Assignment 1: Title of the assignment

Vincent Matthys

vincent.matthys@ens-paris-saclay.fr

QIA.1: (i) Why is it important to have a similarity co-variant feature detector? (ii) How does this affect the descriptors computed at these detections? (iii) How does this affect the matching process?

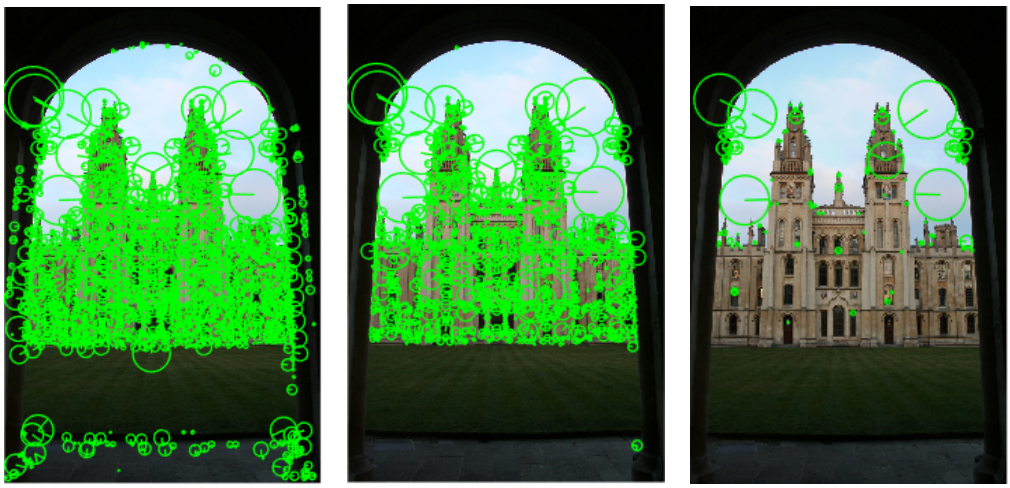
(i) It is important to have a similarity co-variant feature detector in order to extract the same regions of interest regardless of translations, rotations or scales, *i.e.* regardless of viewpoints.
(ii) The fact that the feature detector is co-variant causes the descriptors computed at these detections to undergo the same tranformations than the image.
(iii) Having feature detectors with similarity co-variance and feature descriptors with this and that other property affects the matching process in this way.

QIA.2: Show the detected features in the two images for three different values of the peakThreshold option

The detected features for $peakThreshold \in \{0.0001, 0.001, 0.01\}$ are shown in Figure 1 for the all_souls_000002.jpg image, and in Figure 2 for the all_souls_000015.jpg image. As expected, the number of keypoints decreses with the threshold. Moreover the keypoints are fewer in the darker regions, wich leads to asymetric density in the Figure 2, especially because of the building shadow.

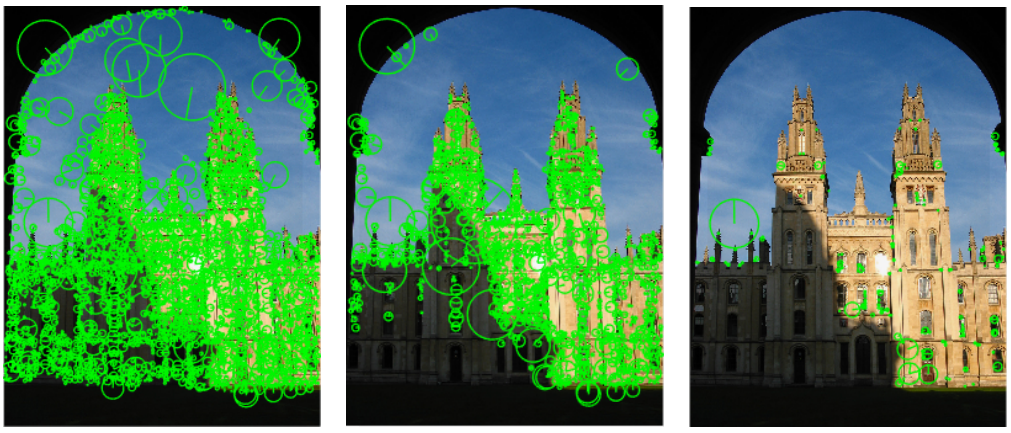
QIA.3: Note the change in spatial density of detections across images, for a given value of peakThreshold. (i) Is the density uniform? If not, why? (ii) Which implications for image matching can this have? (iii) How can it be avoided?

(i) In Figures 1a and 2a. The density is clearly not uniform between the two images. In both, the top-center of the image is very dense, but, in the first one, the grass admits no detection, which leads to a gap in the density, with some detections in the bottom limit of the grass.
(ii) This can lead to error matching the correspondances with local features
(iii) To avoid it we can proceed to a spatial verification relying on global geometric relations.



(a) $peakThreshold = 0.0001$ (b) $peakThreshold = 0.001$ (c) $peakThreshold = 0.01$

Figure 1: Feature detectors with three different values of $peakThreshold$ for all_souls_000002.jpg



(a) $peakThreshold = 0.0001$ (b) $peakThreshold = 0.001$ (c) $peakThreshold = 0.01$

Figure 2: Feature detectors with three different values of $peakThreshold$ for all_souls_000015.jpg