SCC.366 Media Coding and Processing - CW2 - Report

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Abstract

Harris Corner Detection allows to find unique patches in images, it does this using a shifting window for corners since these are more distinctive than flat/edge regions; corners provide significant change in all directions, which is calculated by gradients in X, Y directions of the image by use of Sobel filter. Since gradients find rate of change between two points, we can identify whether the window shifting will give a linear edge, flat or corner region, depending on the type will give variation in terms of gradients for X, Y.
We consider small shifts in change within a window by summing up squared differences between the two points however since this is slow and since the shift is small, we can approximate by use of Taylor Series to have the change be approximated in terms of gradients in quadratic form, by using the second moment derivatives we smooth the image by use of gaussian smoothing, so we use the second moment matrix as well which gives better computation times.
A region must be a corner if it has significant change in X and Y directions, if there is only high change within one gradient direction then it must be an edge, since the region must be not changing for one of the other directions, similarly if there is little change in both then it must be a flat region.
Then a corner is measured of whether the corner is a good enough corner or not using the corner response formula to create corner candidates, then we filter through and pick the best corner points in the image.

Is Harris interest point detector robust to intensity shift?

Experimentally: I ran a few tests where I added on values to the image (Figure 1) and was still receiving the same matching features (Figure 2), I did +20 and -20.

Theoretically: This makes sense because we compute gradients which is difference between values, if all values are increased/decreased the difference between them does not change, so the gradients that we get would be the same.

Figure 1

```
InputImage = imread('Neuschwanstein.png');
InputImage=InputImage+20;
```

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

Experimentally: I multiplied the input image by 0.5 and 1.2 so it became darker and brighter, as shown the results still are the same and is able to correctly detect corner points.

Theoretically: This also makes sense since the values are all being increased/decreased by the same amount, so the gradient between them would not change since it is only the rate of change between two points which remains the same.

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

Experimentally: I used imtranslate() to shift the image by [40 40] and then applied the algorithm, as seen it still works even with translation of an image.

Theoretically: This still makes sense because with use of gradients, the positions at which we apply may change but the difference between two points will still be the same amount just in a different location, so gradients will change slightly in terms of locations but the values will also shift for the gradient hence we can still apply Harris corner detection and get corners correctly.