

Matlab Project #2 – Stabilization and Mosaicking

Introduction

In the lab #2 we have studied the algorithms of stabilization (using template matching) and of mosaicking (using Harris & Stephens corner detector). In this project we'll implement the stabilization and mosaicking algorithms using the Lucas-Kanade program package (Part 1) [1]. (The description of the Lucas-Kanade program package is provided in [2]).

Task

Preliminary work

- Download the Lucas-Kanade (L&K) program package (Part 1) [1] and the description of the package [2].
- Fix the bug in the Lucas-Kanade package:
In the directory **lk20-p1**:
 - in function **test_affine.m**, line 124: add:
fit = [];
 - in function **test_homo.m**, line 125: add:
fit = [];
- Run the function **run_affine('takeo')**. (Hint 1: don't forget to modify the PATH as required. Hint 2: if the function **run_affine('takeo')** runs a long time, try to modify the "**test parameters**" in order to decrease the number of iterations.)
 1. Explain why the command **fit = [];** is necessary. What problem it solves?
 2. Who is shown in the image within the file **'takeo.mat'**? (Hint 1: the same person is shown in Figure 2 in [2]. Hint 2: it is a very famous researcher from the optical flow field.)
 3. Explain the *Forwards Additive*, *Forwards Compositional*, *Inverse Additive* and *Inverse Compositional* algorithms. (Hint: read the paper [2] and find the relevant explanations.)
- Try to understand the code in the L&K package – find out how different optical flow methods are implemented and what experiments are performed in order to compare these methods. (Hint: look in [2], also.)
- Extract from the L&K package the functions that compute optical flow by one of the four methods listed above. Read the relevant explanations in the paper [2].
- Review the algorithms **videostabilize.m** and **videomosaicking.m** that we studied in the lab.

Video stabilization

Create a program that performs video stabilization based on the program **videostabilize.m** and on the optical flow method from the L&K package. (Hint: similarly to the program **videostabilize.m**, it is recommended to use the optical flow only within the ROI (and not for the whole frame).)

Video mosaicking

Create a program that performs video mosaicking based on the program **videomosaicking.m** and on the optical flow method from the L&K package. (Hint: don't forget to decimate the input video - process only 1 frame from 5 input frames.)

Note: The main aim of this project is to study the LK optical flow algorithm and to try using it for mosaicking and stabilization. You may get non-perfect or even bad results – this is acceptable for this project. Explain your approach to the solution and attach your results.

Submission

You have to submit the Project Report (with the code included in printed form) at 23/04/2013 at the lab (from 13:00 until 14:00) or on the Video Processing lesson (at the breaks between the lectures).

References

- [1] Lucas-Kanade Optical Flow Matlab package:
http://www.ri.cmu.edu/research_project_detail.html?project_id=515&menu_id=261
- [2] S. Baker and I. Matthews, "Lucas-Kanade 20 Years On: A Unifying Framework," *Int. J. Comput. Vision* **56**(3), 221-255, 2004.
Available at http://www.cs.cmu.edu/afs/cs/academic/class/15385-s12/www/lec_slides/Baker&Matthews.pdf