SSD

The algorithm takes a window in the centre 270 px by 270 px wide to check different alignments. First it places blue filter windows constant , takes the red filter window and shifts it in all possible combinations of x-y directions within a range of 30 px in both directions.
For each iteration it calculates the SSD between the pixels in the red filter and the corresponding pixels in blue filter . It finds the position that gives the minimum SSD calculations and stores it .

It does a similar procedure for green filter by keeping the blue filter window constant and moving the green filter window in all possible combinations of x-y directions within a range of 30 px in both directions. It finds the position that gives the minimum SSD calculations and stores it .

Finally it concatenates all three images with the calculated alignments for the green and red filter.

NCC

The algorithm takes a window in the centre 270 px by 270 px wide to check different alignments. First it places blue filter windows constant , takes the red filter window and shifts it in all possible combinations of x-y directions within a range of 30 px in both directions.

For each iteration it calculates the NCC between the pixels in the red filter and the corresponding pixels in blue filter . It finds the position that gives the minimum SSD calculations and stores it .

It does a similar procedure for green filter by keeping the blue filter window constant and moving the green filter window in all possible combinations of x-y directions within a range of 30 px in both directions. It finds the position that gives the minimum SSD calculations and stores it .

Finally it concatenates all three images with the calculated alignments for the green and red filter.

FEATURE DETECTION and RANSAC

First it detects features by using Harris corner detection algorithm and after that it performs RANSAC operation to find the best alignment.

For feature detection , the first step is to apply 3x3 mean filter to lessen the amount of noise and soften the image for taking out prominent corners. Next we convolve the image with sober operator to get Ix and Iy matrix . With that we find Ix2 , Iy2 , Ixy by doing element by element multiplication .

To find the H matrix for each pixel , we do a summation of values in Ix2 ,Iy2 and Ixy by convolving with a 5x5 Gaussian filter . By taking the determinant and the trace of H matrix at each pixel we are able to find R value at each filter .

Next we have to determine the threshold of R value above which we will consider that point as a corner . For example , we can take a threshold of mean of all R values in the image multiplied by a factor of 2.5 to limit the amount of corners we take to the next stage of RANSAC .

After obtaining the R values above the threshold and their corresponding x and y coordinates , we sort out the maximum 200 R value points and their coordinates .

For RANSAC we can iteratively take two random points , one on red filter and other on blue filter .

If the offset between those points exceed a certain width we can discard them to speed up our run time. For example we can take the width as 12 pixels . There is no point in shifting a filter more than an unreasonable distance to see whether it matches .

Next after calculating the offset we shift the red filter by the same distances .

Next we iterate through all possible pairs of points (one in red and one in blue) and see if there is a coincidence between them . If there is an coincident pair count it as an inliner points .

Likewise for all random shifts calculate the number of inliners and pick the shift required for maximum inliners .

Similarly , conduct RANSAC to find shift required for green filter over the blue filter .

Save the concatenated image with the calculated shifts .

If misaligned we can run RANSAC for higher number of iterations and increase width between selected random points . But it will increase runtime from the current approximate 10 minutes of the entire program.

	SSD	NCC	HARRIS
IMAGE 1	Rx = -10 Ry = 1 Gx = -5 Gy = 1	Rx = -10 Ry = 1 Gx = -5 Gy = 1	Rx = -11 Ry = 1 Gx = -6 Gy = 0
IMAGE 2	Rx = -10 Ry = -2 Gx = -6 Gy = -0	Rx = -10 Ry = -2 Gx = -6 Gy = -0	Rx = -9 Ry = -2 Gx = -6 Gy = 0
IMAGE 3	Rx = -15 Ry = -5 Gx = -8 Gy = -2	Rx = -15 Ry = -5 Gx = -8 Gy = -2	Rx = -11 Ry = -6 Gx = -8 Gy = -2
IMAGE 4	Rx = -14 Ry = -1 Gx = -10 Gy = -1	Rx = -14 Ry = -1 Gx = -10 Gy = -1	Rx = -7 Ry = -6 Gx = -10 Gy = -1
IMAGE 5	Rx = -12 Ry = -4 Gx = -7 Gy = -1	Rx = -12 Ry = -4 Gx = -7 Gy = -1	Rx = -11 Ry = -6 Gx = -7 Gy = -1
IMAGE 6	Rx = -6 Ry = -1 Gx = -6 Gy = -1	Rx = -6 Ry = -1 Gx = -6 Gy = -1	Rx = -6 Ry = -1 Gx = -7 Gy = -1