Lateral movement detection using the Lucas-Kanade method for optical flow estimation

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1. overall

The Lucas Kanade method is one of the common methodologies for computing the optical flow. This detection is based on pixel position differences between two consecutive frames of the same scene and works by detecting and tracking some point of interest, generally, sift-based features and corners, where optical flow can be easily calculated.

We modify the lk_track.py script provided, to notify the user respecting his lateral movements by means of a terminal output and three images representing left optical flow, right optical flow and a steady state of lateral optical flow.

2. Run the script

To run the script it is only necessary to execute the *lk_track.py* file which can be found in the scripts folder and to have an active webcam connected to the computer.

The program will show two windows, one with the actual frame taken from the camera with the interest points and one containing an image corresponding to the actual state of the lateral optical flow. To obtain a response, the user must move to the left or right.

3. Methodology

The Lucas Kanade algorithm takes the position of the interest pixels, like corners, and computes the difference between their positions, however, the actual *lk_track* file tracks this positions only. For that, the x position of each interest point was obtained from the *new_tracks* variable and the mean horizontal variation of all points was computed.

We established two different thresholds to detect left movement and rigth movement, -1 and 1 track units respectively. The actual magnitude of this units depends on the camera, so no static measure was defined as threshold.

4. Results

The images presented to the user as feedback are shown below:

Figure 1. Image shown when left lateral movement was detected by optical flow estimation using LK.

Figure 2. Image shown when right lateral movement was detected by optical flow estimation using LK.

Figure 3. Image shown when no lateral movement was detected by optical flow estimation using LK.

Also, some snapshots of the interface and the working script are presented:

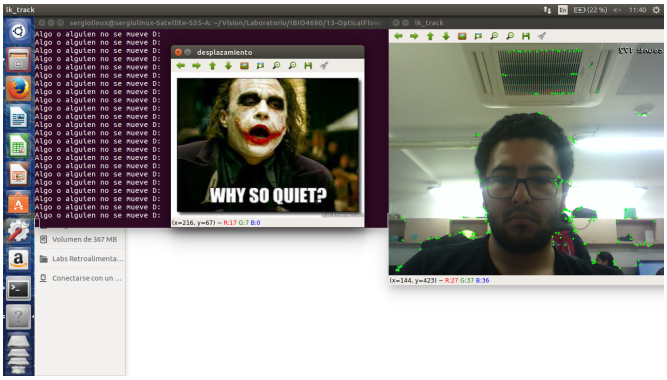

Figure 4. Interface when no lateral movement was detected by optical flow estimation using the lk_track file.

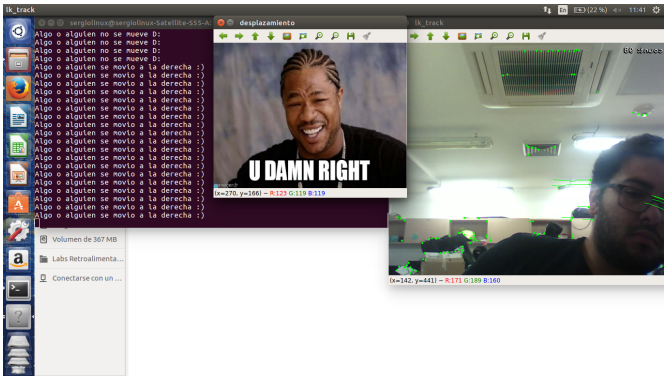

Figure 5. Interface when right lateral movement was detected by optical flow estimation using the lk_track file.

It can be seen that the camera image is shown inverted, however, the interface responds to the user movement respecting his own reference frame.

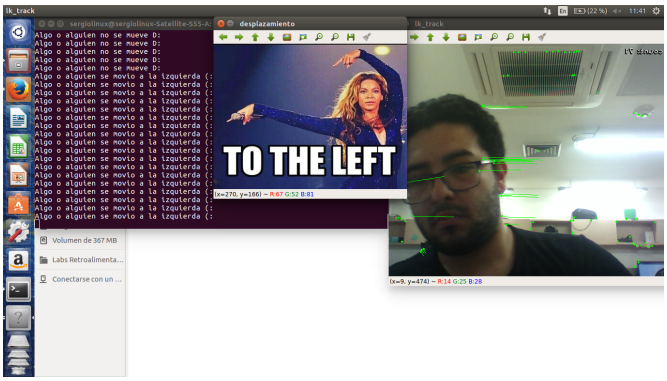

Figure 6. Interface when left lateral movement was detected by optical flow estimation using the lk_track file.