

## Hw\_3

Shyam Sunder Rajasekaran  
5088838103

### 1) COLMAP

10 images with exhaustive



Model Stats:

Cameras	10
Images	10
Registered images	10
Points	2641
Observations	10041
Mean track length	9.87187
Mean observations per image	1004.1
Mean reprojection error	0.6328

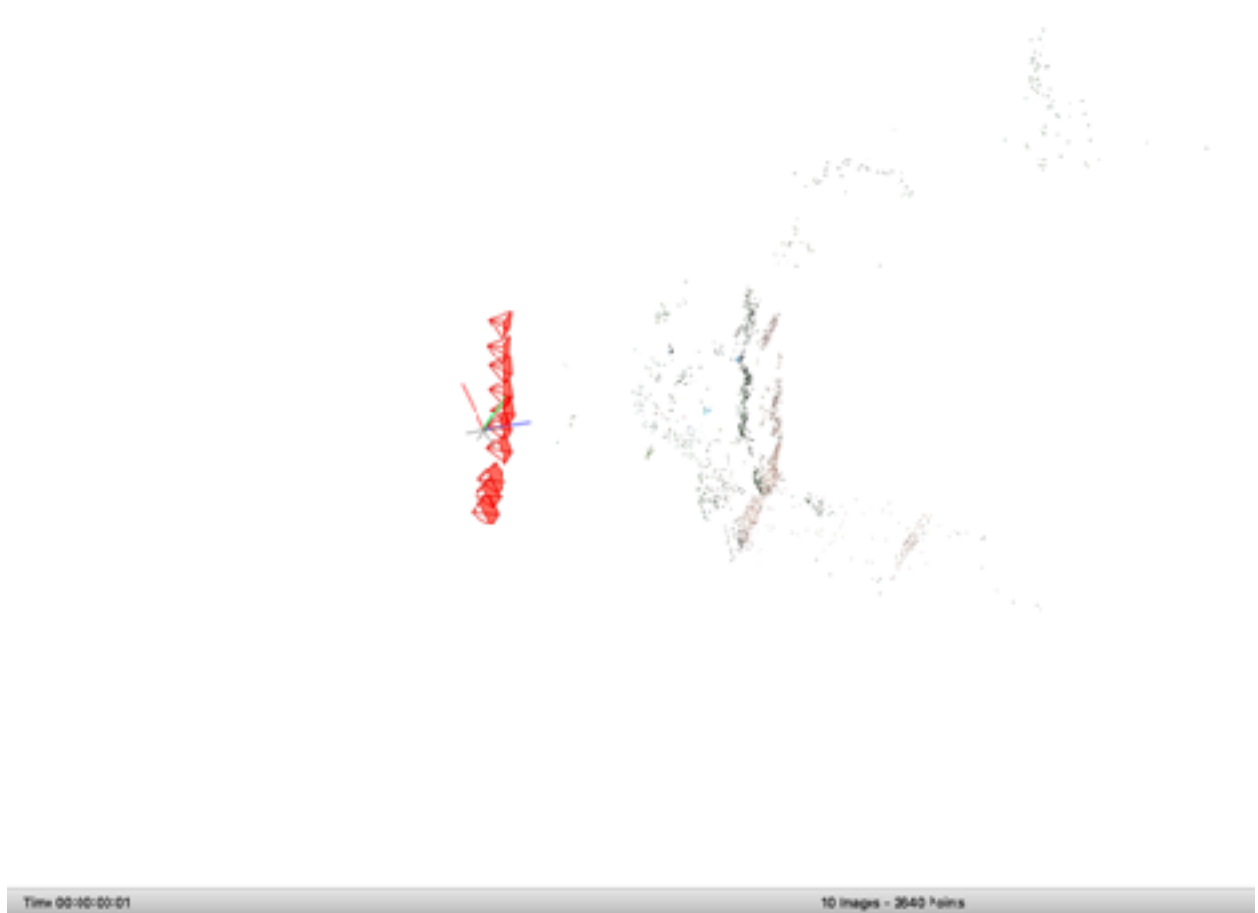
Key Feature points of images 2 and 7:



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



Sequential :10 images



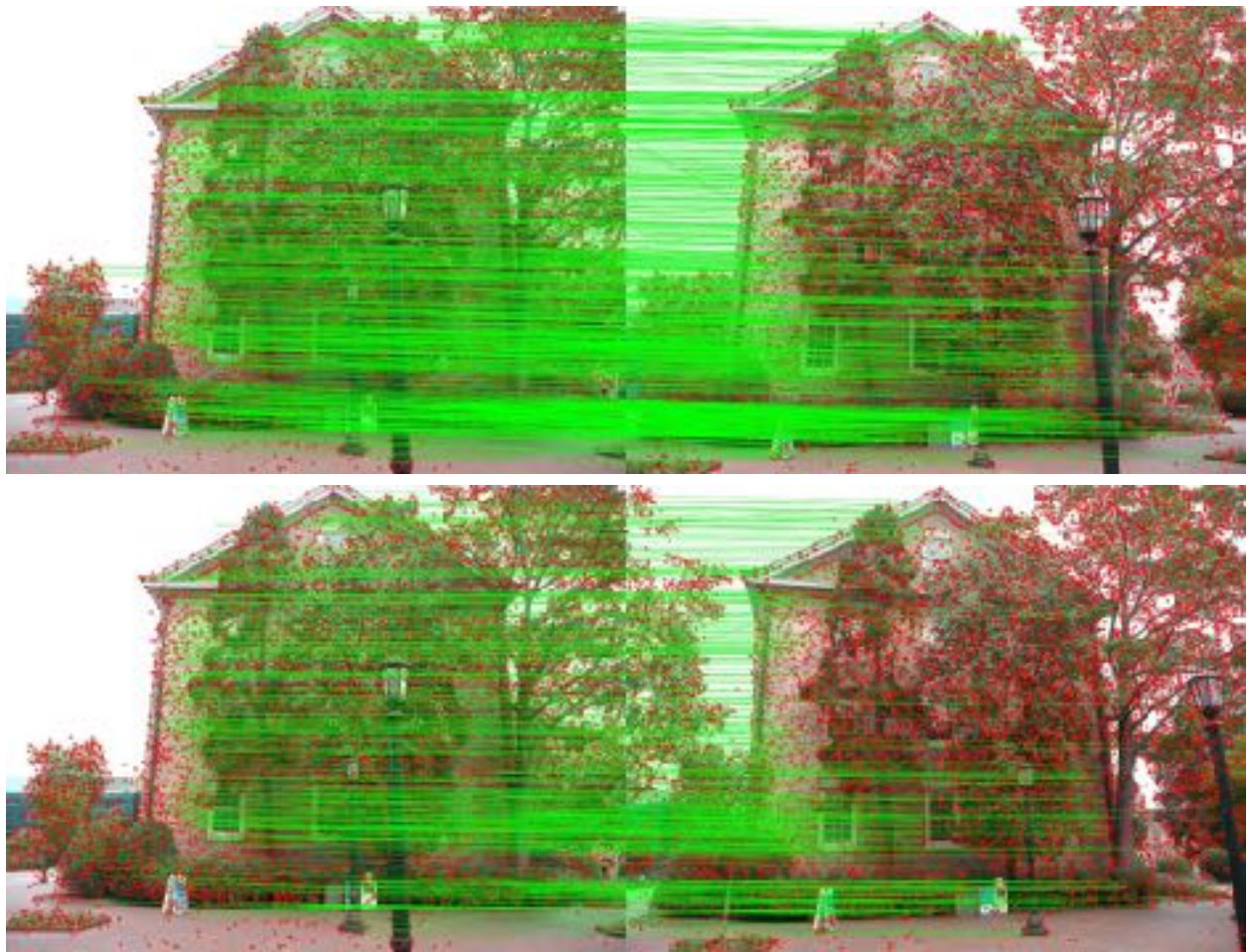
Model Stats:

Cameras	N
Images	N
Registered Images	N
Points	2640
Observations	1037
Mean track length	3.80119
Mean observations per image	103.7
Mean reprojection error	0.5602

