SCC.366 Media Coding and Processing - CW2 - Report

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Abstract

In this report I will be observing the robustness of the Harris interest point detector on Intensity shifts, Intensity scale and image translation. The way I will be testing the Intensity shifts is by comparing the image with no intensity shifts with a image that has been shifted between the values -130 and 130 and checking how much the corner score changes. The way I will be testing the intensity scale is by comparing the original images corner scores with the corner scores of the image that has been scaled with values between 0.5x to 3x. And Lastly I will be testing the image translation by comparing the original corner scores with the image that has been translated with values between -50 and 50.

1. Is Harris interest point detector robust to intensity shift?

Firstly, for the control I tested the Harris interest point detector with no change in the intensity shift so see what it looks like without any changes. The numbers I used for the intensity shifts were between -130 and 130. The small shifts (between -50 and 50) made the detector very robust as the result in the end were very close to the original. So that means the corner scores remained pretty much in the same place. For shifts around -80 to -50 and 50 to 80 there were changes in the corner scores compared to the original as it would miss corners. For shifts around -80 to -130 and 80 to 130 the detector could barely find any corners as the corner scores where completely different to the corner scores of the original.
Theoretically the Harris detector is expected to be robust to intensity shifts because it relies on local intensity variations rather than absolute intensity values.
The detector behaved as expected for small shifts as the corner scores remained the pretty much the same and it was very robust. However, for medium to large shifts there was a noticeable decrease in its corner detection ability especially for large. I think this happened because numbers close to the 0 or 255 were becoming black or white and as the intensity shifts were too high so there weren't any variations in the local intensity.

2. Is Harris interest point detector robust to intensity scale?

To experiment with the intensity scale, I tested scales from 0.5x to 3x. I scaled the image and then outputted the scaled image with the corners it detected.

When I tested the image with the scales between 0.5 and 0.7 the image was a lot darker, and the corner scores were very close the original image meaning it was very robust for those values. When I tested the image with scores between 0.8 to 1.3 the image didn't change much as the multiplier was too low, so the corner score was very close to the original image. When I tested value from 1.4 to 3 the image got a lot brighter, and the corner detector failed to detect some corners as it was less sensitive.
Theoretically Harris detector is expected to be robust for small changes in the intensity scale as the detector relies on detecting corners based on local intensity variation and small intensity scales do not significantly alter the local intensity differences between neighboring pixels. However, for large intensity the image may have pixel saturation. Saturation makes it harder for the detector to accurately identify corners.
The detector behaved as expected as for small changes in the intensity scale the detector still managed to detect most of the corners. For large changes in the intensity scale the detector didn't detect most of the corners however this was expected as there was too much saturation.

3. Is Harris interest point detector robust to image translation?

To experiment with the image translation, I translated the image in the x coordinate and y coordinate with values from -50 to 50. For values between -10 to 10 there wasn't much of a difference in the corner score compared to the original except it that it would detect corners on the edge of the image where there weren't corners. For values between -10 to -30 and 10 to 30 there was a bigger difference in the corner score compared to the original as it would still detect corners on the edge of the image but also miss some corners on the image too. Lastly between -30 to -50 and 30 to 50 there was the biggest difference in corner scores with the original.

Overall, Harris interest point detector is robust for small values for image translation but as the image translation increases the robustness of the detector decreases.