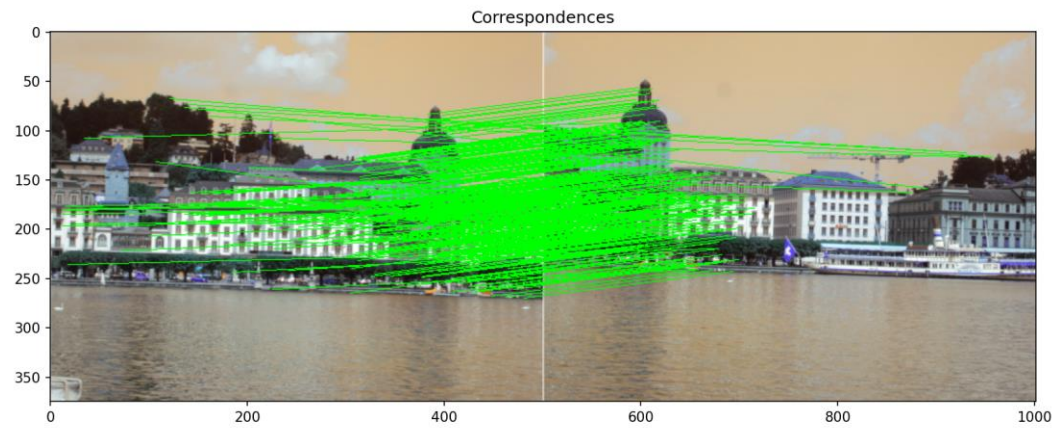Extra Credit (Assignment 6) – Derrick Joyce

