

# Report: Assignment - 3

Chris Andrew  
2018701019

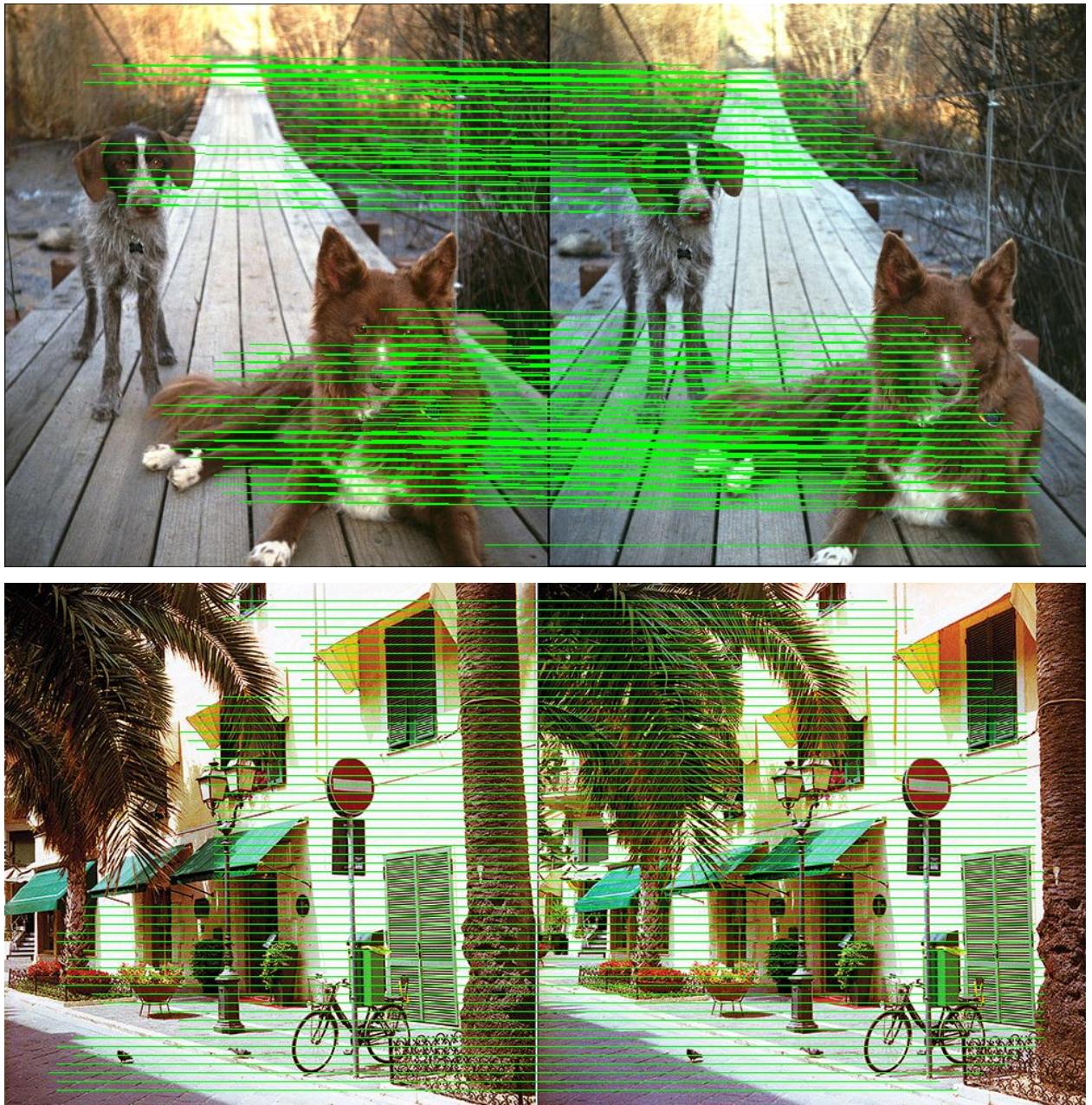
---

## Stereo Image Rectification

- **Basic algorithm for stereo image rectification is:**
  - Match corresponding points in the two image using some point descriptors
  - Use the matched points to find the Fundamental matrix.
  - Rectify the images using the Fundamental matrix to find a homography between the two images.
- **We use different combinations of features and matching algorithms to find matching points:**
  - For features we use: Dense SIFT and Intensity window based correlation.
  - For matching we use Greedy matching(Nearest Neighbour) and DTW(Dynamic Time Warping)
- **Methodology:**
  - For Dense SIFT, we sample points at regular intervals in the image with overlapping regions of interest. These points and their ROI are then used to compute SIFT