

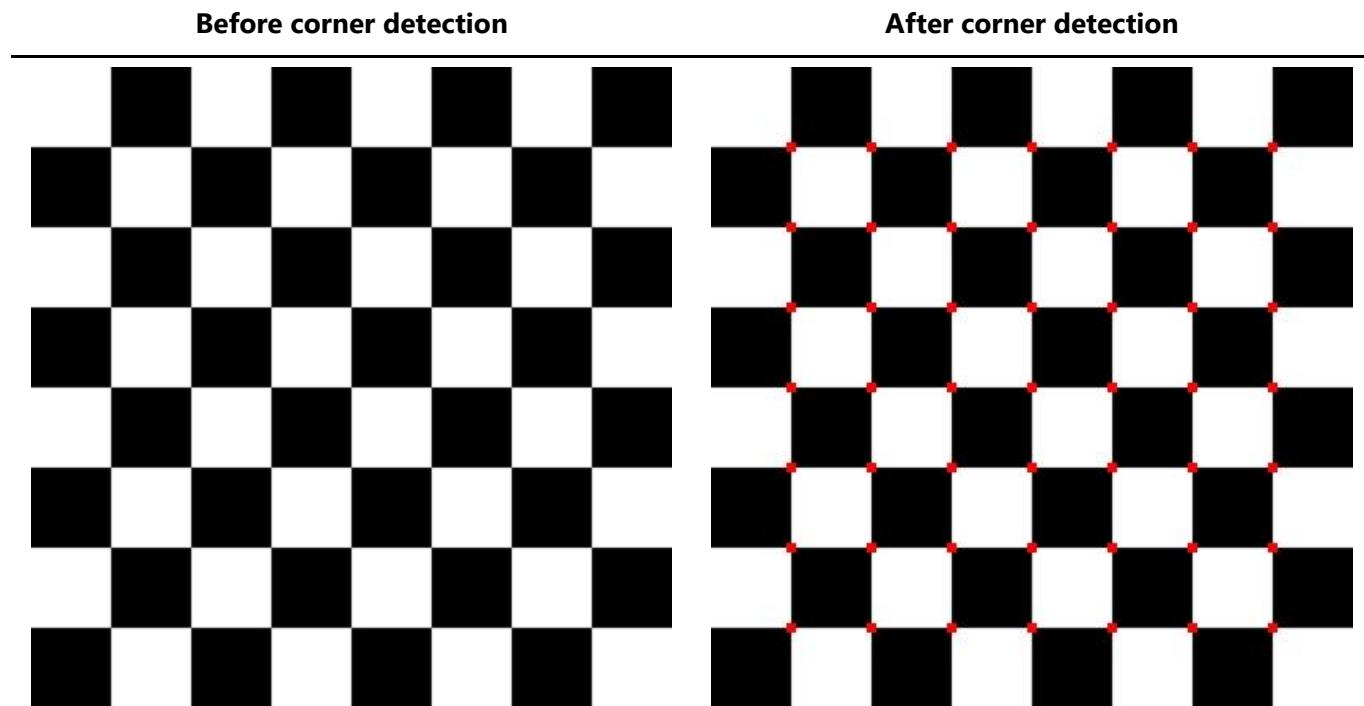
# Computer Vision SBE404B

## Assignment\_3 " Feature point detection, features descriptors (SIFT) and image matching (SSD and normalized cross correlation)"

<b>Submitted by:</b>	<b>Sec.</b>	<b>B.N.</b>	<b>E-mail</b>
Ashar Seif el Nasr Saleh	1	9	asharzanqour@gmail.com
Alaa Allah Essam Abdrabo	1	13	alaaeessammirah@gmail.com
Razan Salah El-sayed	1	32	razansalah022@gmail.com
Sohila Mohamed Maher	1	38	sohilamohamed583@gmail.com
Mariam Ashraf Mohamed	2	24	mariamashraf731@outlook.com

