Computational Exercises #2 and #3

(due Nov. 29th, 2001)

1. **Snakes:** Implement and execute the snake (deformable contour) algorithm as described in the class (or in the Trucco and Verri book) on the two images (img1.tif and img2.tif). Document the free parameter settings: i) number of points on the snake, ii) $\alpha\,\beta_i, \gamma$, iii) threshold for setting some of the β_i to zero, iv) fraction of snake points that don't move as a convergence criterion, v) neighborhood in which search is conducted. Please execute the algorithm on the two images for parameter settings, i) $\gamma = 1.0, 1.2, 1.4$, and ii) neighborhood size$= 3 \times 3, 5 \times 5, 7 \times 7$. Discuss the results and your experience in getting/or not being able to get the snake to work reliably.

2. **Generalized Hough Transform:** Examine the three images (sff1can1.tif, sff1sca1.tif, template_ex.tif). The first image is an edge detector output corresponding to the second image (which is a shot of the Transamerica tower in SF). The third image is an example template. Do the following:

i) Convert the edge detector output and the template images into sets of point locations.

ii) Setting of the template: Allow the template to rotate and translate across the edge detector image. In Hough space, this corresponds to a 2D voting space of rotations and translations of the template. Determine the range of translations of the template by limiting it to the entire image area. These limits will vary with the chosen rotation. Use these limits to set the range of translations. Sample the translations in pixel coordinates (one pixel interval). Sample the rotations in one degree intervals.

iii) For each setting of the template, determine the nearest neighbor in the edge image for each template point (note that this is opposite to what was asked in the midterm question). Determine the distance of the nearest neighbor for each template point. Add up all the nearest neighbor distances over the set of template points. The weighted vote for each setting of the template can be conveniently chosen to be the inverse of the sum of the nearest neighbor distances.

iv) For the set of all rotations and translations of the template, determine the weighted vote. List those configurations of the template which receive the "highest" weighted votes. As a sanity check, what is the vote received when the template exactly matches a portion of the edge image.

v) Repeat the above for a different choice of template culled from the edge image.

vi) The above description is necessarily very rough. I expect plenty of questions regarding this scheme when I return on 11/13/01.