1. Qualitative result - matched keypoints between 2 images

2. Final stitched image
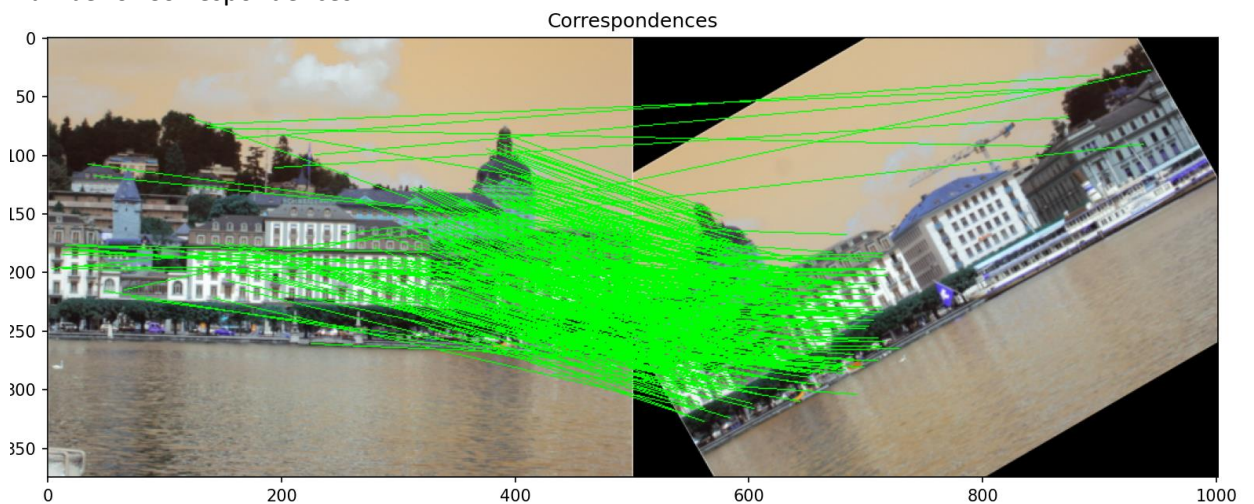

Analysis of Properties
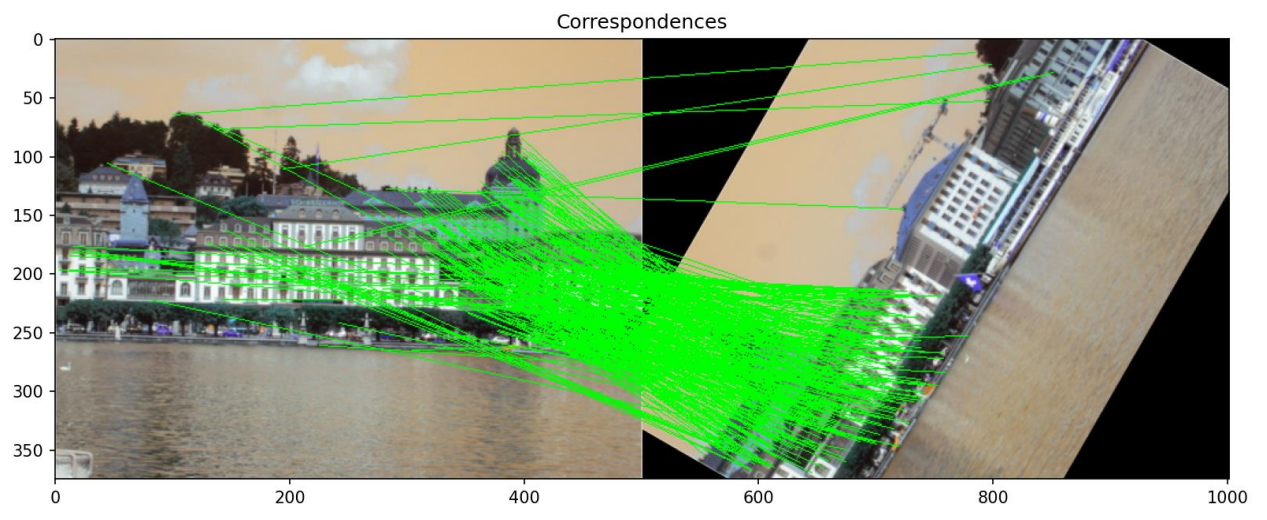
1. **Rotation (30 degrees -> 360 degrees)**
   30 degrees
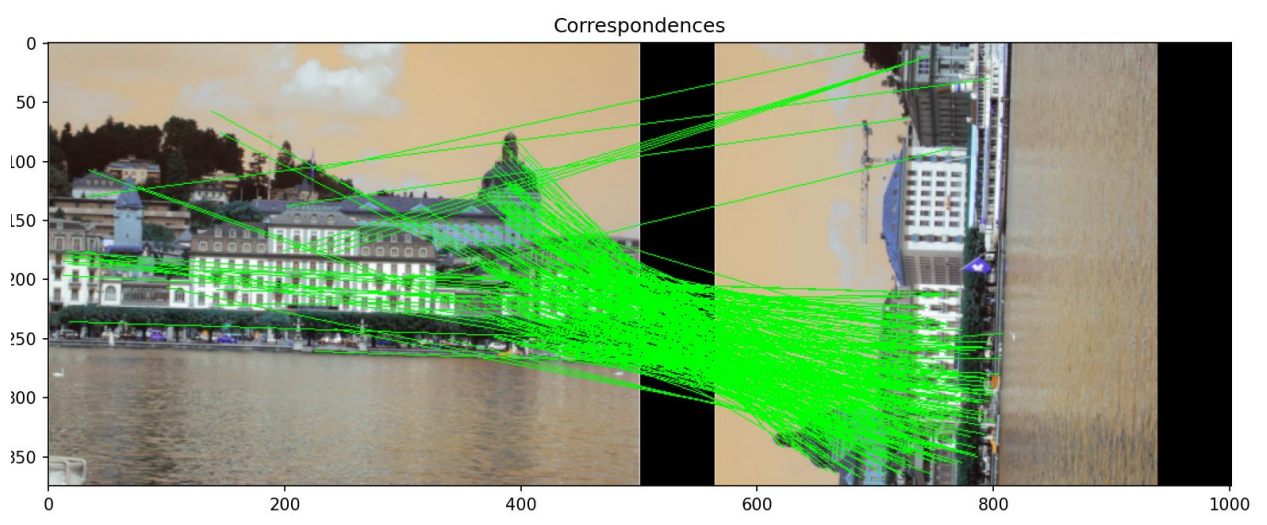   Number of Correspondences = 441
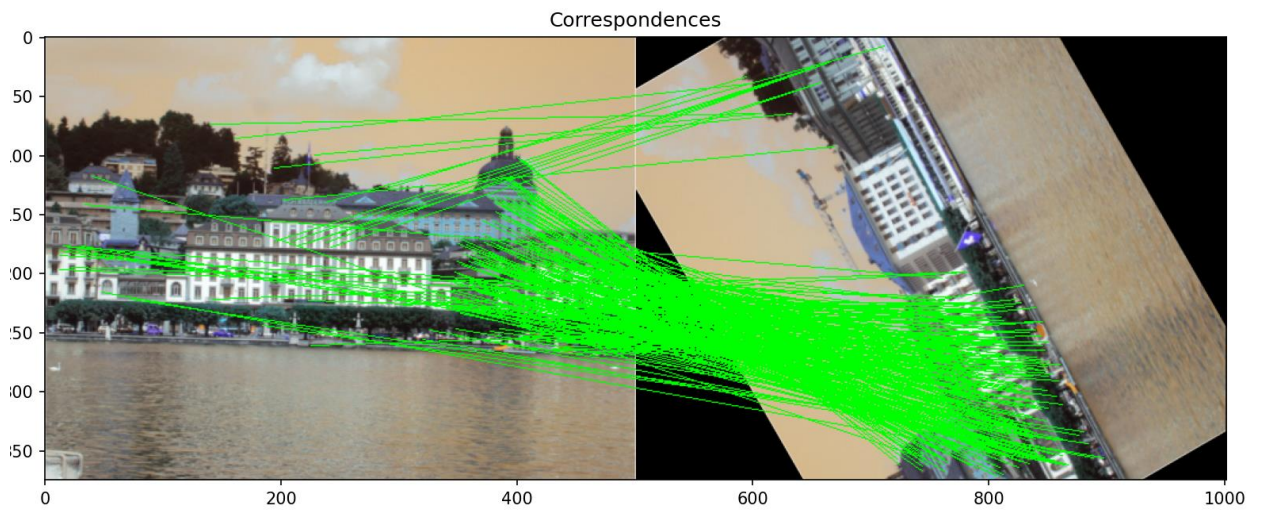
60 degrees
Number of Correspondences = 383

90 degrees
Number of Correspondences = 298

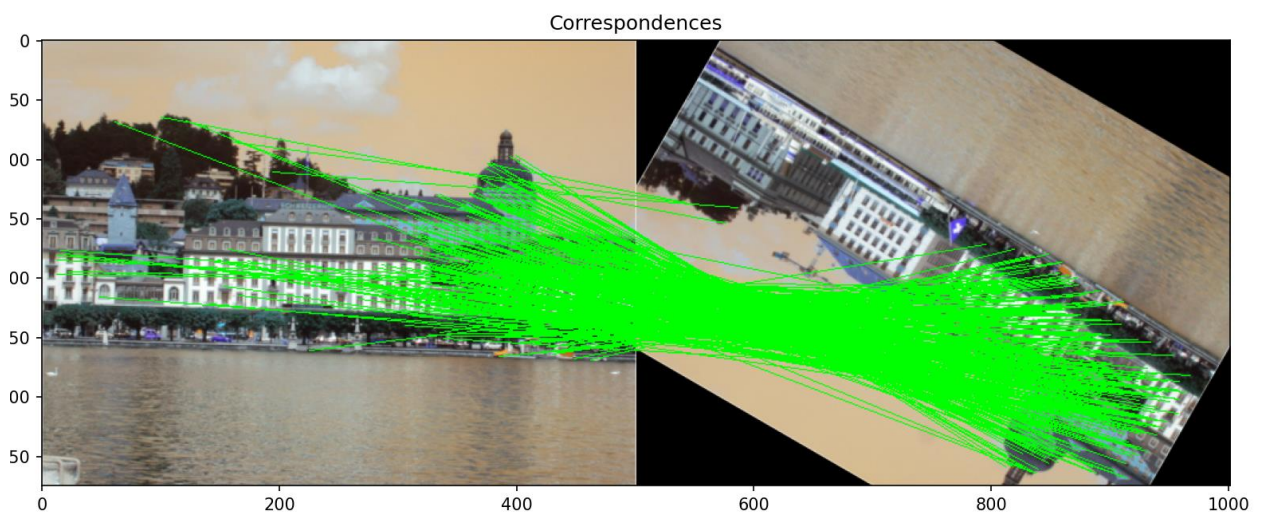## 120 degrees
Number of Correspondences = 304