descriptors at each point for the given ROI. Once we have the descriptors, we match descriptors from both images to find corresponding points between them. These set of corresponding points are then used for rectification.
  - For Intensity window based correlation, we consider non-overlapping windows at regular intervals in the image, each window in one image is correlated to each window in the other to find matching windows. We use Pearson correlation to determine if the windows are correlated, high Pearson value means better match.
  - Once we have matches, we find Fundamental Matrix and homography to rectify the images.
  - We repeat experiments with rectified images.
  - We also use DTW along with the Greedy approach on the rectified images.

## Results:

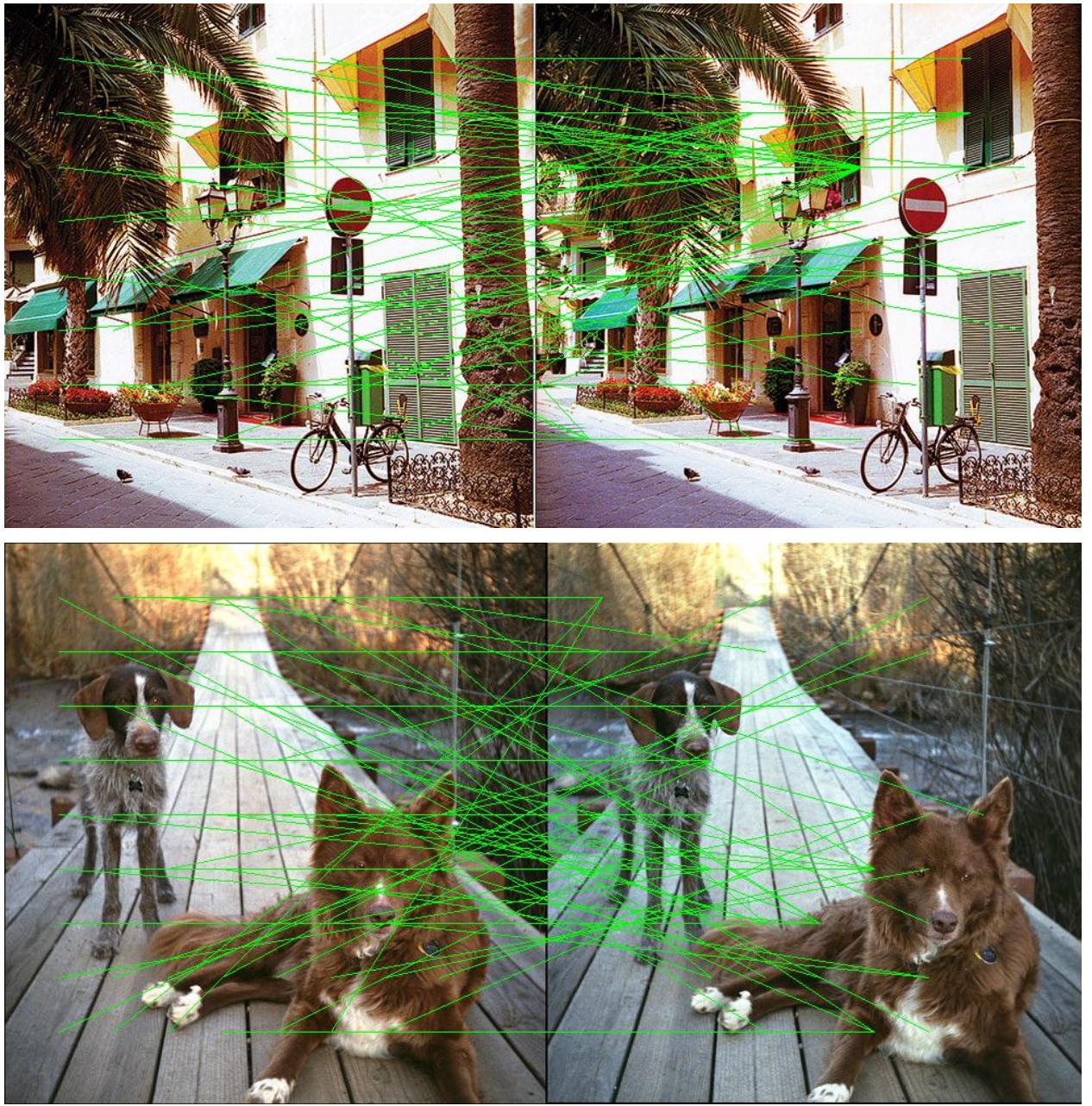
- Point matching using Dense SIFT and Greedy matching