## Results

1.1 Extract the unique features in all images using Harris operator and  $\lambda$ -

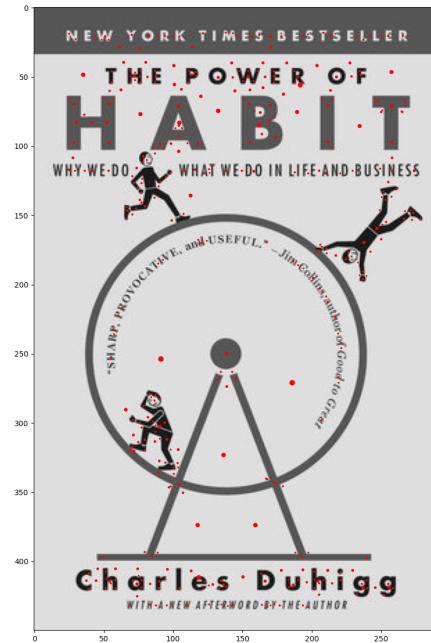
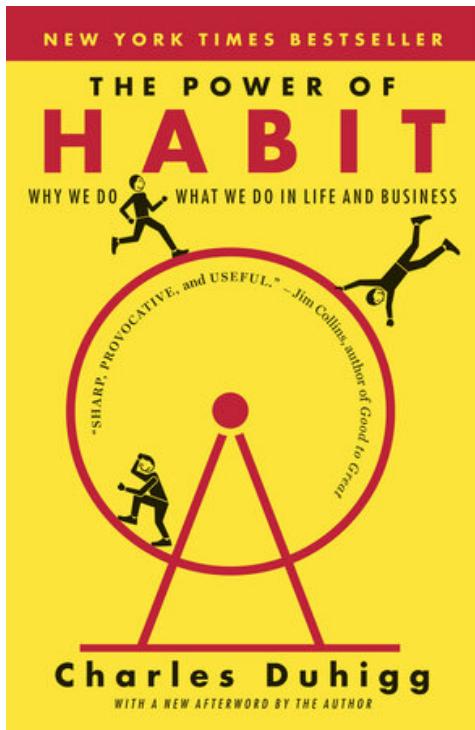