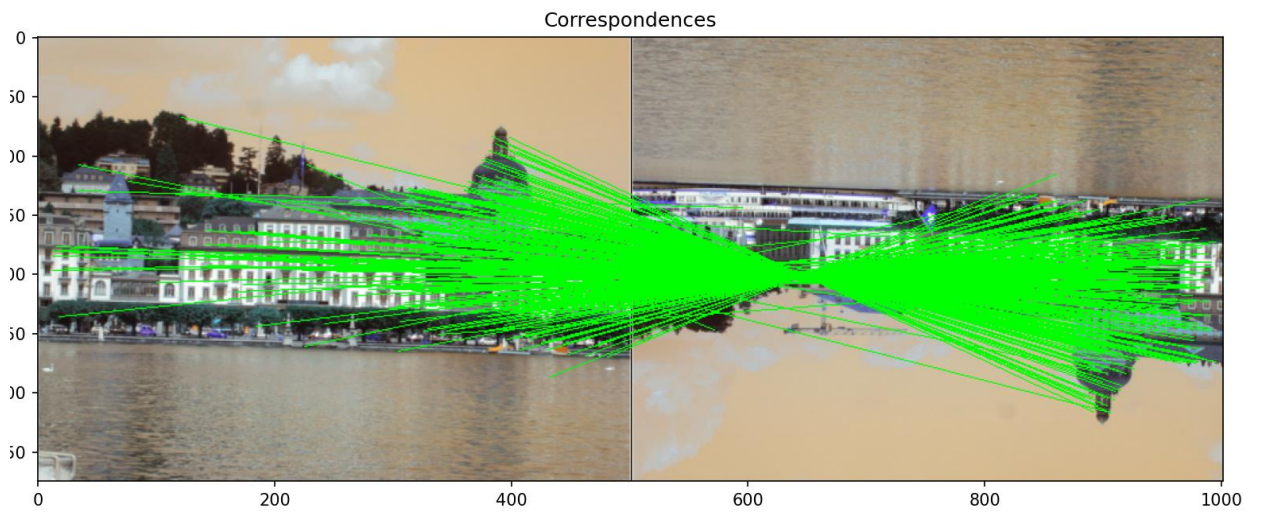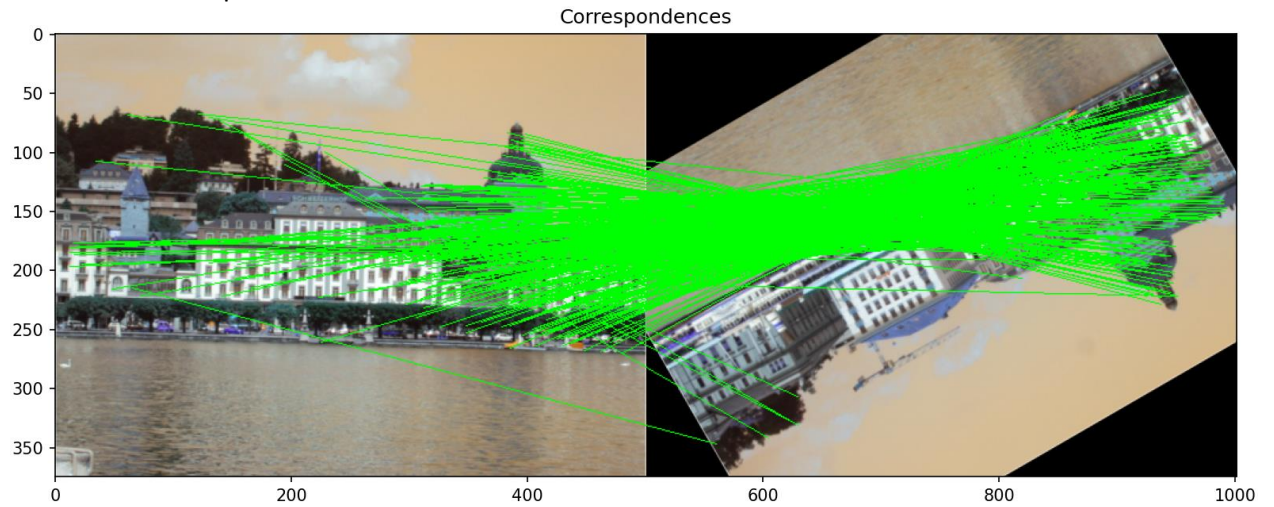Correspondences

150 degrees
Number of Correspondences = 401

Correspondences

180 degrees
Number of Correspondences = 425

Correspondences

210 degrees
Number of Correspondences = 429

Correspondences

240 degrees
Number of Correspondences = 386
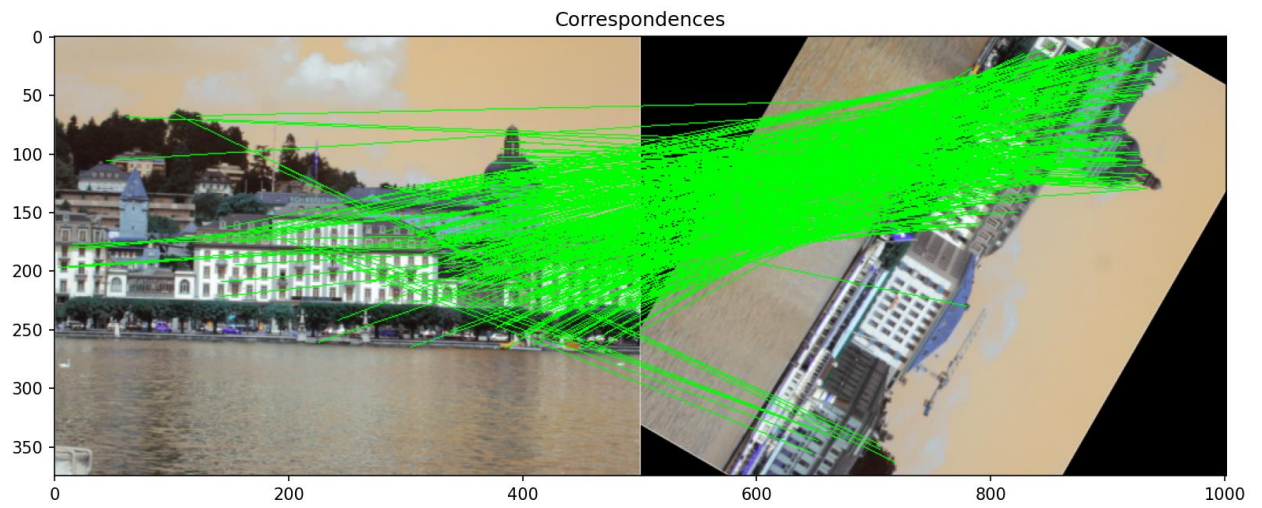
Correspondences

