Computer Vision (CSL840)   Major (take home part)   May 6, 2011

1. Consider the *Viola-Jones* method of face detection:

   (a) Explain how the *Adaboost* algorithm has been used for this problem. Why does it work?

   (b) What is the role of the *attentional cascade*?

   (c) Suppose that you have to use this method for detection and tracking of faces in a surveillance video. How would you integrate a tracker with this scheme to ensure temporal consistency?

2. (a) Give a *graph-cut* formulation for 3D reconstruction from two calibrated images.

   (b) Give an object space *graph-cut* formulation for 3D reconstruction from multiple calibrated images. Assume that the *sites* are a set of voxels enclosing the object to be reconstructed and the *labels* are 0 (indicating that either the voxel doesn't belong to the object or is invisible) or 1 (indicating that the voxel is on visible surface boundary of the object). Please clearly state any assumption that you may be making.

3. Provide the rationale for:

   (a) Use of a pyramid based multi-resolution strategy for image blending (in mosaicing, for example).

   (b) Using muti-resolution feature detectors like *SIFT* for detection and tracking.

4. Suppose you have entered a robotic competition where you are allowed to carry your own mobile robot with stereo cameras and onboard computers and you have your own robot motion control programmes available with you. Suppose the competetion orgranizers give you a problem situation where

   (a) The robot workspace is identified by floor area with a distinctive colour which is different from that of all static obstacles.

   (b) The navigation problem is specified as one of visiting a set of landmarks in a sequence.

   (c) The landmarks are differently textured cube objects of different sizes, and are presented to you for learning, on at a time, before their placement on the workspace by the organizers.

   (d) You are guaranteed that at least one landmark will be visible from the start position, and, as you moving past one landmark the next landmark is guarateed to be visible.

   Please outline your algorthmic strategy for the competetion. Would you require any other inputs from the organizers. There is a negative marking scheme in the competetion for every additional input that you may seek.