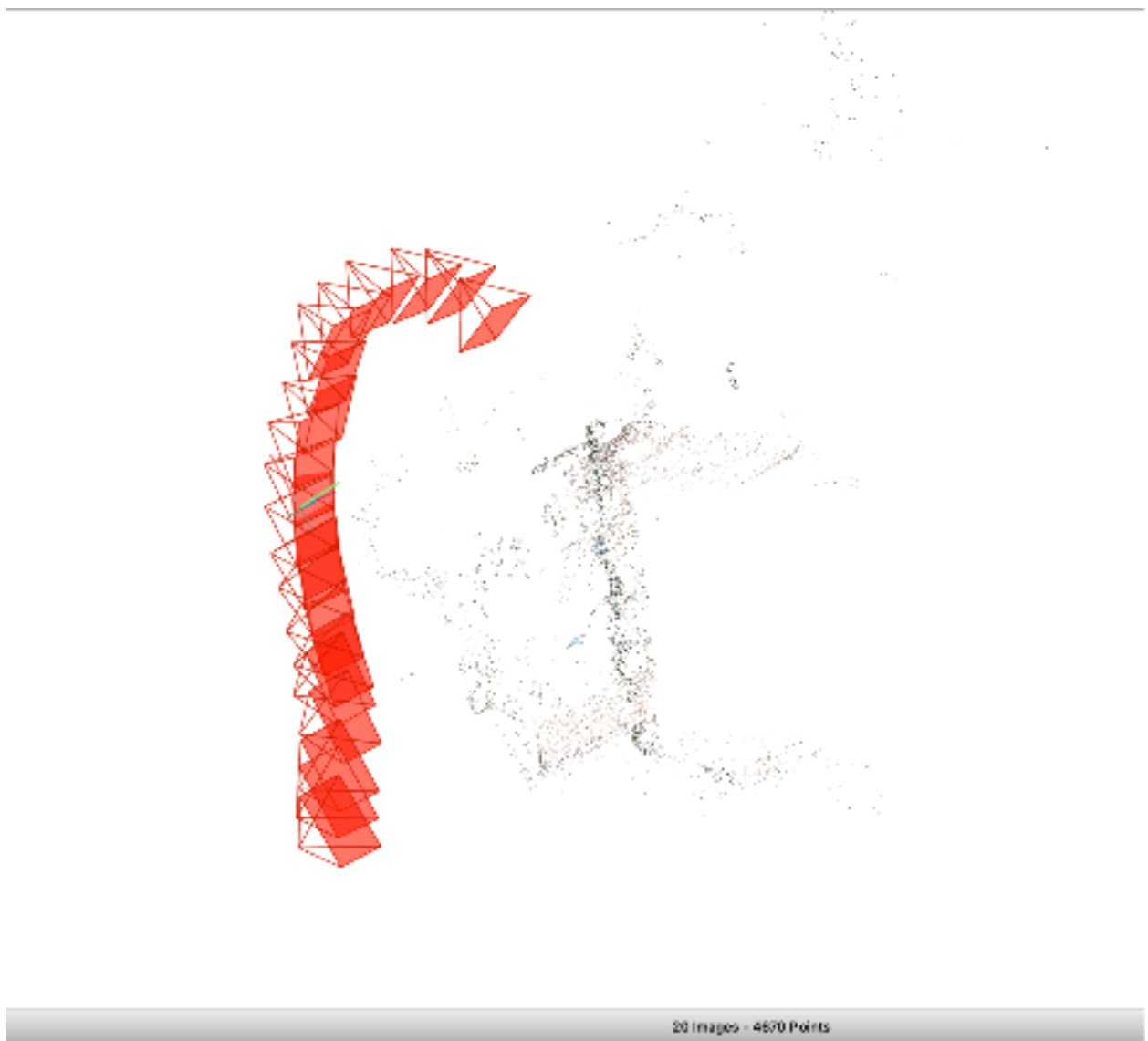
Key Feature points images 3 and 9:



Overlap matches between pairs 8 and 7:



20 images Exhaustive:



Model Stats:

Cameras	20
Images	20
Registered images	20
Points	4670
Observations	19387
Mean track length	1.91116
Mean observations per image	913.35
Mean reprojection error	1.57305

