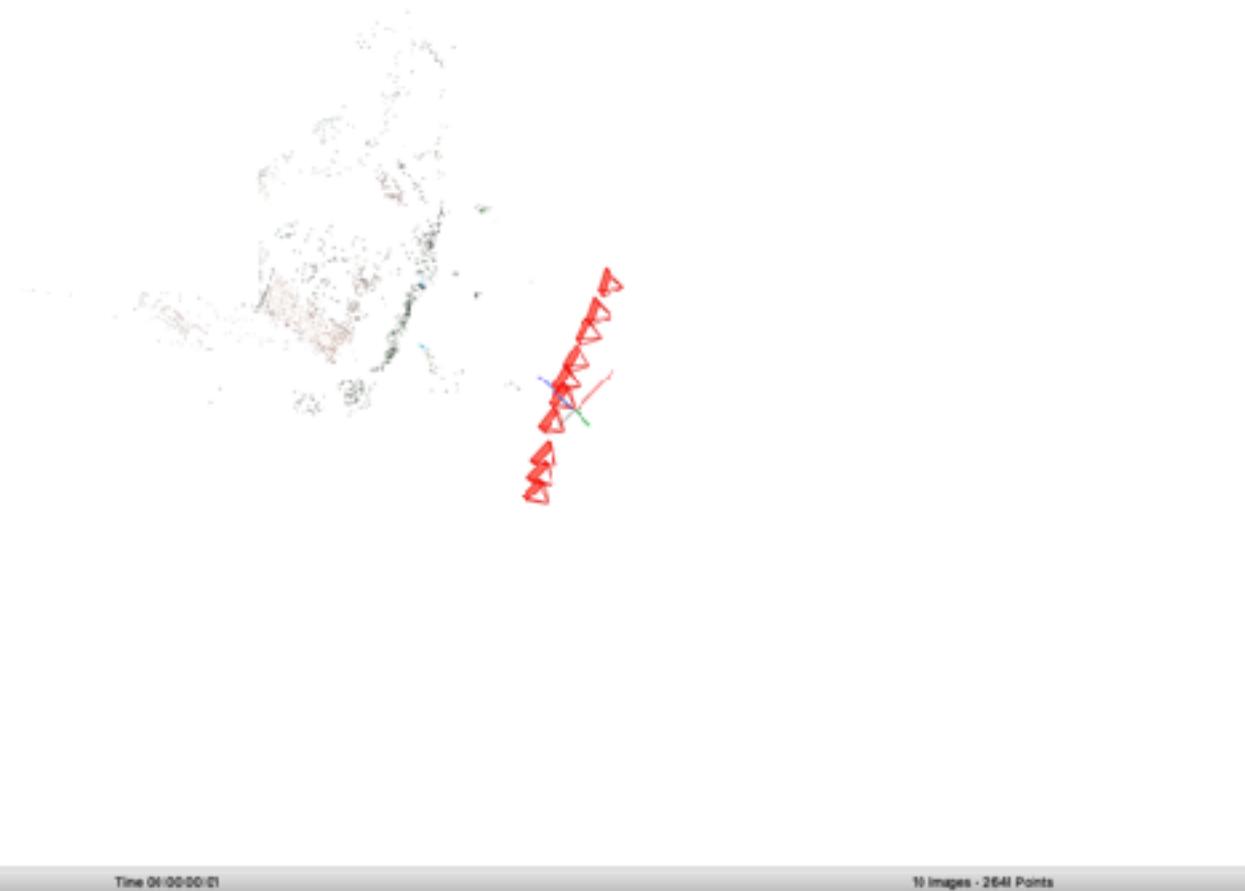


Hw_3

Shyam Sunder Rajasekaran
5088838103

1) COLMAP

10 images with exhaustive



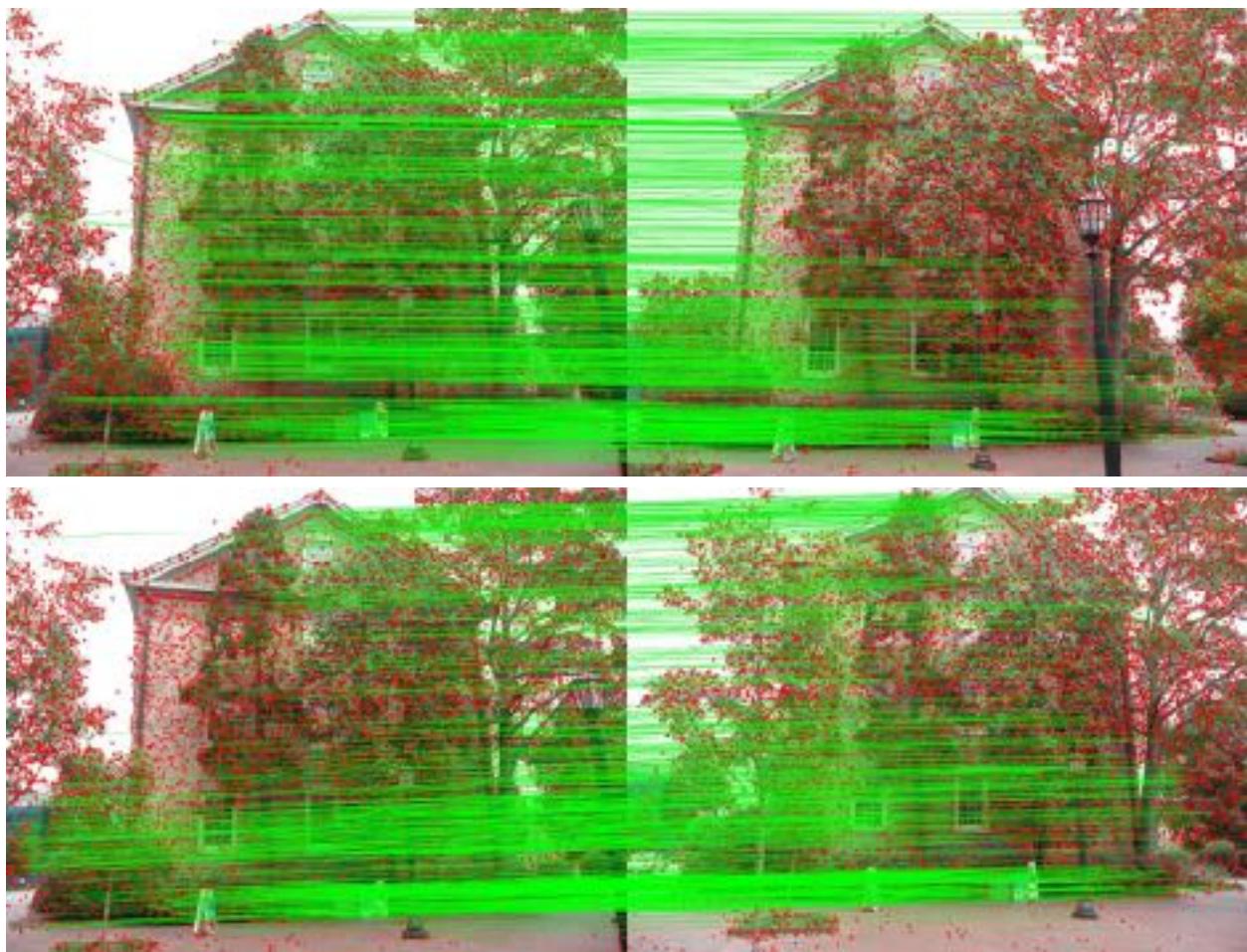
Model Stats:

| | |
|-----------------------------|---------|
| Cameras | 10 |
| Images | 10 |
| Registered images | 10 |
| Points | 2541 |
| Observations | 1041 |
| Mean track length | 3.85187 |
| Mean observations per image | 104.1 |
| Mean reprojection error | 0.06325 |

Key Feature points of images 2 and 7:



Match points of two pair of images from first 10 samples:



Sequential :10 images



Time 00:00:00:01

10 Images - 2640 Points

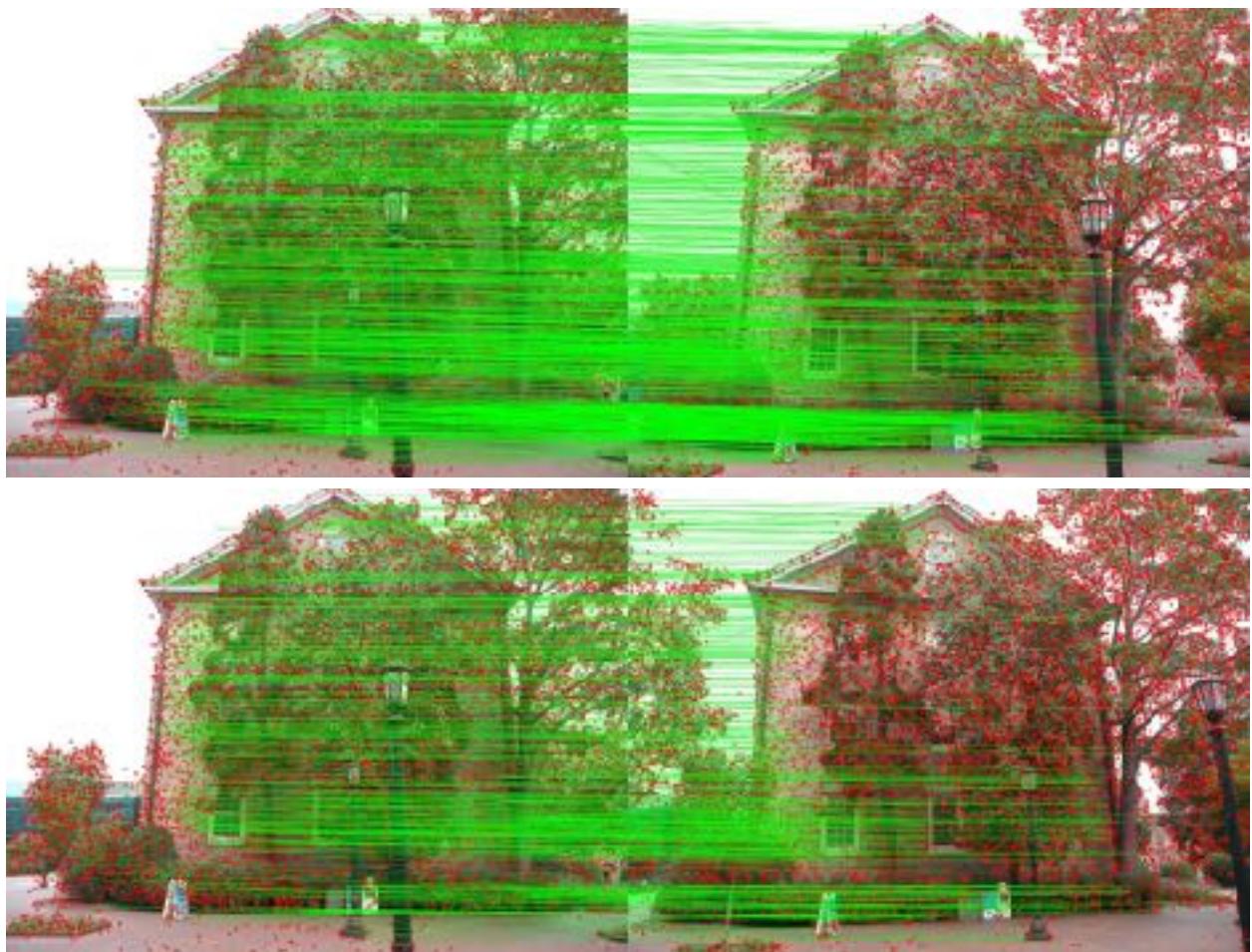
Model Stats:

| Cameras | N |
|-----------------------------|---------|
| Images | 10 |
| Registered images | N |
| Points | 2640 |
| Observations | 1037 |
| Mean track length | 3.80189 |
| Mean observations per image | 103.7 |
| Mean reprojection error | 0.9602 |

