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

**Collection**

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Prokudin-Gorskii photograph is a vertical combination of the same photograph with three different frames viz: blue, green and red. Hence to get the colored photograph, the images needs to be spliited into three images and concatenated to get the photograph. Now after the merge of three image, it’s not ecessary that the alignment is of the layers will be correct as seen in the images as “image\*-color.jpg”.

To correct the alignment of the image we use different approaches. While calculating the offset the borders are excluded and the mid of the image is matched.

Approaches Used:

1. **Sum of Squared Differences (SSD):**

In this approach we take two images at a time and find the offset. Initially we take blue as the base image and try to align red and green frame to it.

We calculate the ssd for two image at a time ((blue,red), (blue,green)).

SSD is defined as: sum(sum((image1-image2)^2))

To calculate the SSD, blue is taken as base and red/green layer is iterated from -15 to +15 in both X and Y direction and SSD is calculated for each iteration. The index to provide the minimum value of SSD gives the actual value of offset that should go to red/green layer.

Alignments:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Image | Red | | Green | |
| X-OffSet | Y-OffSet | X-OffSet | Y-OffSet |
| Image1.jpg | 10 | 1 | 5 | 2 |
| Image2.jpg | 9 | 2 | 4 | 2 |
| Image3.jpg | 15 | 4 | 7 | 3 |
| Image4.jpg | 13 | 15 | 15 | 6 |
| Image5.jpg | 11 | 4 | 5 | 2 |
| Image6.jpg | 5 | 1 | 0 | 0 |

1. **Normalized cross-correlation (NCC):**

In this approach, we tend to find the template in the image. In the given problem, it is assumed that we are provided with the blue image and we try to find out the position of other two layers(red/green) on it.

Normxcorr2: This function provided by octave is used for the same.

The output of this function is correlation coefficient. The maximum of the coefficient is found, and the actual offset is calculated. This provides with the position of second image on the first. At the end to get the final value, displacement of second image is calculated with respect to its original position.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Image | Red | | Green | |
| X-OffSet | Y-OffSet | X-OffSet | Y-OffSet |
| Image1.jpg | 10 | -2 | 5 | -1 |
| Image2.jpg | 9 | 1 | 2 | 0 |
| Image3.jpg | 15 | 3 | 7 | 1 |
| Image4.jpg | 14 | -1 | 2 | 0 |
| Image5.jpg | 12 | -2 | 3 | 1 |
| Image6.jpg | 7 | 2 | 0 | 1 |