Pid: A15677346

Name: ShihHan Chan

CSE152

Homework 2

1.1 Preliminary

What is A? (Hint: See slides P28 in lecture 11 for good reference.)

A=$\nabla I \frac{\partial W}{\partial \boldsymbol{p}}$

And A also looks like this after expansion in matrix form:

A= $\begin{bmatrix} I_x(\mathrm{p}_1) & I_y(\mathrm{p}_1) \\ I_x(\mathrm{p}_2) & I_y(\mathrm{p}_2) \\ \vdots & \vdots \\ I_x(\mathrm{p}_{25}) & I_y(\mathrm{p}_{25}) \end{bmatrix}$

What is the solution of Δp? (Represent it by A and b)

$$\Delta \boldsymbol{p} = -(\sum_x A^T A)^{-1} \sum_x A^T b$$

What conditions must A meet so that the template offset can be calculated reliably?

A must meet the following conditions to calculate the template offset ($\Delta \boldsymbol{p}$) correctly.

1. A^TA should be invertible
2. A^TA should not be too small due to noise, eigenvalues l_1 and l_2 of A^TA should not be too small
3. A^TA should be well-conditioned, l_1/ l_2 should not be too large (l_1 = larger eigenvalue)

1.2 Iterative KLT Tracker [50 points]

complete the code in the file

1.3 Testing [25 points]

1.4 Failure analysis [10 points]

In your write-up, give a short analysis on the possible reasons the tracker could fail; give a possible solution to fix some of these problems.

1. KLT track takes care of error such as image noise and view point change (ex. Affine transformation). And that's why we need brightness constancy: the patch intensities will not change substantially in the next image. Solution: sample the picture with less noise or use some denoise method.

2. KLT track is a local search, it will get stuck to local minimal, and that's why we need small motion assumption to make sure the point doesn't go too far away. Solution: sample the picture sequence more frequently to make sure the object we track is always in small motion.

There are some modified KLT track algorithm to solve these problems like pyramidal KLT.

2 Questionnaire [1 point]

Approximately how many hours do you spend on this homework? Please answer it in your write-up.

16hours