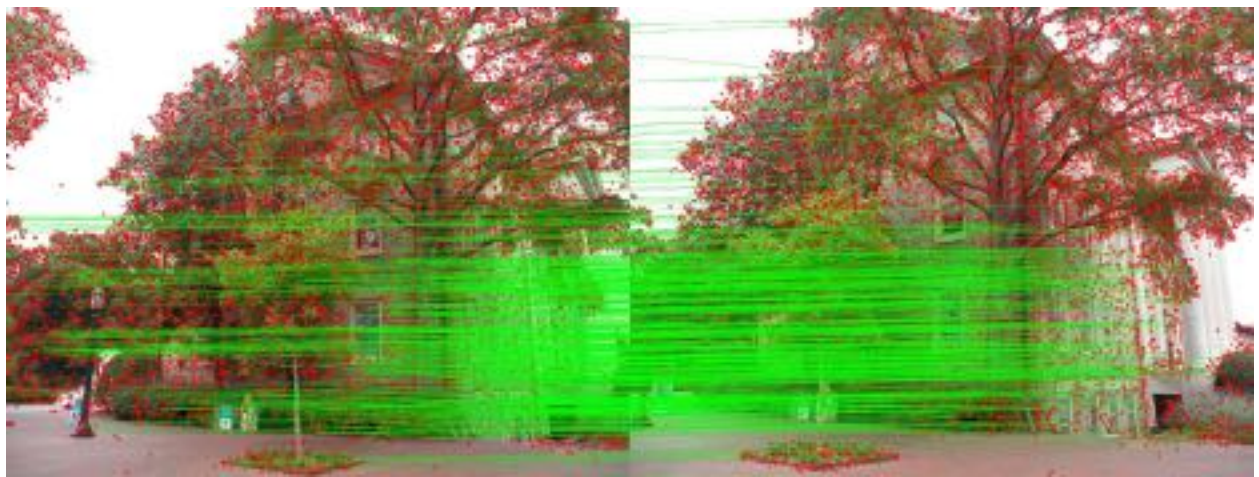
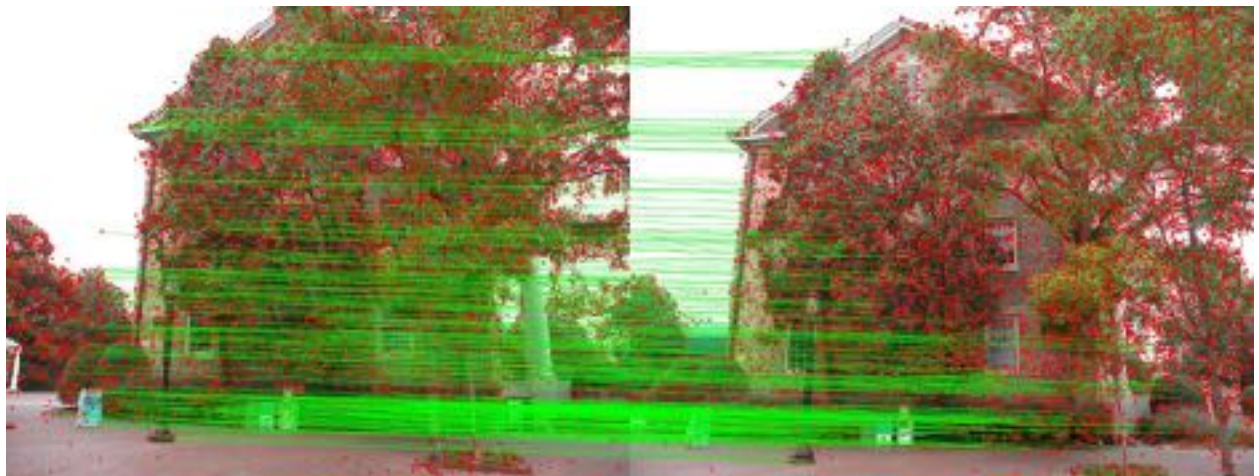
Match matrix:



