[Algorithms Overview]

Theory

The optic flow computation from Lucas and Kanade is based on the image brightnes constancy assumption which states that for a motion (u,v) of a point in an image I the brightness of the point does not change:

$$I(x, y, t) = I(x+u, y+v, t+1)$$

Using first order Taylor expansion leads to the gradient constraint equation

$$I_x\ u + I_y\ v + I_t = 0$$

This underdetermined system is solved by a least squares estimate over an image patch given by

$$(u\ \ v)^T = [\Sigma\ (I_x\ I_y)^T(I_x\ I_y)\ ]^{-1}\ \Sigma\ I_t(I_x\ I_y)^T$$

References

Lucas, B. D., & Kanade, T. (1981). An iterative image registration technique with an application to stereo vision. International joint conference on artificial intelligence (Vol. 3, pp. 674–679).

Baker, S., & Matthews, I. (2004). Lucas-Kanade 20 years on: A unifying framework: Part 1: The quantity approximated, the warp update rule, and the gradient descent approximation. International Journal of Computer Vision, 56(3), 221–255.

Bouguet, J. (1999). Pyramidal Implementation of the Lucas-Kanade Feature Tracker Description of the algorithm. Intel Corporation, Microprocessor Research Labs,, 1(2), 1-9.

Bruhn, A., Weickert, J., & Schnörr, C. (2005). Lucas/Kanade Meets Horn/Schunck: Combining Local and Global Optic Flow Methods. International Journal of Computer Vision, 61(3), 1-21.

Shi, J., & Tomasi, C. (1994). Good features to track. IEEE Conference on Computer Vision and Pattern Recognition.

Tomasi, C., & Kanade, T. (1991). Detection and tracking of point features. Image (Rochester, N.Y.).

Algorithm

An implementation of the described algorithm using integer or floating point arithmetics is provided in:

" visual_processing/optic_flow/LucasKanade.hpp " " visual_processing/optic_flow/LucasKanade.cpp "

The sample code computes a single optc flow vector over an image patch. Different kernels can be used for the spatial gradient computation. The method returns the estimated optic flow vector as a homogeneous vector (x, y, d) .

An example for using the sample code is given in

" visual_processing/optic_flow/LucasKanade_test.cpp "