel against the Blue

channel. I then find the peak cross-correlation between the comparison to find the x and y

offset of the image. From the x and y offset I can find the alignment shift in pixel needed

by shift array circularly through multiple both the x and y offset to get the alignment shift

value. After getting the alignment shift value I then proceed to adjust the respective image

so that they can be concatenated to form the complete RGB image.

1. Alignment Shift Calculated:

* The alignment images1 of Red Channel is circularly shifted by : 6 pixel using NCC.
* The alignment images1 of Green Channel is circularly shifted by : 10 pixel using NCC.
* The alignment images2 of Red Channel is circularly shifted by : 0 pixel using NCC.
* The alignment images2 of Green Channel is circularly shifted by : 0 pixel using NCC.
* The alignment images3 of Red Channel is circularly shifted by : 3 pixel using NCC.
* The alignment images3 of Green Channel is circularly shifted by : -4 pixel using NCC.
* The alignment images4 of Red Channel is circularly shifted by : 0 pixel using NCC.
* The alignment images4 of Green Channel is circularly shifted by : 0 pixel using NCC.
* The alignment images5 of Red Channel is circularly shifted by : -6 pixel using NCC.
* The alignment images5 of Green Channel is circularly shifted by : -6 pixel using NCC.
* The alignment images6 of Red Channel is circularly shifted by : 6 pixel using NCC.
* The alignment images6 of Green Channel is circularly shifted by : 0 pixel using NCC.

Afterword: I seem to have issue with using blue as the base color to compare and have more error than using red as the base when using SSD. I guess it like the instruction say that the border causes issue. For accuracy:

SSD using blue: Images 1, 2 and 4 are accurate while 3 and 5 are still fairly accurate but 6 is grossly inaccurate.

SSD using red: Images 1, 2, 4 and 5 are accurate while 3 and 6 are still fairly accurate.

NCC using blue: Images 3 and 6 are accurate while the others moderately accurate.

Somehow my NCC using blue and SSD using red complement each other for accurate images.