270 degrees
Number of Correspondences = 309

Correspondences
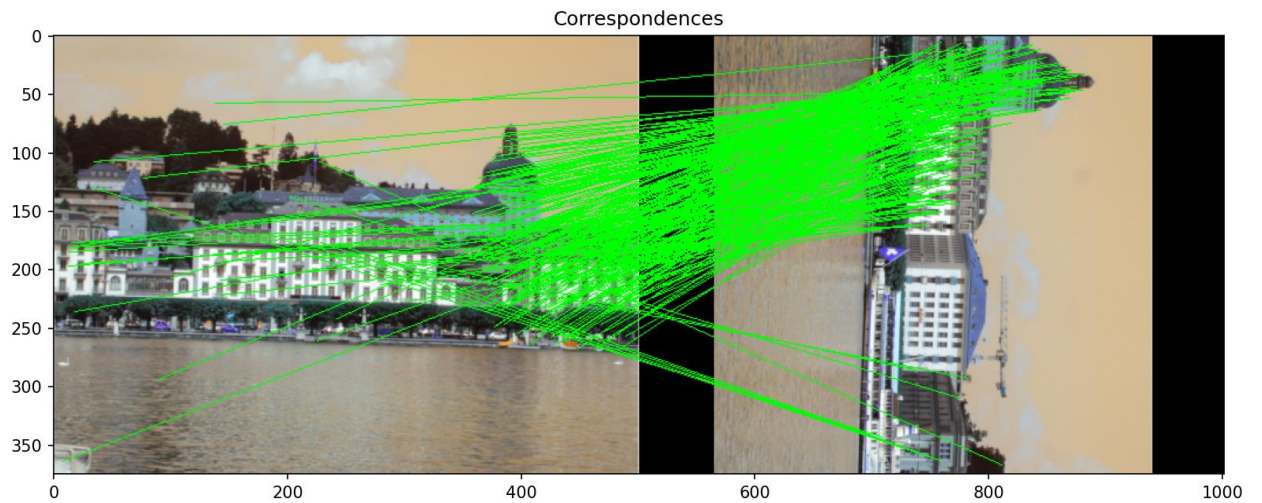
300 degrees
Number of Correspondences = 307
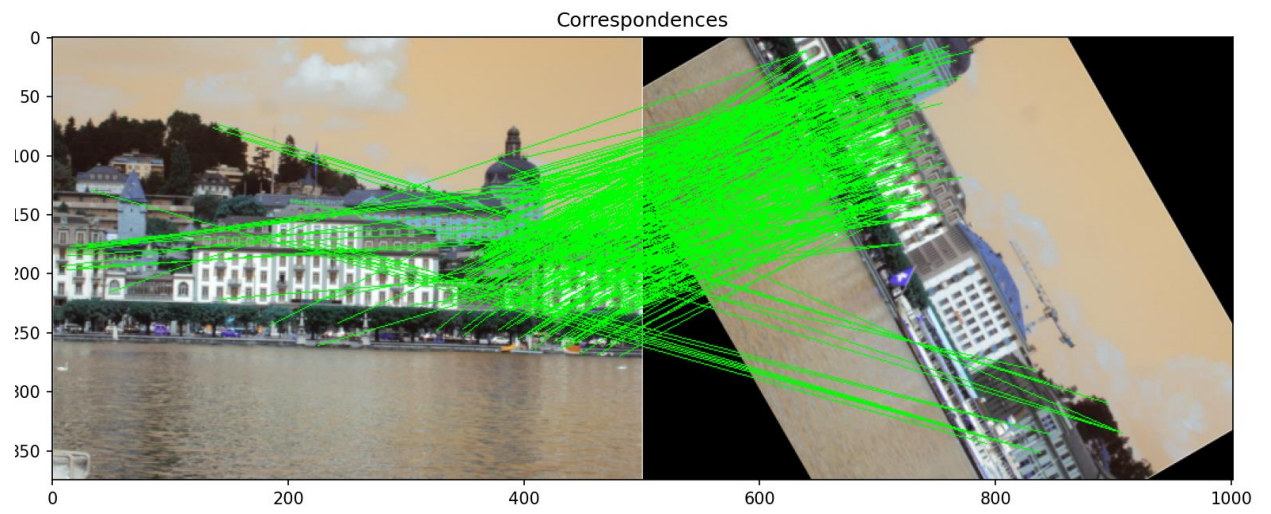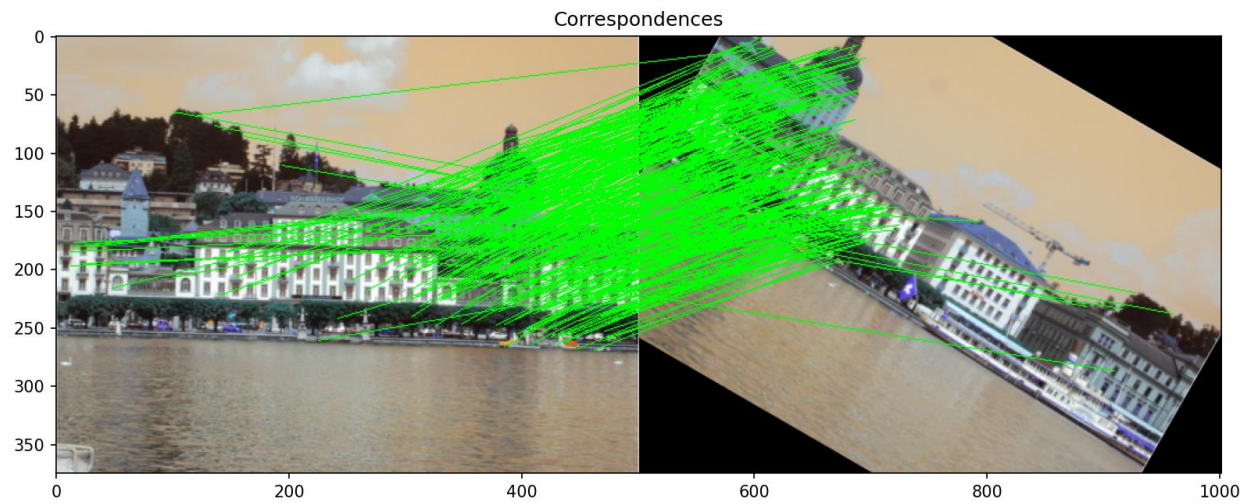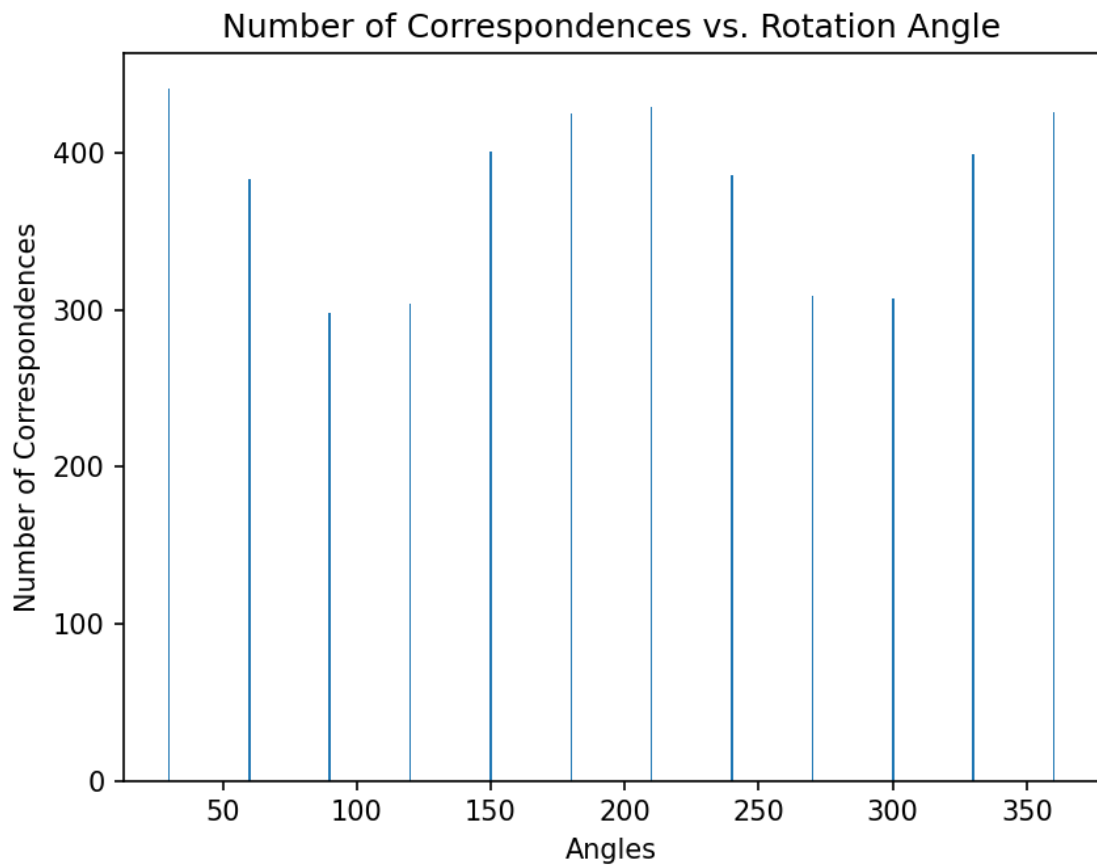