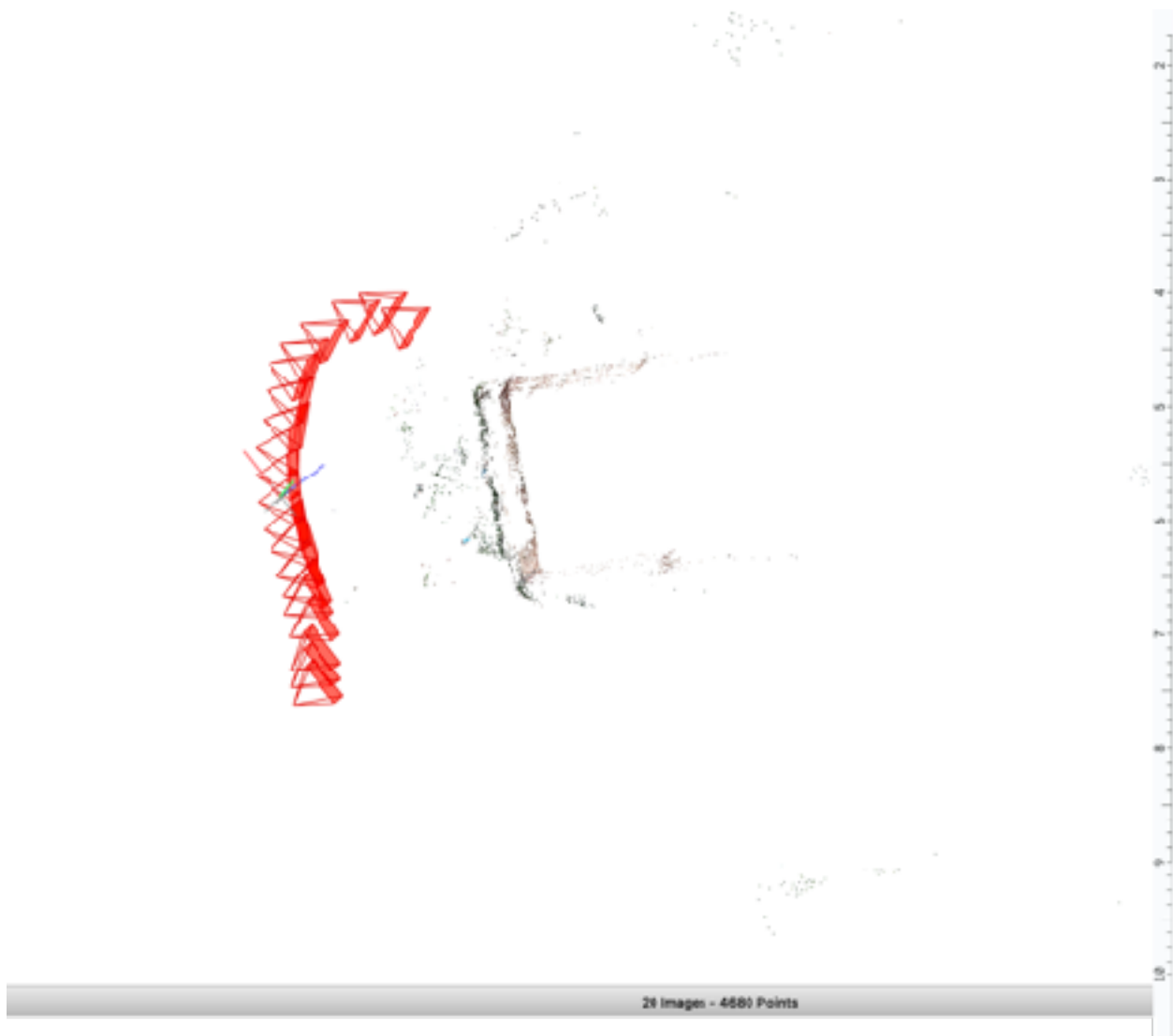
Key feature points 10 and 15:



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



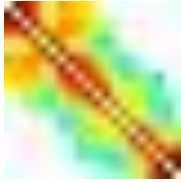
20 images Sequential:



Model stats:

Cameras	20
Images	76
Registered images	20
Points	4880
Observations	18265
Mean track length	3.90275
Mean observations per image	913.25
Mean reprojection error	0.572663