1.2 Generate feature descriptors using scale invariant features (SIFT)



Original Image

Image Keypoints with SIFT



**Original Image****Image Keypoints with SIFT**

1.3.1 Comparison between SIFT Keypoints in this algorithm and Open Cv built in algorithm

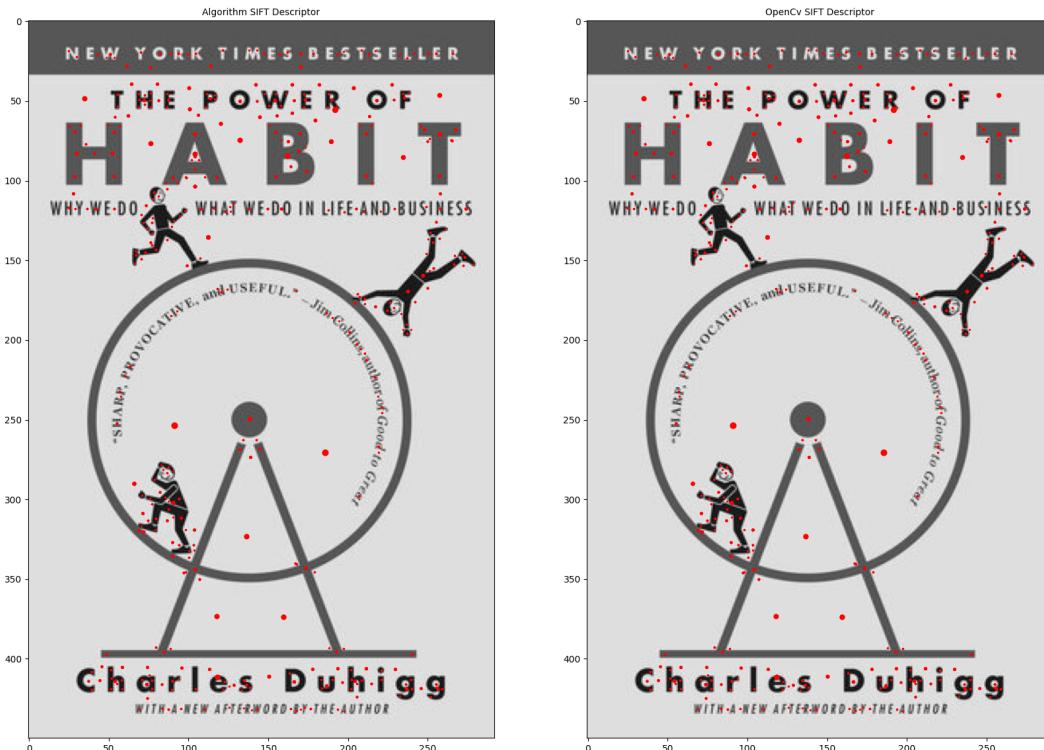
---

**Algorithm SIFT Descriptors VS OpenCv SIFT Descriptors**

---

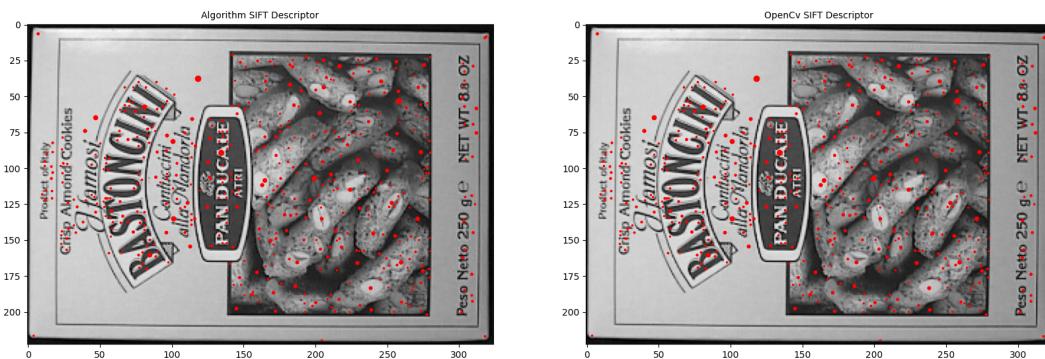
## Algorithm SIFT Descriptors VS OpenCv SIFT Descriptors

---



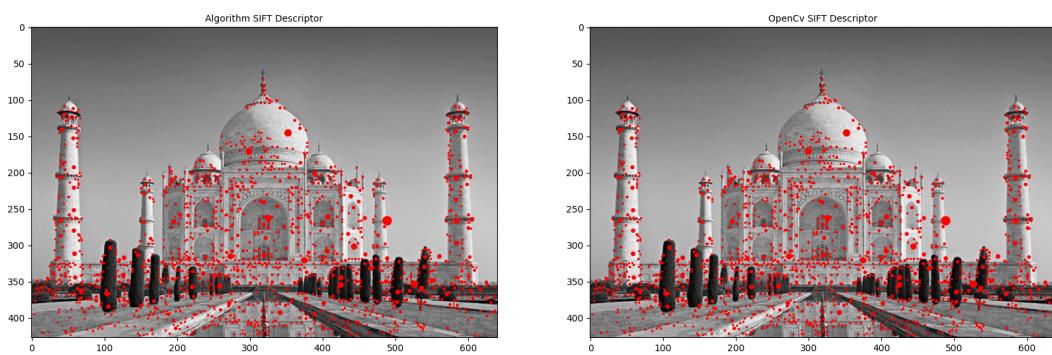
## Algorithm SIFT Descriptors VS OpenCv SIFT Descriptors

---



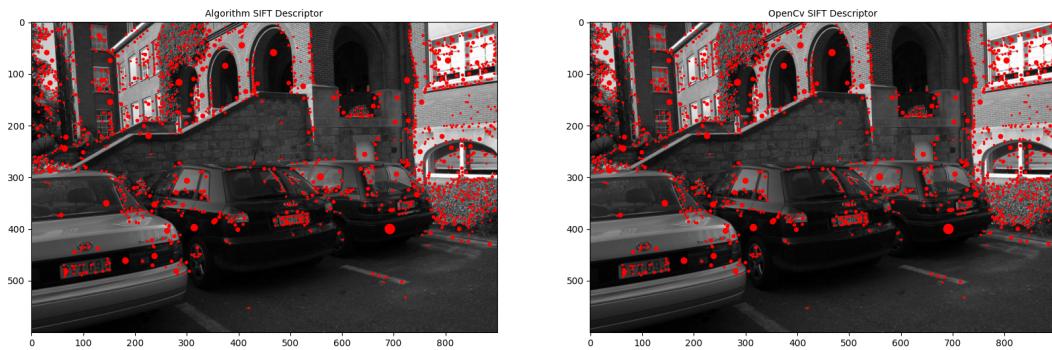
## Algorithm SIFT Descriptors VS OpenCv SIFT Descriptors