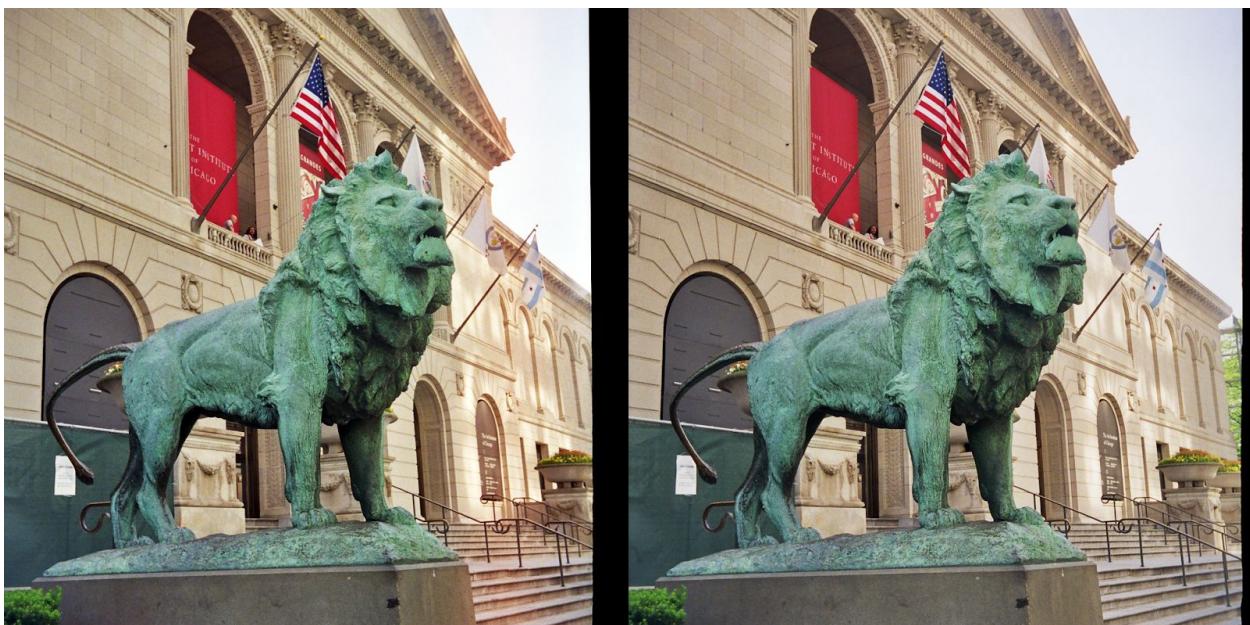
- Point matching using Intensity window based correlation and Greedy matching:

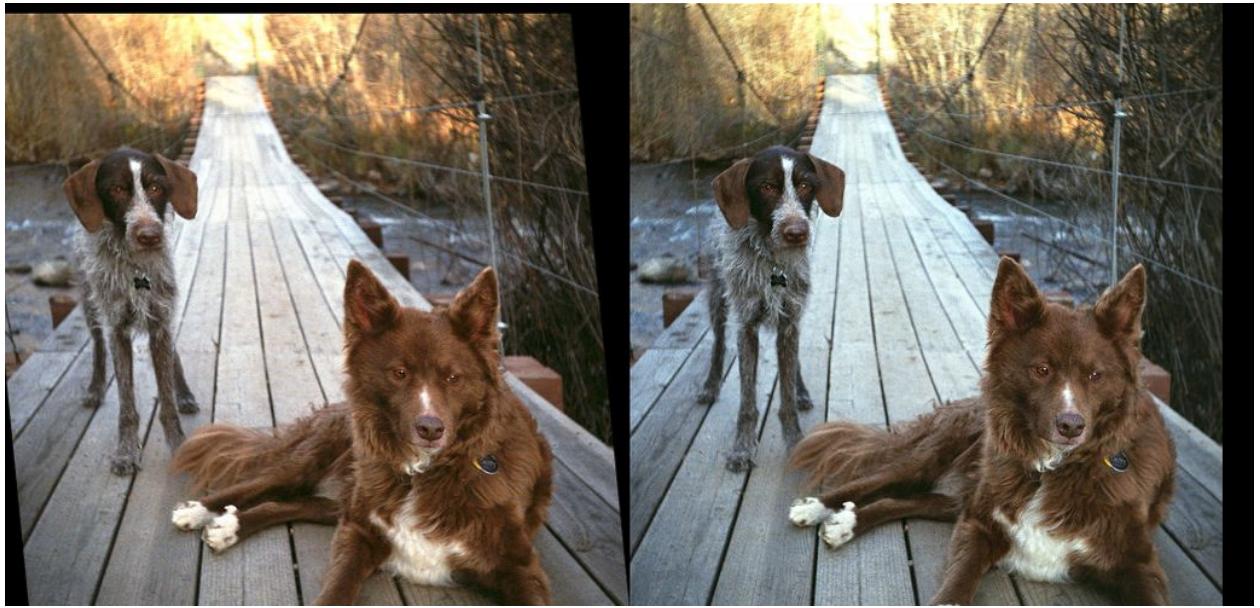




It is observed that intensity window based correlation is not a good descriptor to match points. We can see that points that are matched in the image are not similar, but their intensity profile may be. SIFT on the other hand does a good job of matching points to the corresponding points in the other image.

