INF5300 – Lab: Motion cues from video and tracking

This lab will use MATLAB to implement and explore topics covering motion estimation (optical flow) and object tracking (particle filter).

Optical flow

The following Matlab scripts implement Lucas Kanade as a dense pyramid estimation.

http://www.mathworks.com/matlabcentral/fileexchange/23142-iterative-pyramidal-lk-optical-flow

Acquaint yourself with the code, and apply it on the demo images and some sequential images of your choice. One challenge with using all possible positions for flow estimation is the computational cost. One example implementing a simple corner detector to choose only "good regions to track" (based on the seminal work of Shi & Thomasi), is the following Matlab scripts.

http://www.mathworks.com/matlabcentral/fileexchange/30822-lucas-kanade-tracker-with-pyramid-and-iteration

Test these scripts on the same images and compare results.

Both these methods have the "deficiency" that the confidence estimate (aka tracking failure detection) is somewhat heuristic. A better way of estimating confidence in flow fields is proposed in [Z. Kalal, K. Mikolajczyk, and J. Matas, "*Forward-Backward Error: Automatic Detection of Tracking Failures*," *International Conference on Pattern Recognition*, 2010, pp. 23-26.], which quite simply is to track a feature point forward, initialize tracker with the tracked location and track backward. If you do not end up with in the same (relatively close) location, the track can be discarded.

Particle filter

Write a 2D version of the following code: 1D sequential importance resampling example in pure Matlab (very clearly commented): http://www.mathworks.com/matlabcentral/fileexchange/35468-particle-filter-tutorial

Useful demo (with some C-code) but with lacking comments in the code: http://www.mathworks.com/matlabcentral/fileexchange/33666-simple-particle-filter-demo

Combine parts from these two examples to make a PF tracker that uses a color appearance model to calculate the observation likelihood. Try a qualitative evaluation of your tracking results.

Some useful tips (from last lab):

Extensions to Image Processing Toolbox: http://vision.ucsd.edu/~pdollar/toolbox/doc/index.html

Useful image processing functions for this and future labs:
http://www.csse.uwa.edu.au/~pk/research/matlabfns/