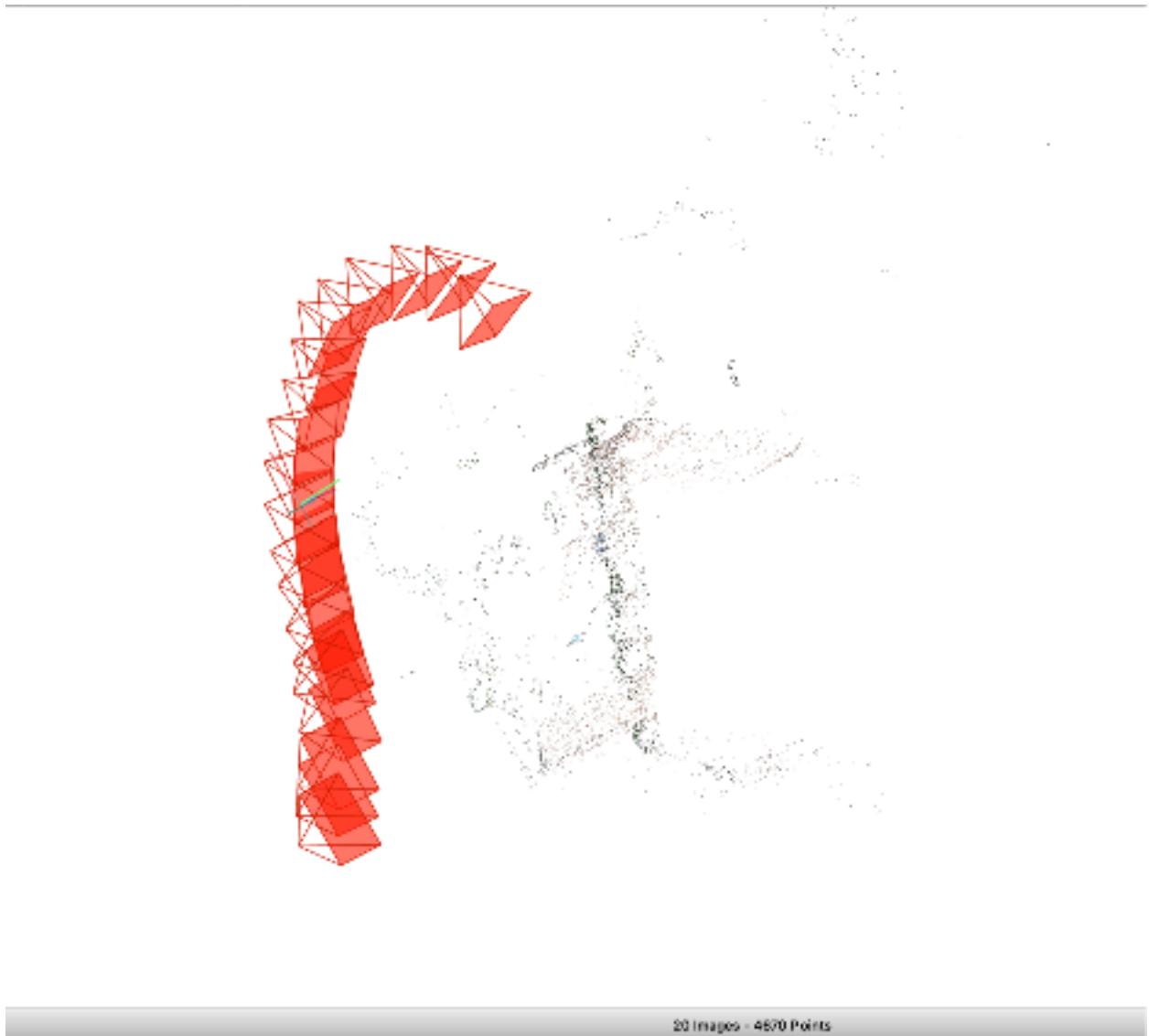
Key Feature points images 3 and 9:



Overlap matches between pairs 8 and 7:



20 images Exhaustive:

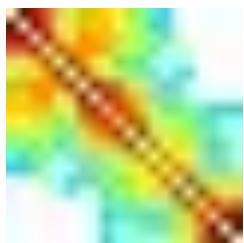


20 Images - 4670 Points

Model Stats:

| | |
|-----------------------------|--------|
| Cameras | 19 |
| Images | 19 |
| Registered images | 19 |
| Points | 470 |
| Observations | 1387 |
| Mean track length | 1.9116 |
| Mean observations per image | 93.35 |
| Mean reprojection error | 1.6705 |