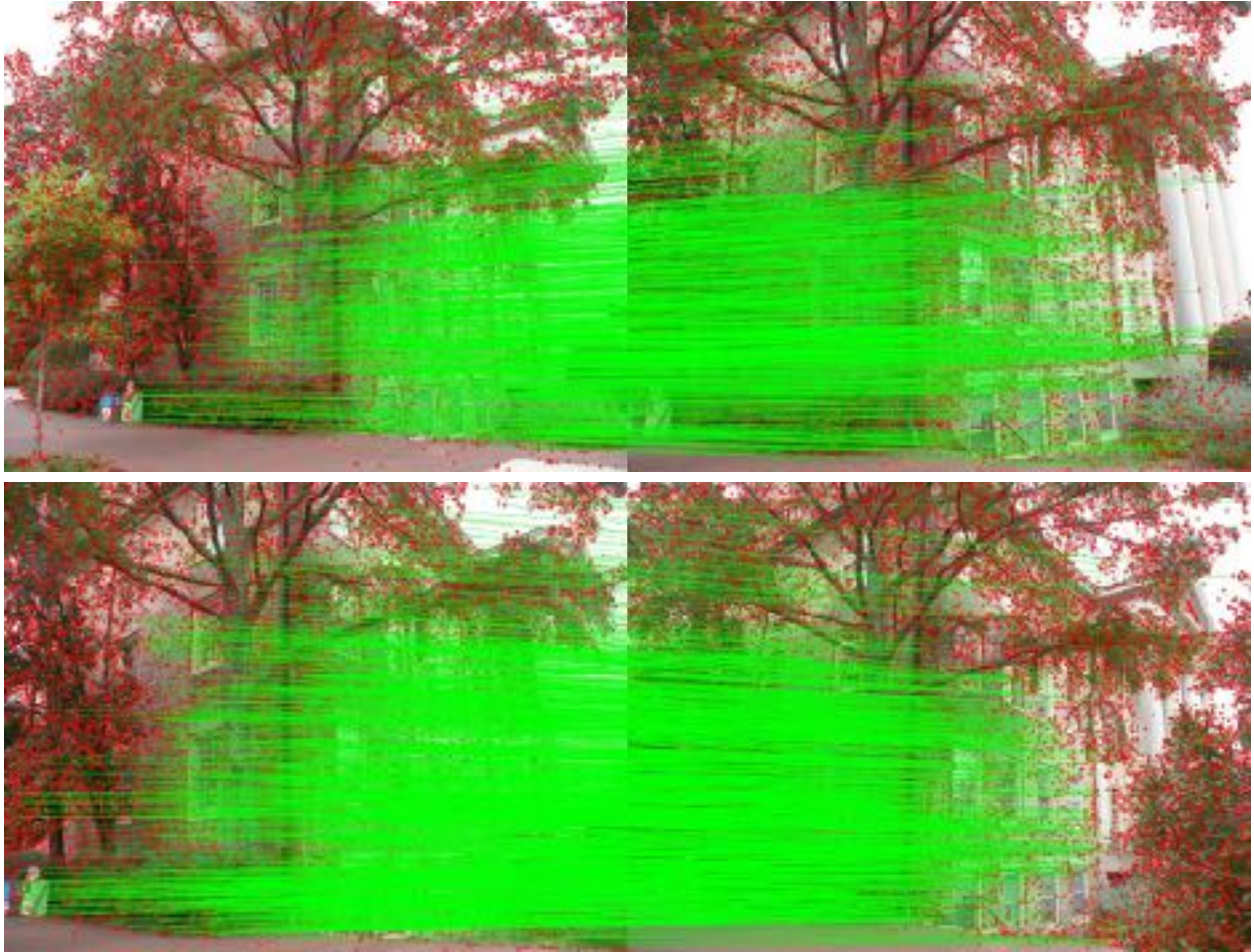
Match matrix:



Key feature points of 11 and 18:



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



**Model stats table comparison:**

<b>DATASET</b>	<b>Matching</b>	<b>Mean Reprojection Error</b>
<b>10 Images</b>	Exhaustive	0.56326
<b>10 Images</b>	Sequential	0.56012
<b>20 Images</b>	Exhaustive	0.571815
<b>20 Images</b>	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