

CV Assignment 2 Report

Aryan Jain

2019101056

Harris Corner Detector:

Experimentation: Experimentation with different parameter values were done which includes window size, threshold, and k.

Observations: Some of the key observations during the above experimentation are listed below:

- a) Number of corners detected becomes 0, after we increase threshold crosses a certain value.
- b) As we increase the window size, it is observed that number of points increases and the pointer of that point becomes very large such that it is hard to discriminate neighbouring points from each other.
- c) Increasing the value of k leads to no point detection after certain point.

Conclusion: The idea behind the Harris method is to detect points based on the intensity variation in a local neighbourhood: a small region around the feature should show a large intensity change when compared with windows shifted in any direction. The idea is to consider a small window around each pixel p in an image. We want to identify all such pixel windows that are unique. Uniqueness can be measured by shifting each window by a small amount in a given direction and measuring the amount of change that occurs in the pixel values.

Shi-Tomasi Corner Detector:

It is basically an advanced corner detection algorithm, that detects corners by considering a small window on the image and then moving it around. If the difference is large, then it is reported as corner. It differs in Harris Corner detector in just the measurement of R value.

Here $R = \min(\lambda_1, \lambda_2)$, whereas in Harris Corner Detector $R = \lambda_1 * \lambda_2 - k * (\lambda_1 + \lambda_2)^2$

Experimentation: Experimentation with different threshold values were done to check if a point is a corner or not and window size to check if a point can be a corner or not.

Observations: Few of the observations during the experimentation are:

- a) Number of points detected goes down as the threshold value is increased.
- b) After increasing the window size to a certain limit, we won't be able to discriminate the points that are too close to each other.

Comparison between the Harris and Shi-Tomasi Corner Detector:

It is observed that Shi-Tomasi detect more number of points than Harris Corner Detector. Also in Shi-Tomasi we have an option to detect the top corners of the image than just detecting each and every point. In practice Shi-Tomasi corner detector works better than Harris Corner Detector.

Single-scale Lucas-Kanade Algorithm:

Experimentation: Experimentation with different tau values and window size were done.

Observations: Window size 5 worked well and $\tau = 0.01$ turned out to be optimal one.

Quiver plot superimposed on the images are shown in the code and is plotted for each of the dataset. For each dataset, I took 2 consecutive images at a time and applied the algorithm. The results of which are shown in the jupyter notebook.

Multi-Scale Coarse-to-fine Optical Flow

Experimentation: experimentation with window size and numLevels were done.

Observation: This method works better than the above method, and is used when the velocities of the objects in the 2 frame is too high. This method also helps to circumvent the aperture problem to some extent.