CV Homework 4

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1.1 Math

$A^T A$ is the Hessian. It is the sum of all pairs of gradients
$\begin{bmatrix} \sum dxdx & \sum dxdy \\ \sum dxdy & \sum dydy \end{bmatrix}$
$A^T A$ has to be invertible so that the Δp can be calculated.

1.3 Car Tracking

The rectangle is only translated, and tracks the car as follows:

Figure 1: 20

Figure 2: 50

Figure 3: 100

1.4 Failure Modes for Translating L-K Tracking

There are several reasons the tracker could fail. The primary is occlusion, where the object being tracked is lost and the tracker then templates a new object.

Even partial occlusion could cause problems. A possible solution to this is to implement a more robust method of updating the template than just every frame - mabe by verifying that there are greater than some number of feature matches with the last few templates and the current guess.

Another possibility is low frame rate, where the car translates too far for the tracker to update, depending on if the tracker is constrained on number of iterations.

2.1 Affine Equation

To optimize Eq 2
$I_{t+1} = I_t + \sum w_c B_c$
We want to minimize
$J(w) = (I_{t+1} - I_t - \sum w_c B_c)^2$
Then w has the closed form solution $w_c = \sum_x B_c(x) * [I_{t+1}(x) - I_t(x)]$

2.3 Book Tracking

This is the comparison between the normal and Basis L-K tracker. The normal tracker is yellow, the Basis one is blue. The normal tracker appears to be better for this set of images.

Figure 4: Frame 30

In the first part of the images, the trackers overlap.

Figure 5: Frame 150

Figure 6: Frame 248