Laboratory deliverable

SERRA, Xavier

Master in Artificial Intelligence - Computer Vision

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1   Laboratory 2.1

The code related with this section can be found in *Labo 2_1/feature_detection.m.*

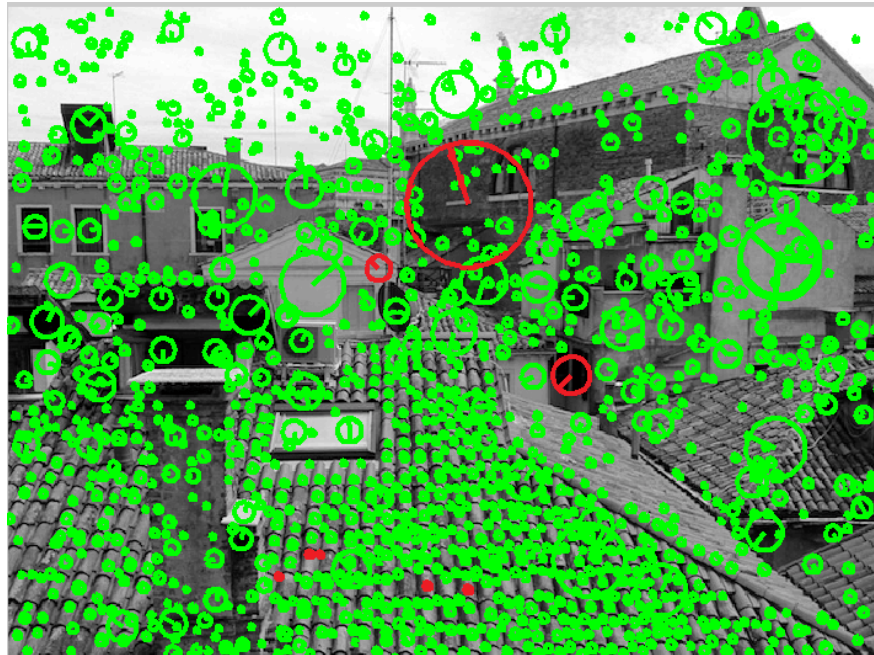- *Question:* The chosen keypoints can be found in the following image:

Figure 1: Caption

The explanations about them are provided below:

1. The big one in the middle: This one requires a large distance to reach a distinct point. It may be a rather smooth slope, but the contrast at between the center and the radius is high. Maybe because of this it has been selected.

2. The rather small one at its side: it detects the inclination of the ceiling of the house, and it requires a quite low distance in order to detect the variation. The reason why it may have been chosen is that it it an edge with two slopes, so it must have a reasonably high variation.

3. The small ones at the bottom: These small keypoint at the bottom correspond to the ceiling. They require a really small distance in order to detect the required variation. This variation is quite accentuated, so it may be because of this that they are chosen.

4. The medium one at the right: This one is quite mysterious, as it crosses the black window. The distance required is the necessary to reach the other side of the windows. As the total variation is quite high, even though it is not continuous, it may be this reason why it is chosen.

- *Question:* Yes, it is. An increased peak threshold implies that the peak gaussian required in order to be selected as a keypoint also increases. Therefore, the higher it is, the less keypoints will surpass that threshold and will be discarded. Thus, it follows the expected behaviour.

- *Question:* Yes, it is. As increased edge threshold implies that the curvature required in order to be classified as a keypoint increases. Therefore, those keypoints with a smooth curvature will be discarded as the threshold increases. Thus, it follows the expected behaviour.

2 Laboratory 2.2

2.1 Feature detection and matching

The code related with this section can be found in *Labo 2_2/feature_extraction.m.*

- *Question:* The higher the threshold, the less points there are, which happen to be the best ones. The reason for this is that, a high threshold indicates a high uniqueness for every point surpassing the threshold and, therefore, only the best points are selected.

- *Question:* The resulting model does not provide an exact transformation between both images, but it does provide an indicator of the direction into which the image has been moved. The reason for this is that the transformed image seems to be the result of a linear transformation, and it is just that the approximation has not been properly done, and not that it was a bad one.

2.2 Panorama creation

The code related with this section can be found in:

- *Labo 2_2/panorama.m*

- *Labo 2_2/panoramizeImage.m*

This code will generate a total of 18 images, which corresponds to different combination of parameters in 2 images:

- Number of samples: This parameter corresponds to the number of matches selected to calculate the linear transformation within the two images. The code tries with 1, 10 and 100 samples.

- M: This parameter indicates the number of iterations done in order to find the best linear transformation. The code tries with 10, 100 and 1000 iterations.

The results obtained are not exhaustive enough to extract a solid conclusion, but a certain pattern can be found:

1. Unsurprisingly, the higher the number of iterations, the better the resulting image tends to be. Even though it is not an extreme improvement, it can be noticed that the transition between images is smoother with 100 iterations than with 10. However, between 100 and 1000 iterations the difference is not so clear, and it may be because, with 100 iterations, the best transformation has already been found, so there is no need of more iterations.

2. There are some images in which this method works better than in others. In our case the first panoramic obtains better results than the second one. The reason for this is thought to be the fact that two images may not have a linear transformation between them, or, on the other hand, this transformation may be difficult to find.

3. The number of samples used clearly improves the quality of the union of images. However, a certain phenomena occurs: with 100 samples this union results in a much smaller panoramic image, as most of it is "discarded". However, the part in which both images are fused has a higher quality than when fewer samples are used.

3   Laboratory 2.3

The code related with this section can be found in *Labo 2_3/color_movement_detection.py*
In order to make it work, follow these instructions:

1. Execute the code

2. Face the webcam to a static background and press *q*

3. Adjust the trackbars in order to detect only the desired color, and press *q*

4. Place the, at most, 5 objects in front of the camera, and see how it only recognizes the moving one