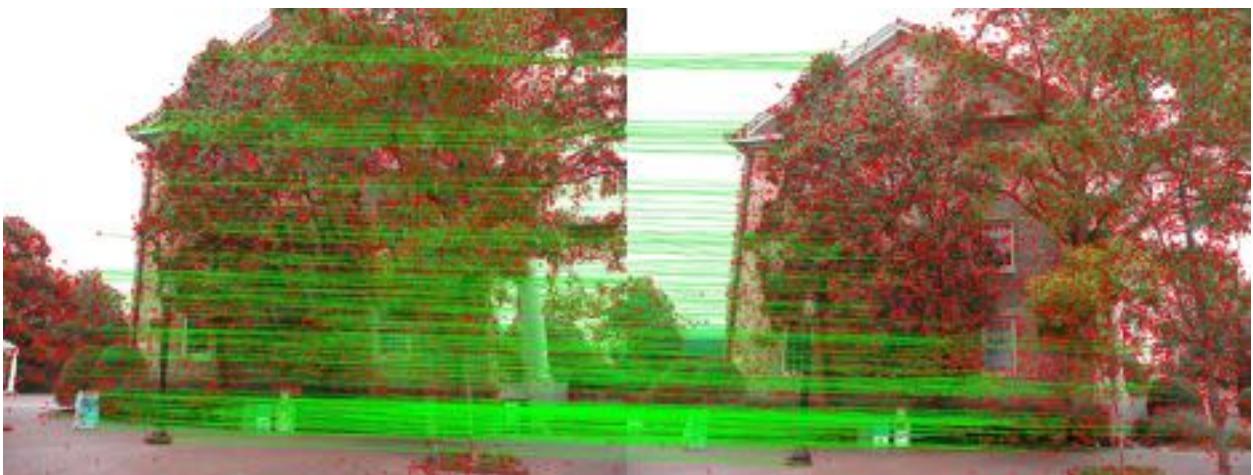
Match matrix:



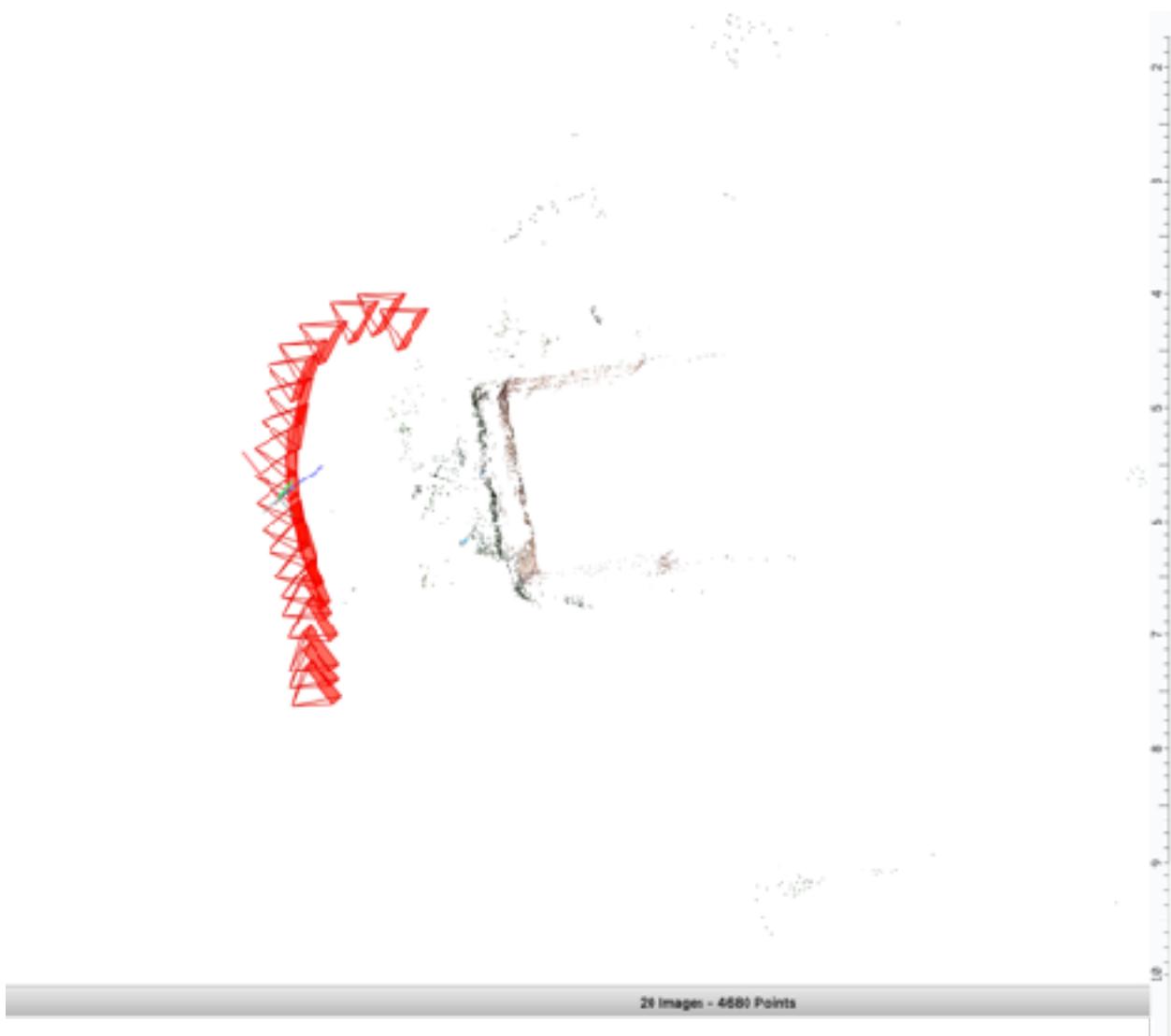
Key feature points 10 and 15:



Overlap match between img 16-17 and 13-12:



20 images Sequential:



Model stats:

| | |
|-----------------------------|----------|
| Scenes | 8 |
| Images | 96 |
| Re-projected images | 29 |
| Points | 4680 |
| Observations | 10265 |
| Mean track length | 399278 |
| Mean observations per image | 93.25 |
| Mean reprojection error | 0.572883 |

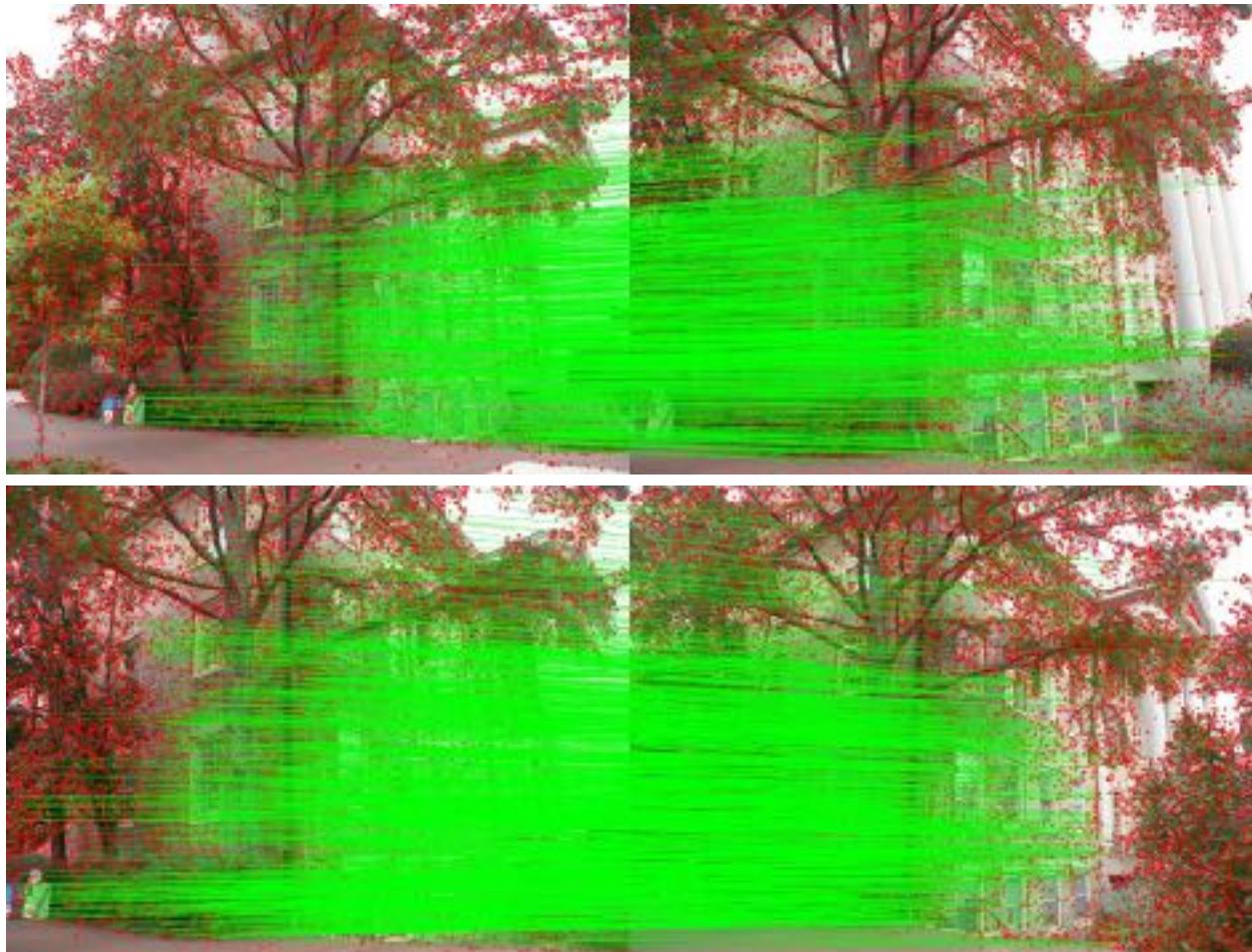
Match matrix:



Key feature points of 11 and 18:



Overlap matches between img pairs 18-20 and 20-19:



Model stats table comparison:

| DATASET | Matching | Mean Reprojection Error |
|------------------|-----------------|--------------------------------|
| 10 Images | Exhaustive | 0.56326 |
| 10 Images | Sequential | 0.56012 |
| 20 Images | Exhaustive | 0.571815 |
| 20 Images | Sequential | 0.572863 |

OBSERVATIONS:

Datasets with **10 vs 20 images**:

In comparison to the 10-image datasets, the 20-image datasets yielded over twice as many points and observations.

The 20-image datasets had somewhat larger mean reprojection errors, which may have been caused by their greater complexity and propensity for error accumulation.

Sequential vs exhaustive matching:

Extensive matching yielded somewhat more points and observations for both datasets than sequential matching.

The mean reprojection errors in the 10-image dataset were slightly reduced by sequential matching, whereas the errors in the 20-image dataset were slightly increased.

In conclusion:

- The 10-image dataset with sequential matching yielded the lowest mean reprojection error (0.56012 pixels), according to the results, indicating that it may offer the best accurate reconstruction given its complexity.
- Nevertheless, at the expense of a marginally larger reprojection error, the 20-image dataset with exhaustive matching offered the most thorough reconstruction with the greatest number of points and observations.
- In a smaller scenario, the 10-image sequential matching would be better for maximum accuracy.
- The 20-image exhaustive matching would be a superior option for more thorough coverage and detail, particularly in larger or more complicated scenes, because the gain in reconstruction detail is far more than the increase in reprojection error.

2) Gaussian Splatting

From the Colmap results we found that 20 images with exhaustive matching is superior, therefore we are using 10-image with 7000 iterations and 20 image exhaustive matching with 30000 iterations for the Gaussian splatting.

10-image exhaustive:

Ground truth:



7000 iterations:



SSIM: 0.8442792

PSNR: 27.0978211

LPIPS: 0.1432617

20-images exhaustive:

Ground Truth:





30000 iterations:







SSIM: 0.9032534

PSNR: 30.64971389770508

LPIPS: 0.1037524