Correspondences

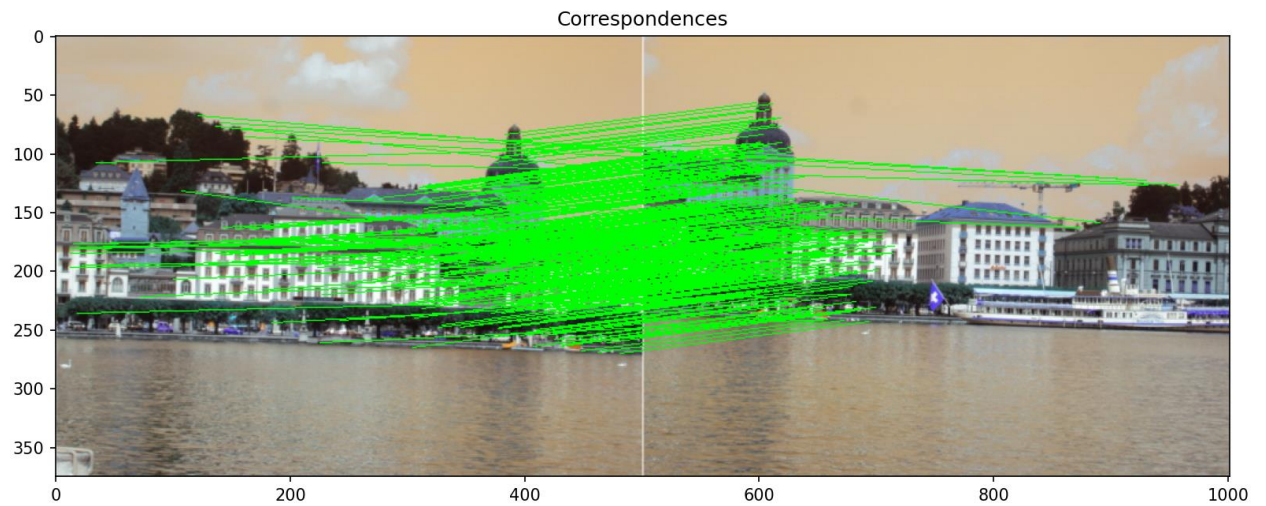## 330 degrees
Number of Correspondences = 399

