

Computer Vision

Lab 02: Feature Extraction

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1 Feature extraction

- First I computed the gradients I_x, I_y of the images in x and y -direction
- Then I computed the Harris response for every pixel
- I applied Non-Maximum-Suppression in a 3 pixel radius to the pixels whose response is over threshold (**0.045**)
- Lastly I returned the pixel coordinates of the resulting keypoints

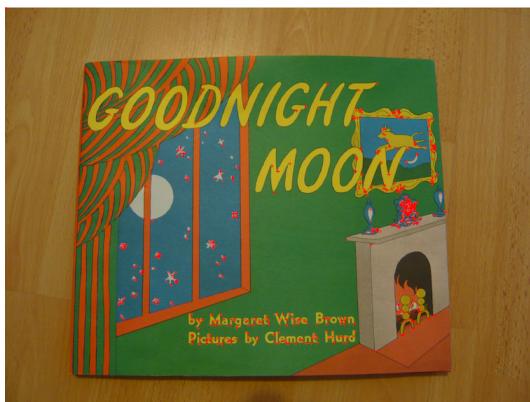


Figure 1. pre NMS image 1

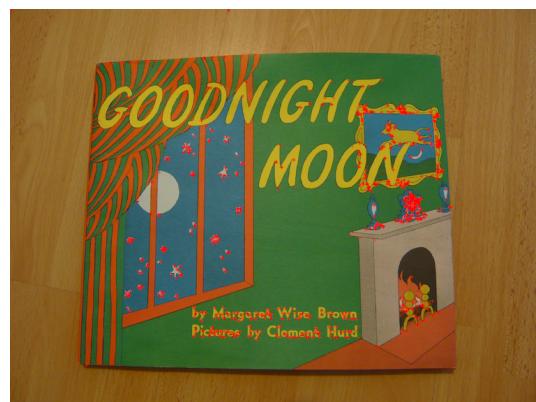


Figure 2. pre NMS image 2

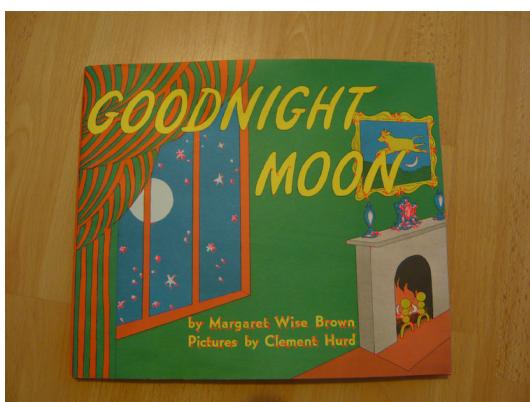


Figure 3. post NMS image 1

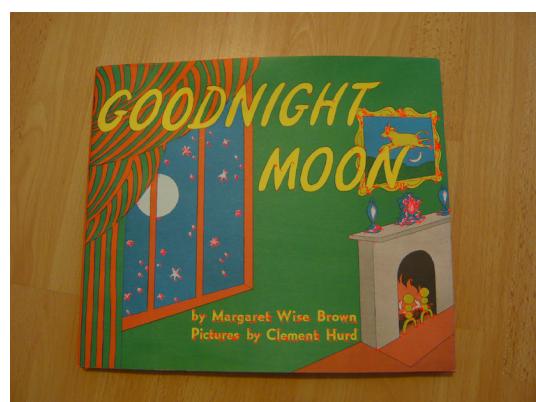


Figure 4. post NMS image 2

Figure 1 and *2* show the extracted Harris corners before the non-maximum suppression and *Figure 3* and *4* show the extracted Harris corners after the non-maximum suppression. The number of keypoints for image1 and image2 reduced from **2933** and **6850** to **540** and **840** respectively after non-maximum suppression. For closer inspection, these images are provided in *Report/images* directory.

2 Feature descriptor

For this section, I extracted a 9×9 image patch as my descriptor, converted this image patch to a vector and returned a matrix of such vectors for all keypoints.

3 SSD Feature matching

For this section, I matched features from both the images using Sum of Squared Differences. I took the ratio of the best and the second best distances for a feature match, and if this ratio was greater than a value (**0.8**), I discarded the match. This took care of the ambiguous matches. Lastly, noticing that the images given for this assignment are only slightly different from each other, I implemented a distance threshold. This threshold discarded any match that had distance more than **0.1cm**.



Figure 5. Feature matching using SSD for Harris corners

4 SIFT features

I downloaded and installed the SIFT feature extractor provided at <http://www.vlfeat.org>. I extracted and matched the SIFT features for the given images. *Figure 6* and *7* show the extracted SIFT features. *Figure 8* shows the Feature matching using SIFT.

Both Harris corners extraction-SSD and SIFT did a good job in feature extraction and matching. The difference in the results would have been highlighted if the images were very different in view-angles, rotation, and illumination. In that case, SIFT might have performed better than the Harris Corner - SSD method. For these two images, their performance was virtually the same.