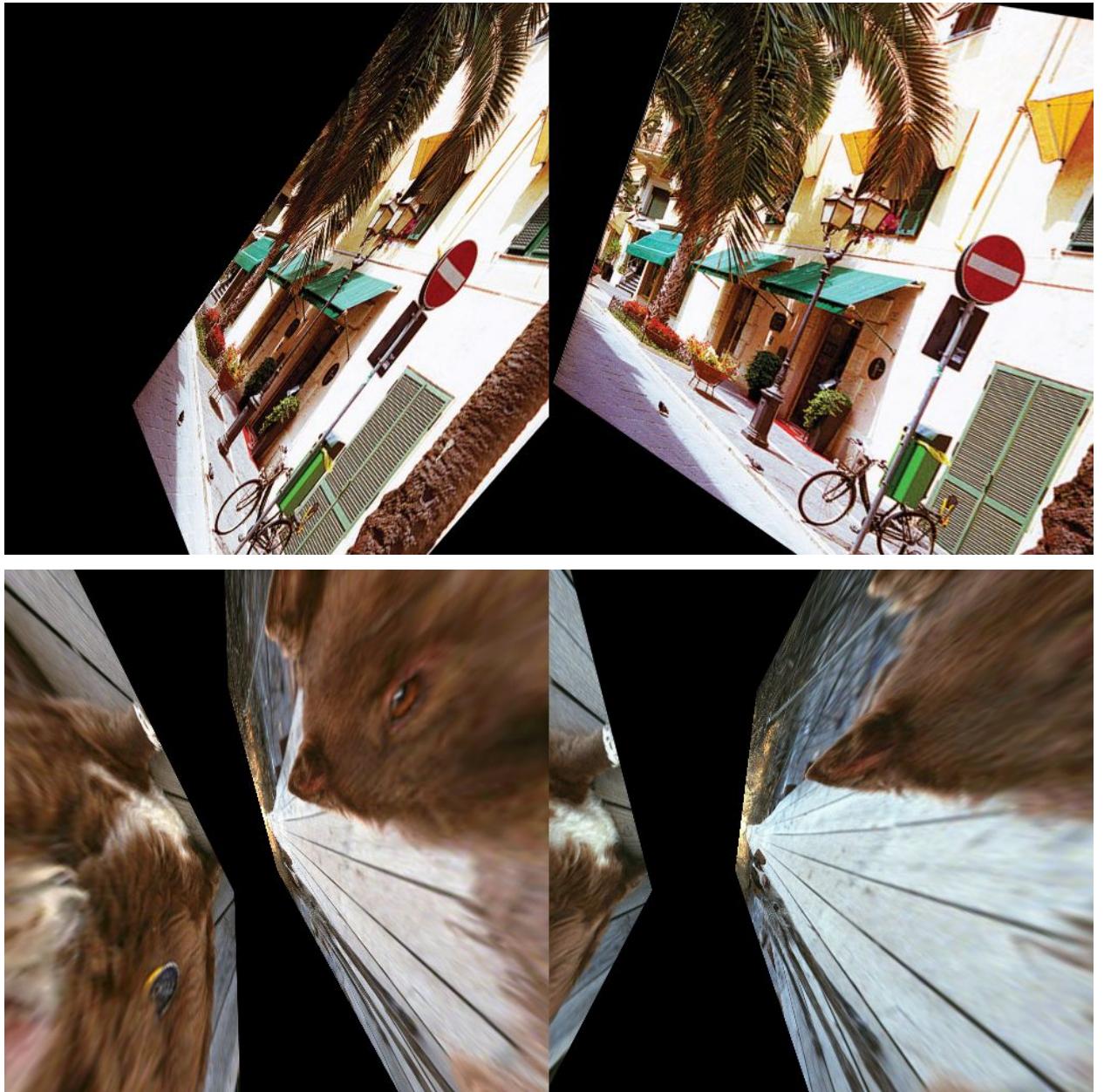
- Image rectification using SIFT + Greedy:





- **Image rectification using Intensity window based correlation + Greedy:**





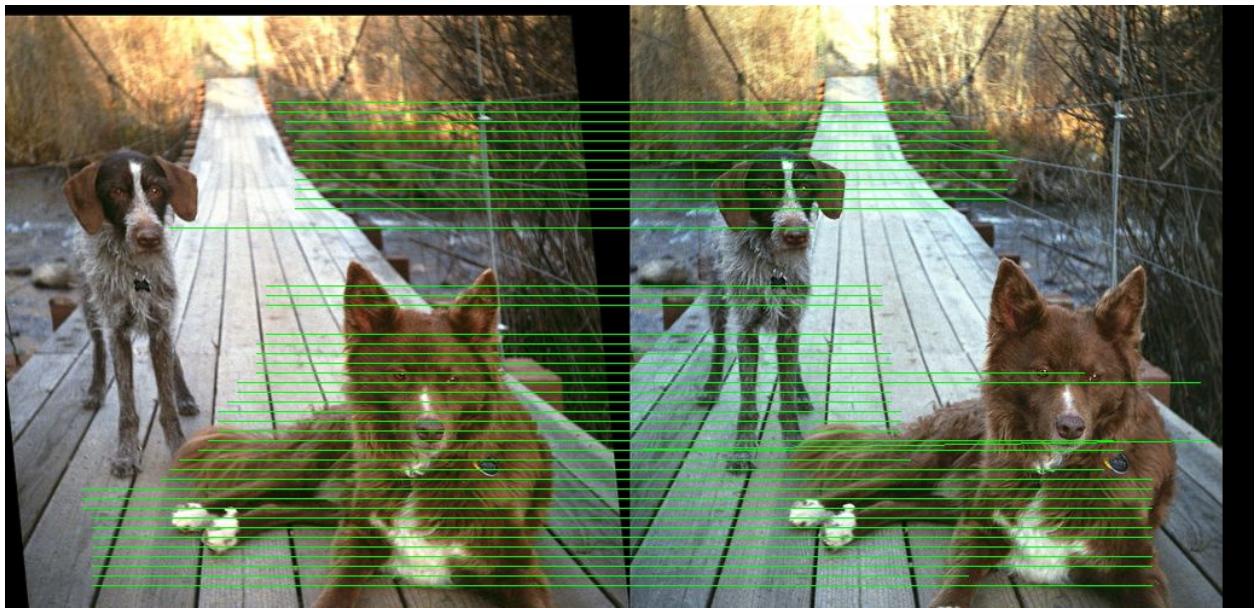
Since the matched points in SIFT were more accurate, the rectification is correct when using the SIFT descriptor. Intensity window based correlation on the other hand has made the image unrecognisable after rectification.