Correspondences

<u>360 degrees</u>
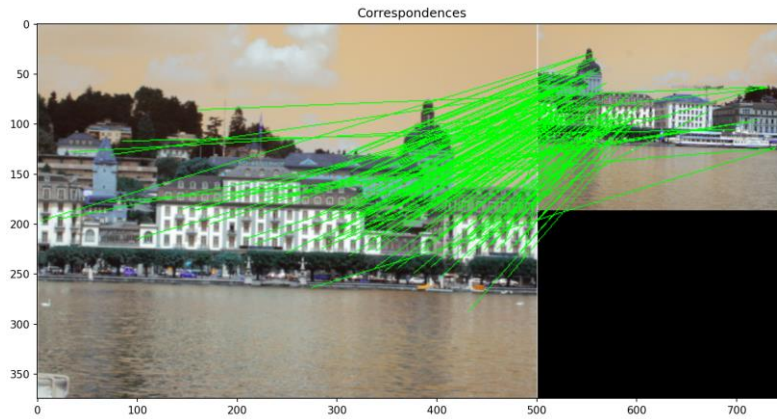Number of Correspondences = 426

The above histogram shows that SIFT is rotation invariant but performs better when the orientations of both images are closer together (or in increments of 90 degrees). The number of correspondences is higher at 0, 180, 210, and 360 degrees and this is because the matcher has

an easier time finding the corresponding pixels at these orientations. Other angles such as 120, 270, and 300 degrees result in less correspondences as the matcher is less likely to find these points.

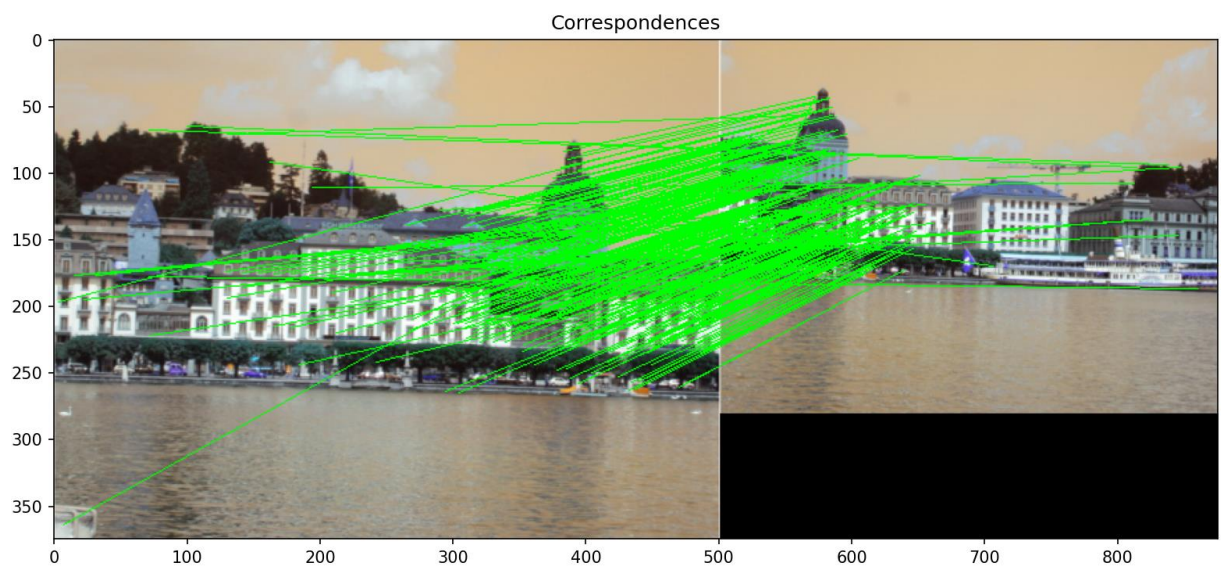2. **Scale** (using scaling factors: 0.5, 0.75, 1.25, 1.5)

Scaling Factor = 0.5
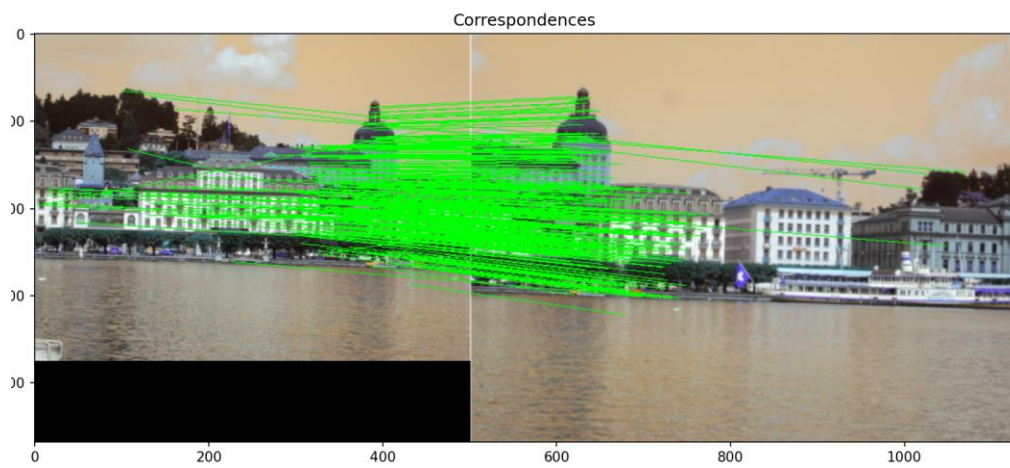
Number of Correspondences = 173