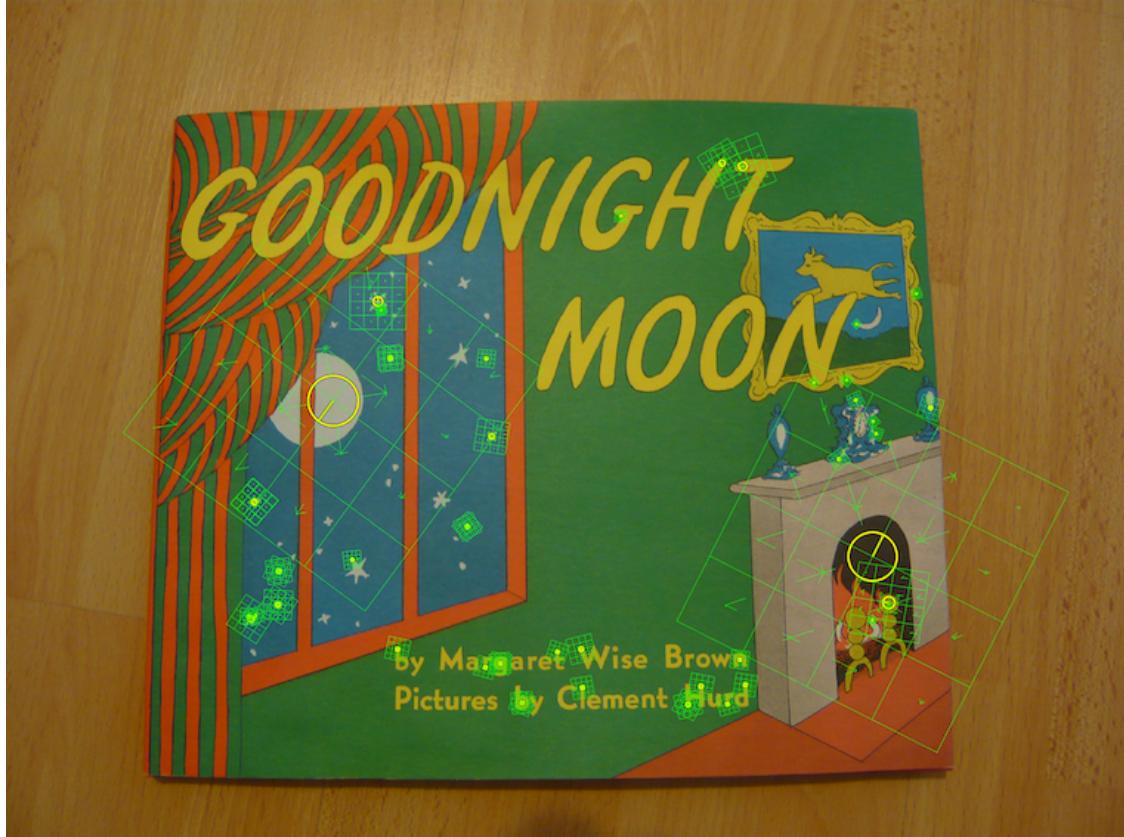


Figure 6. SIFT features for image 1

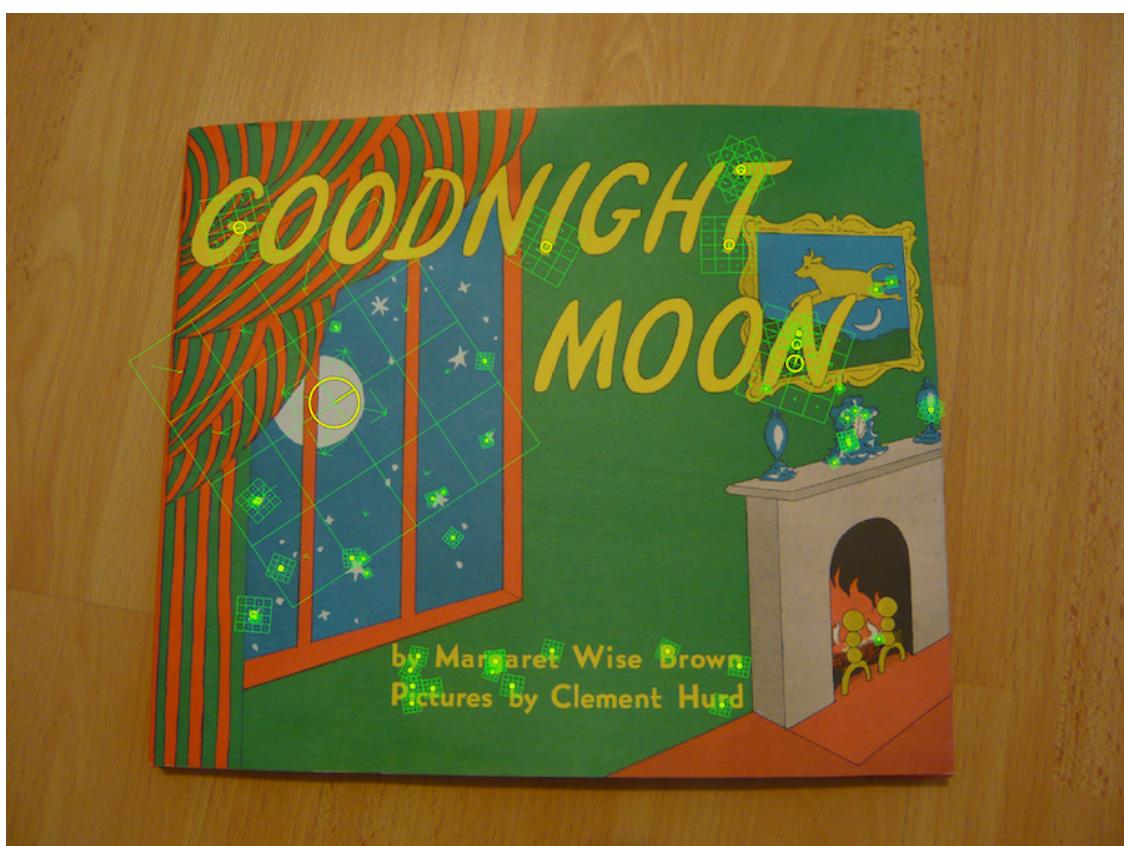


Figure 7. SIFT features for image 2



Figure 8. Feature matching using SIFT