Assignment 1: Title of the assignment

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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

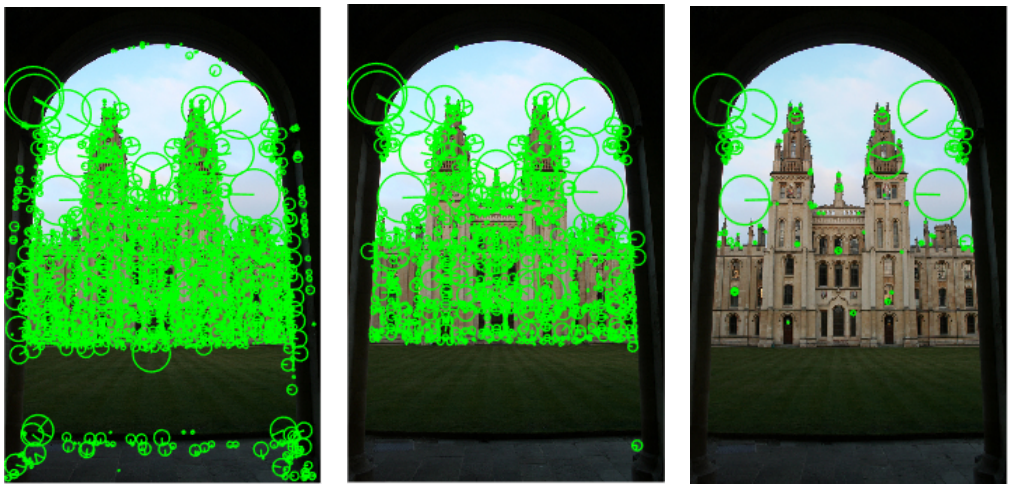
The two classification boundaries are shown in Figure 3. As it can be observed, model A, represented in green, is producing a very irregular classification boundary which gives a training error of zero, while model B, represented in black, is producing a smoother classification boundary which mis-classifies a few examples of the training data.

However, although the training error is higher for model B than for model A, we expect model B to perform better on the test data, as its smoother classification boundary is more robust to the noise in the training data, while model A is overfitting to the noise in this particular training data.

It is therefore concluded that model B is superior, as it will offer better generalization properties.

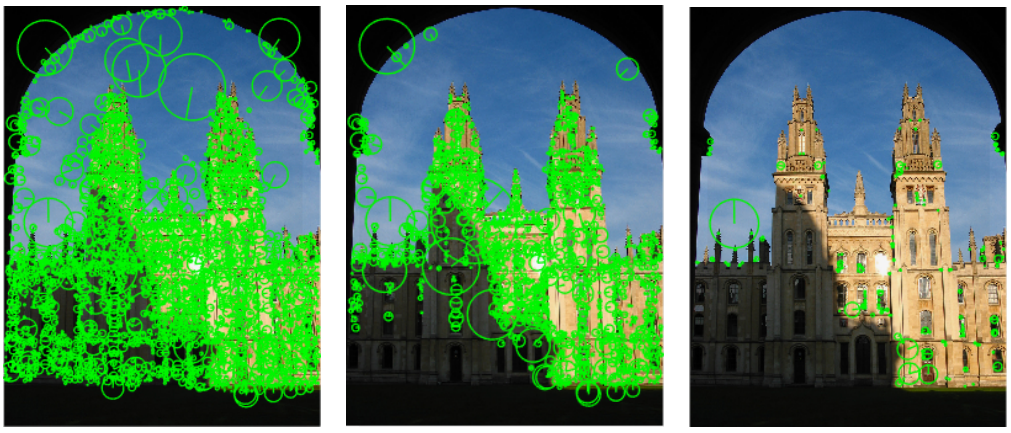
QIA.3: Show the detected features in the image for three different values of the peakThreshold option.

The detected features with three different values of $peakThreshold$ are shown in Figure 4.



(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

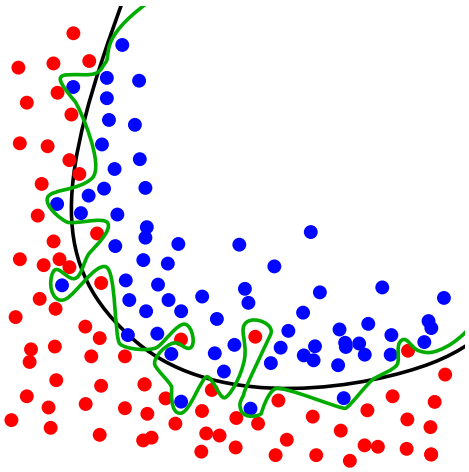
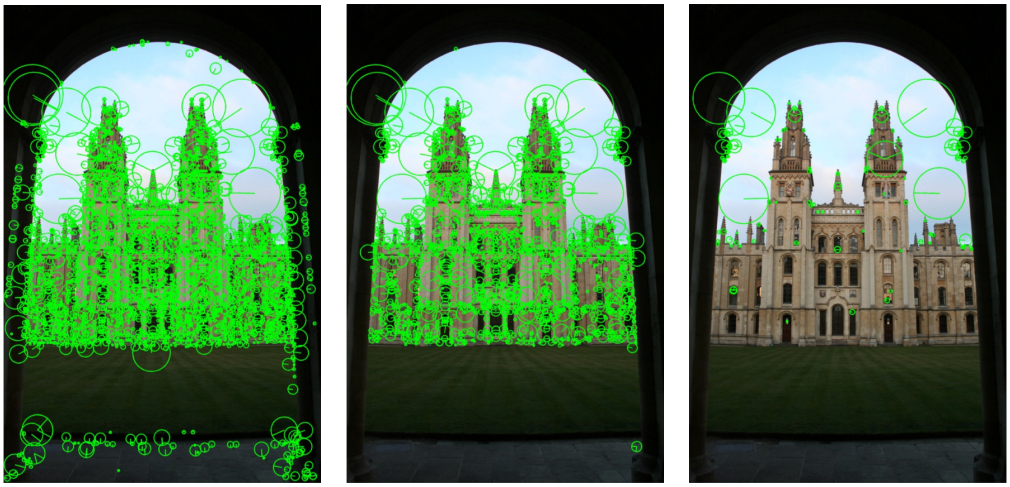


Figure 3: Two different models for fitting the data. The classification boundaries for models A and B are shown in green and black respectively.



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

Figure 4: Feature detectors with three different values of $peakThreshold$