Scaling Factor = 0.75

Number of Correspondences = 299

Scaling Factor = 1.25
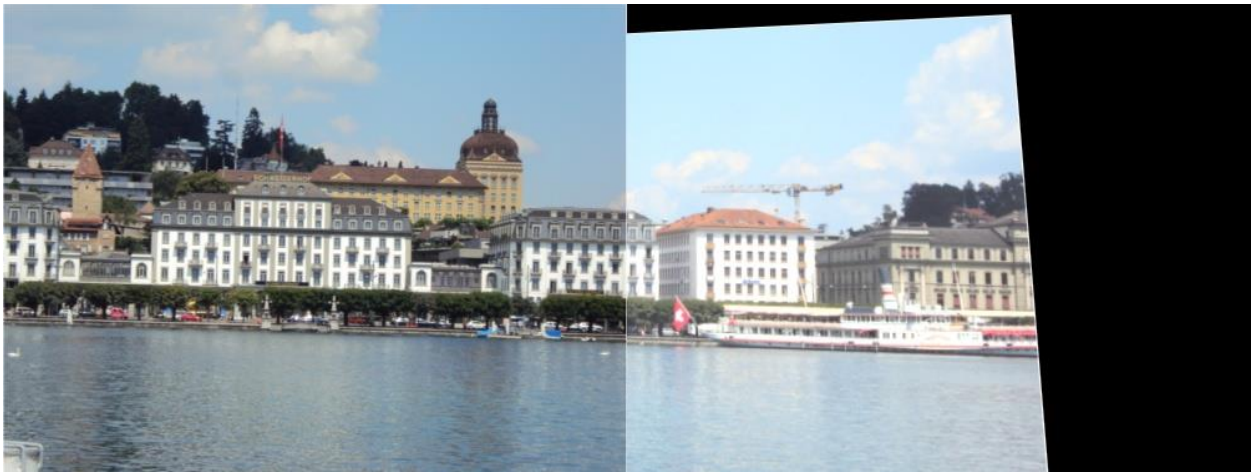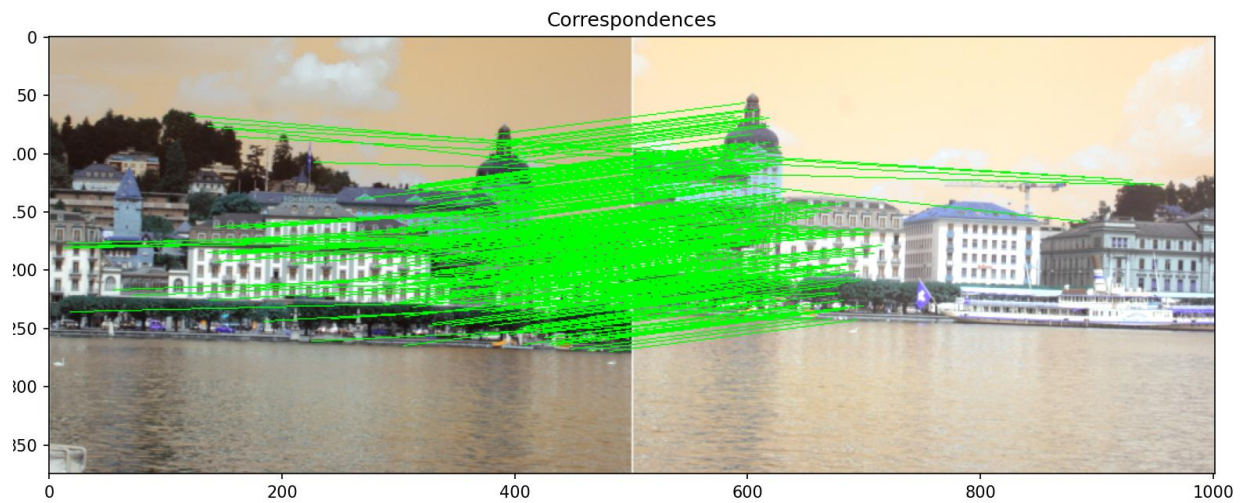
Number of Correspondences = 439

As shown by the above images, scaling the right image by 0.5, 0.75, and 1.25 produced valid correspondence matching and valid final stitches. This is to be expected because SIFT is scale invariant so it should be able to stitch images regardless of scale. The number of correspondences increased as the scale increased.
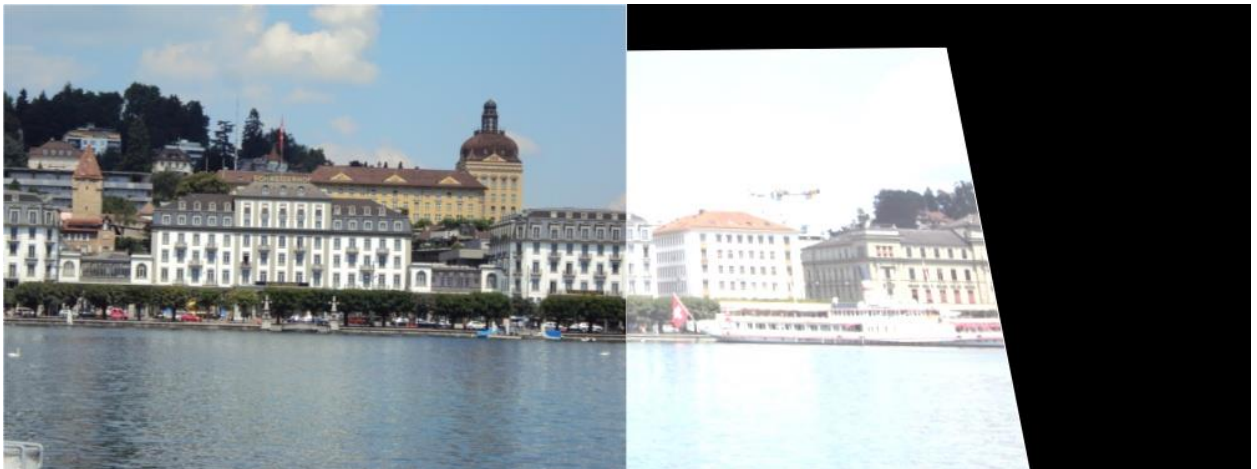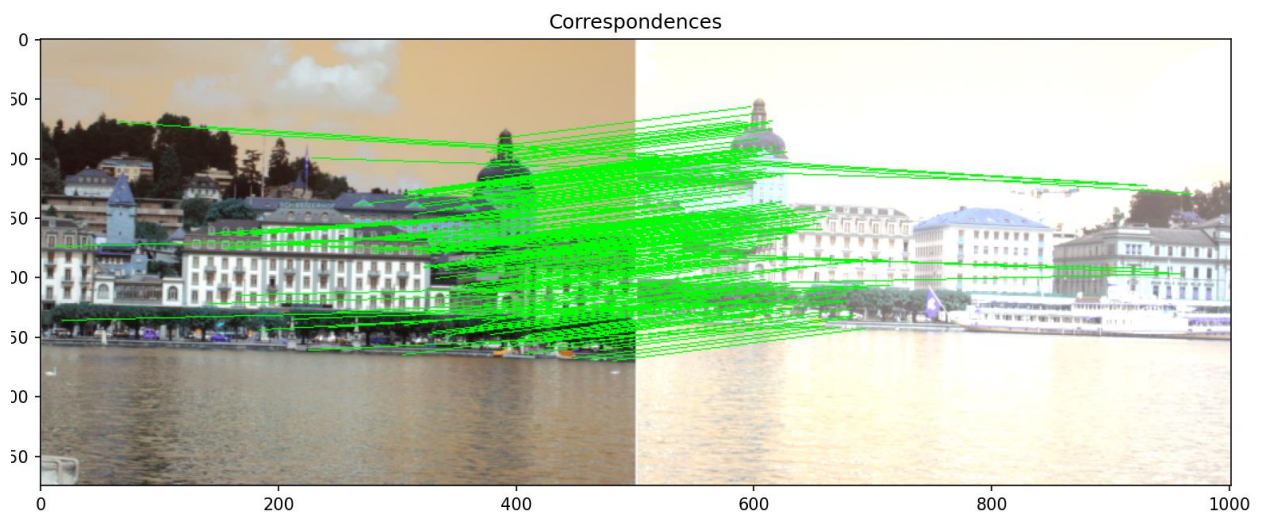
3. Illumination