### **Matching on rectified images:**

**NOTE:** All rectified images used are rectified using SIFT and Greedy matching based methods, since Intensity window based matching gave wrong results.

- Rectified images, with SIFT + Greedy





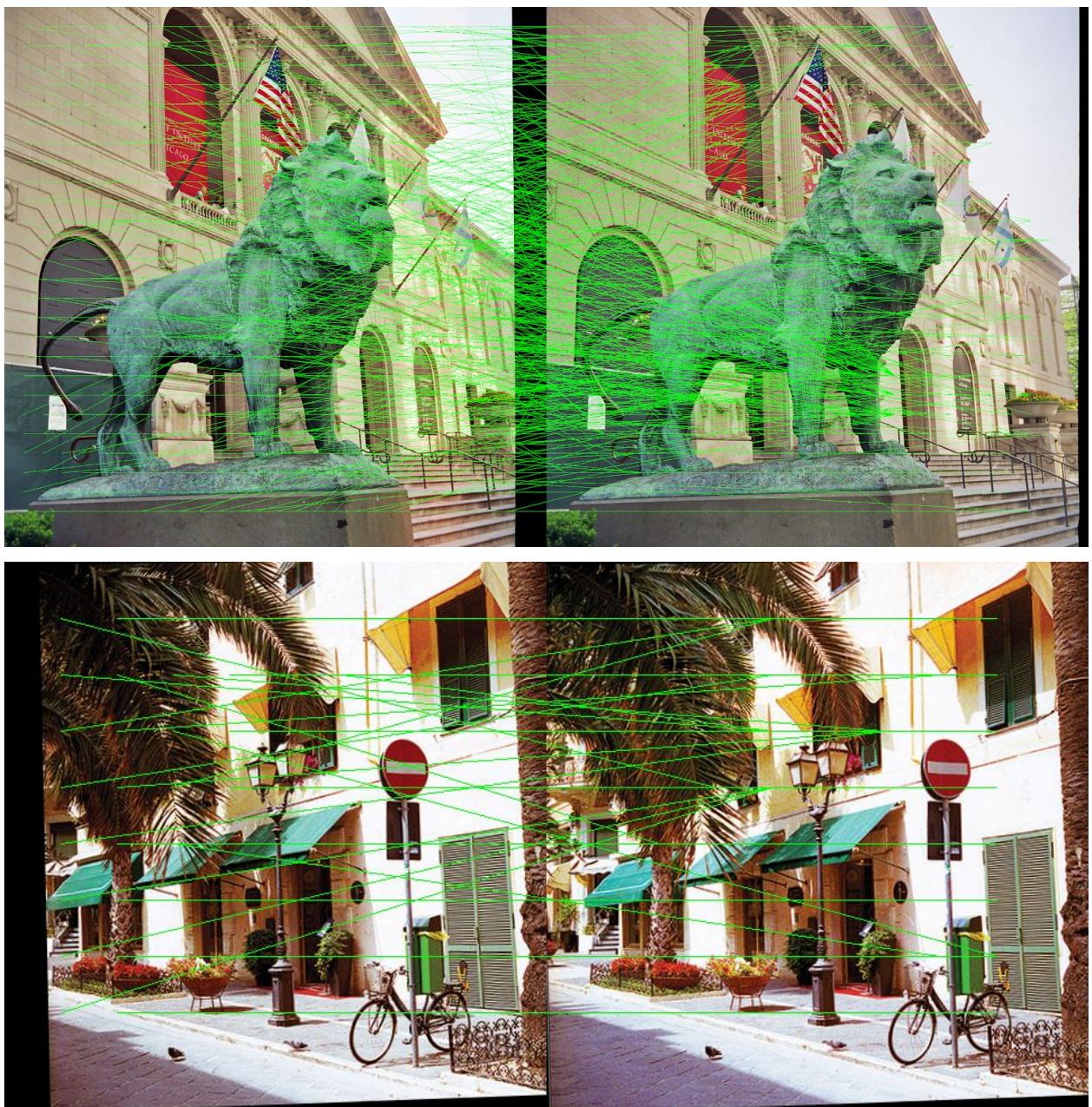
- Rectified images, with SIFT + DTW

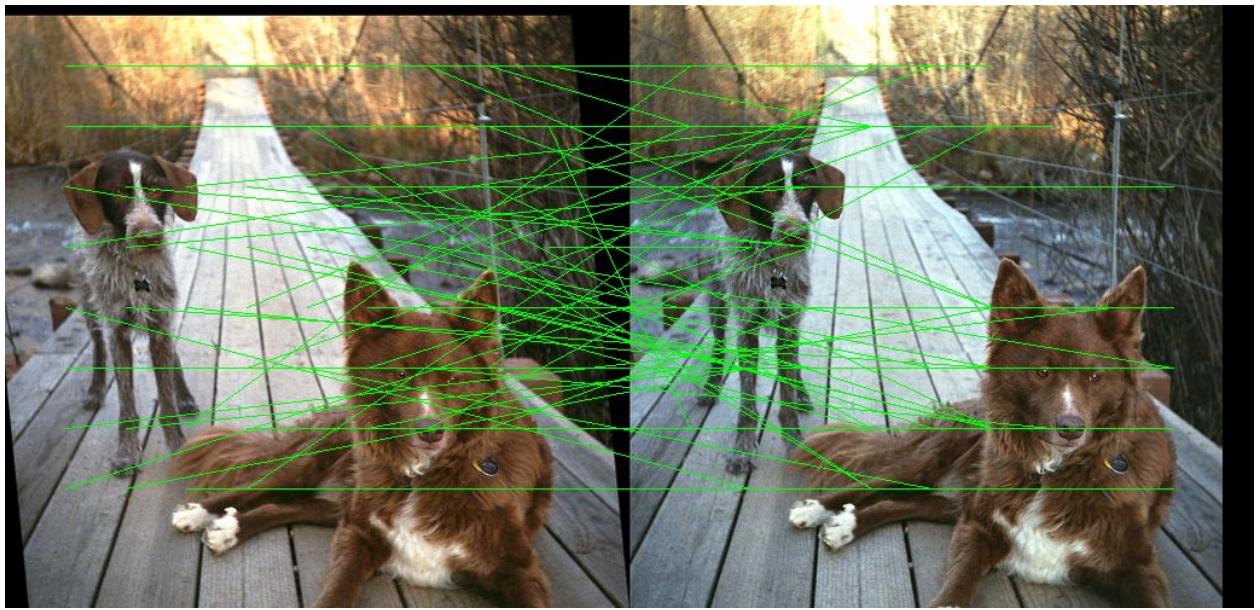




Matching lines are parallel after rectification. This shows that both the images are now lying on a common camera plane. DTW matching seems to match incorrect points in the two images as compared to greedy. This is because DTW tries to match a sequence of similar points rather than individual points themselves.

- Rectified images, with Intensity window based correlation + Greedy:





- Rectified images, with Intensity window based correlation + DTW:





In both cases, the matching lines are not parallel. This is because correct points are not matched using Intensity window based correlation. While using DTW, points matched are even more incorrect, whereas while using Greedy, a few points are matched correctly.