---



## Algorithm SIFT Descriptors VS OpenCv SIFT Descriptors

---



1.4 Match the image set features using sum of squared differences (SSD) and normalized cross correlations (NCC)

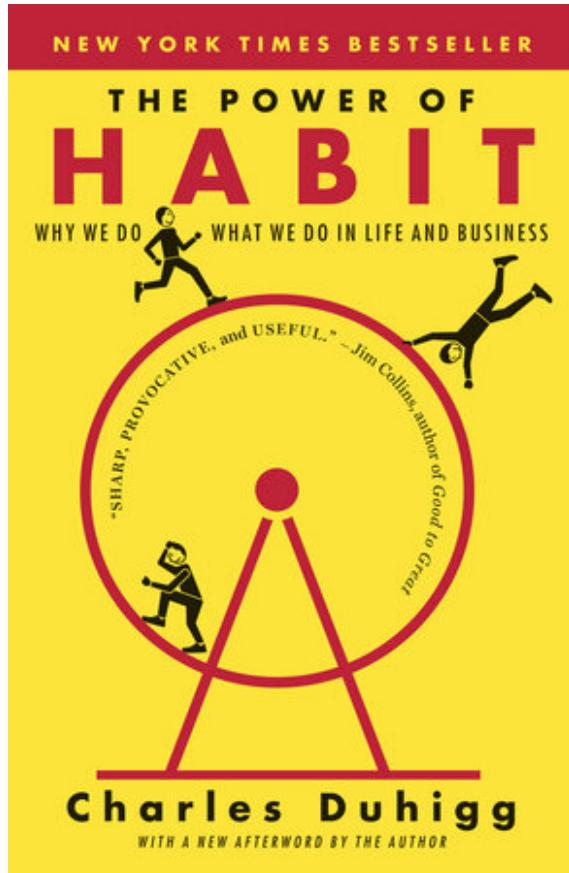
---

**Before image matching**

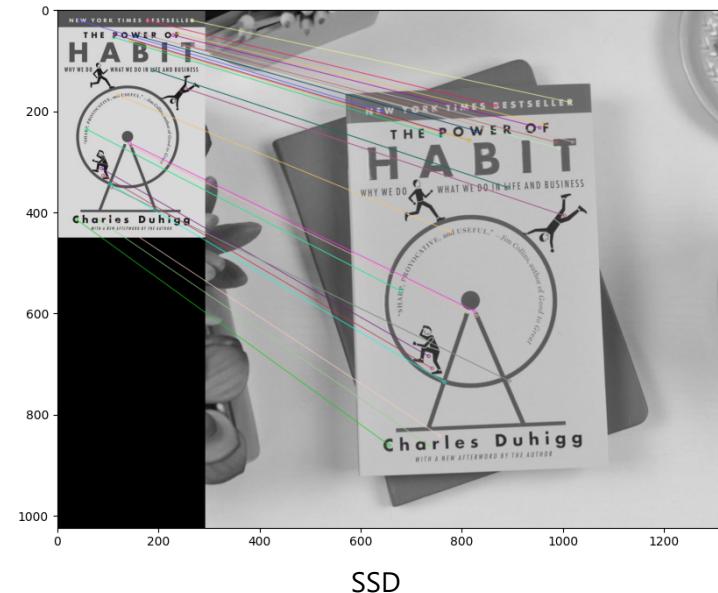
**After image matching**

---

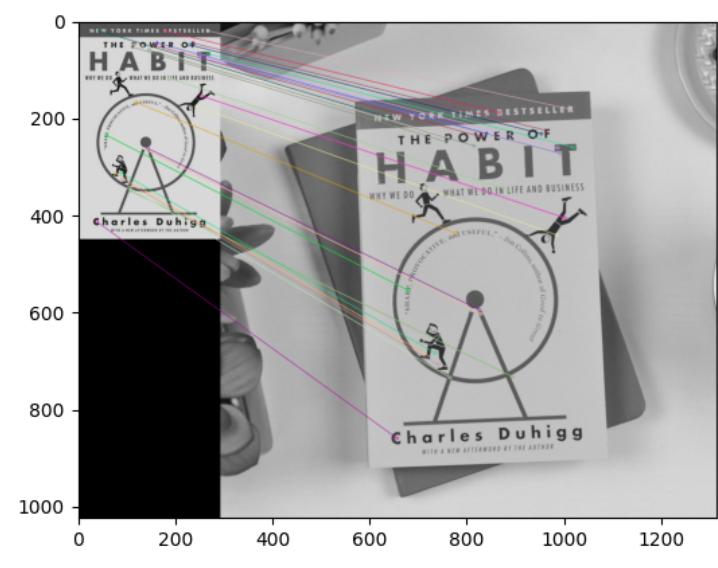
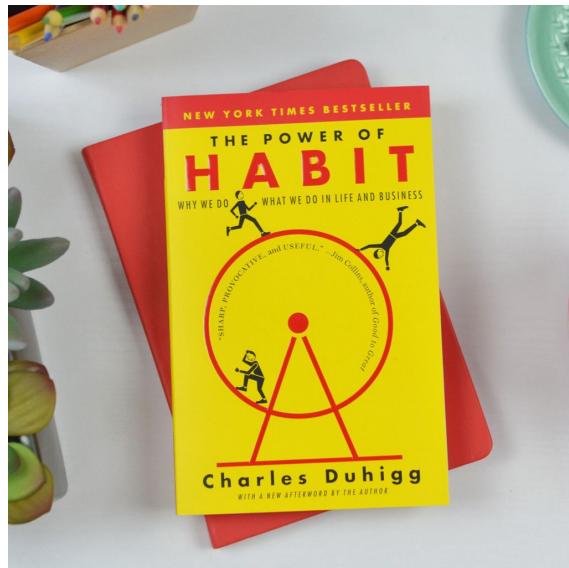
Before image matching



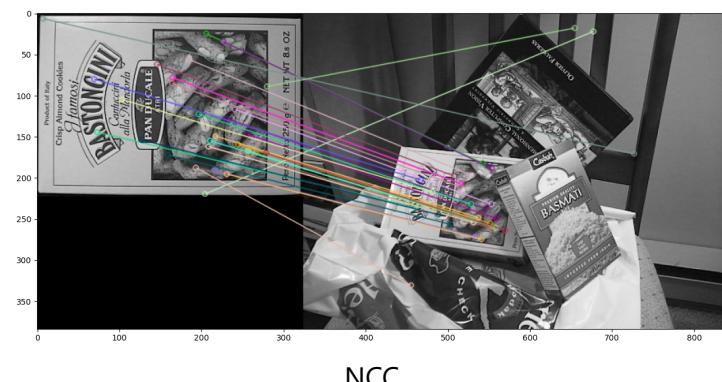
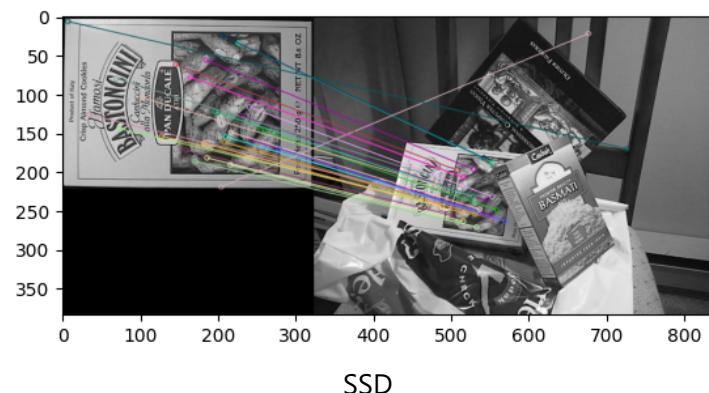
After image matching



SSD



NCC

**Before image matching****After image matching**

## Discussion

### 1.2 Generate feature descriptors using scale invariant features (SIFT):

- The computations time of the algorithm ranges between 80 to 160 s with average one minute and half for different images.
- The Comparison table shown in results section shows that the algorithm output and OpenCV Built-in SIFT function are very similar and compute almost the same descriptors.

### 1.3 Match the image set features using sum of squared differences (SSD) and normalized cross correlations (NCC):

- The computations in this algorithm are heavily and extreme, and it took around 10 minutes or more to finish the whole process in both algorithms.
- The Sum Square Distance is calculated between two feature vectors. SSD values examples: (50, 200, 70), we need to minimize SSD (Choose 50) , in case of SSD matching: (value is returned as a "negative" number) (-50, -200, -70) so we compare it with -np.inf. (The sorting is reversed later)
- The Normalized Cross Correlation is calculated between two feature vectors. NCC values examples: (0.58, 0.87, 0.42), we need to maximize NCC (Choose 0.87) , in case of NCC matching: (value is returned as a "positive" number) (-58, -0.87, -0.42) so we compare it with -np.inf. (The sorting is reversed later)