Brightness Factor = +50
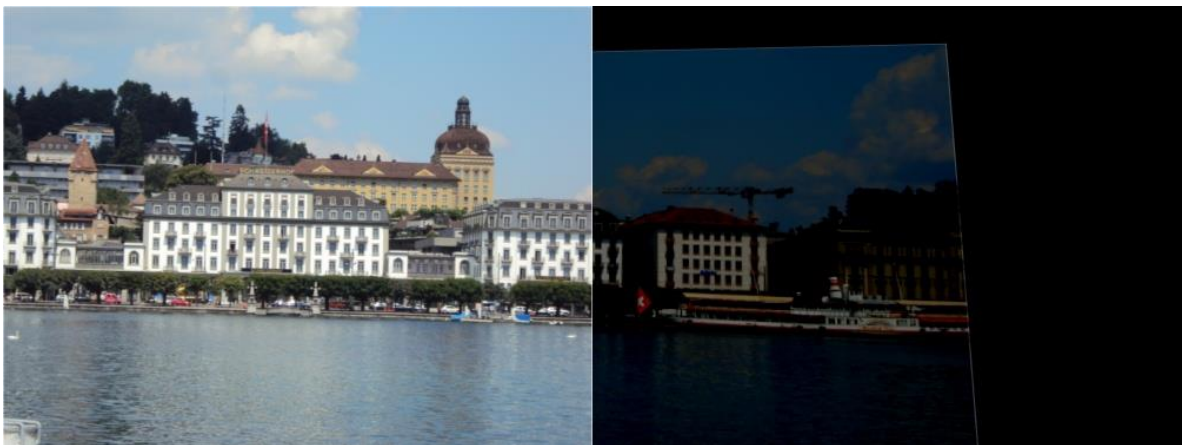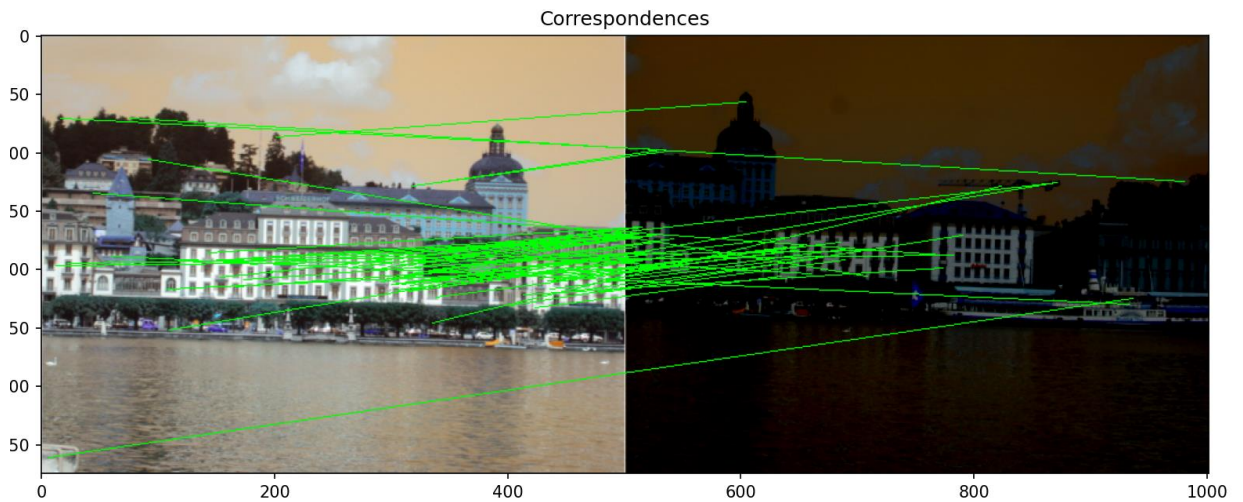
Number of Correspondences = 392

Brightness Factor = +100

Number of Correspondences = 243

Brightness Factor = -150

Number of Correspondences = 65

As shown by the above images, impacting the brightness of the right image by +50, +100, and -150 produced valid correspondence matching and valid final stitches. This indicates that SIFT is also relatively invariant to illumination differences. The number of correspondences decreased as the brightness difference increased (in both directions).

Applicability to Real World

SIFT appears to be a very robust mechanism for image stitching applications. The ability to perform well regardless of rotation, scale, or illumination is the reason SIFT is widely used in the real world today. Further examinations will need to be conducted to understand SIFT's limitations, and to test its invariance to other factors such as occlusion or combinations of transforms (ex. rotation + scaling or scaling + brightness).