**Algorithms**

My algorithms should be similar to others. I looped over the pairs of images and extracted the keypoints and their descriptors. I utilized FLANN matching instead of BF to lessen computation time, though I am unsure of whether the search parameters are optimized for our current dataset. I then used the mask from findFundamentalMat to find the inliers and did the same for findHomography. To create the mosaic, I mapped the corners of image 1 to image 2 coordinates to find the bounding box and created two different images; one with warped image 1 in bounding box and one with image 2. Then I combined them together to create the final mosaic. To create the epipolar lines, I followed an OpenCV tutorial on constructing/graphing them and concatenated the two images to create the side by side image.

**Decision Criteria**

Threshold 1 (matches)

At first, I decided on setting a strict threshold but decided against it. I considered this part to be like the application process where the next threshold (an interview) would be the core of selecting pairs that pass. This allows scenes that have some relationship to each other, i.e. drink machines (Image 1) or trees (Image 2), to be able to be scanned through. However, this also increases computation time.

Threshold 2 (F inliers)

As mentioned before, this threshold is stricter considering it inherently calculates matching points that project onto each image with the Fundamental Matrix. This will filter out the majority of images because it is the final decision about whether two images depict the same scene. However, choosing this high of a threshold filters out some office image pairs which should technically pass but fail at the next stage. Images (3 & 4)

Threshold 3 (H inliers)

This threshold answers the question of if the two images can be accurately aligned. I chose this threshold because of the office image pairs. When I allowed them to pass, their images only correctly mapped the screen and did not account for the angle of the room. Their inlier percentage over F inliers was a little bit less than 65 so I took that as the basis. (Images 3 & 4)

**Blending**

The blending algorithm relies on the addWeighted function to combine images into the mosaic. Because of this, I had to cancel out the averaging over regions where the images do not overlap and overlapping region alone.

**Results (overall)**

Strengths: Strict thresholds, optimized matching (somewhat), utilization of optimized cv functions

Weaknesses: Weak first threshold, incorrect epipolar lines (Image 5), blending issues (intensity), small dataset, less control over processes (because of cv functions)

Image 1

A cooler with bottles of water

Description automatically generated

Image 2

A tree with rainbow colored lines

Description automatically generated with medium confidence

Image 3

A computer on a desk

Description automatically generated

Image 4

A computer on a desk

Description automatically generated

Image 5

A computer screen with a white box

Description automatically generated with medium confidence

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Image Pairs | Matches | F Inliers | H Inliers | Decision |
| Drink Machine |  |  |  |  |
| Image1: 3607  Image2: 4707 | 315  Fraction: 0.087  Fraction: 0.066 | 172  Over matches: 0.546 |  | No.  Few inliers, Different scenes |
| Image1: 3607  Image3: 3683 | 122  Fraction: 0.034  Fraction: 0.033 |  |  | No.  Few matches, Different scenes |
| Image2: 4707  Image3: 3683 | 368  Fraction: 0.078  Fraction: 0.01 | 224  Over matches: 0.609 |  | No.  Few inliers, Different scenes |
| Frear Park |  |  |  |  |
| Image1: 668  Image2: 863 | 152  Fraction: 0.228  Fraction: 0.176 | 147  Over matches: 0.967 | 132  Over F: 0.898 | Yes.  Over 0.65 percent inliers. |
| Office |  |  |  |  |
| IMG2536: 667  IMG2537: 610 | 257  Fraction: 0.385  Fraction: 0.421 | 222  Over matches: 0.864 | 168  Over F: 0.757 | Yes.  Over 0.65 percent inliers. |
| IMG2536: 667  IMG2538: 751 | 153  Fraction: 0.229  Fraction: 0.204 | 95  Over matches: 0.621 |  | No.  Few inliers, Different scenes |
| IMG2537: 610  IMG2538: 751 | 121  Fraction: 0.199  Fraction: 0.161 | 78  Over matches: 0.645 |  | No.  Few inliers, Different scenes |
| Tree mrc |  |  |  |  |
| Image1: 6861  Image2: 7277 | 1613  Fraction: 0.235  Fraction: 0.222 | 1535  Over matches: 0.952 | 1377  Over F: 0.897 | Yes.  Over 0.65 percent inliers. |
| Image1: 6861  Image3: 5997 | 505  Fraction: 0.074  Fraction: 0.084 | 400  Over matches: 0.792 |  | No.  Few inliers, Different scenes |
| Image1: 6861  Image4: 5475 | 109  Fraction: 0.016  Fraction: 0.020 |  |  | No.  Different scenes |
| Image2: 7277  Image3: 5997 | 1289  Fraction: 0.177  Fraction: 0.215 | 1184  Over matches: 0.919 | 896  Over F: 0.757 | Yes.  Over 0.65 percent inliers. |
| Image2: 7277  Image4: 5475 | 311  Fraction: 0.043  Fraction: 0.057 |  |  | No.  Few matches, Different scenes |
| Image3: 5997  Image4: 5475 | 734  Fraction: 0.122  Fraction: 0.134 | 613  Over matches: 0.835 | 406  Over F: 0.662 | Yes.  Over 0.65 percent inliers. |
| VCC Entrance |  |  |  |  |
| Image1: 2337  Image2: 4457 | 964  Fraction: 0.412  Fraction: 0.216 | 881  Over matches: 0.914 | 454  Over F: 0.515 | No.  Less than 0.65 percent inliers. |
| Image1: 2337  Image3: 491 | 125  Fraction: 0.053  Fraction: 0.255 | 34  Over matches: 0.272 |  | No.  Few inliers, Different scenes |
| Image2: 4457  Image3: 491 | 202  Fraction: 0.045  Fraction: 0.411 |  |  | No.  Few matches, Different scenes. |