

Image Registration Techniques

Homework 6

Due: Wednesday 8/12 at the beginning of class.

This homework explores Lectures 13, 14 and 15. There is only one problem, however, because we want you to begin to focus on the project.

1. **(30 points)** Write a vxl/rgrl program to align the range data set posted on the web page with itself (scaled_dragonStandRight.0.txt). The range data set is taken from the Dragon data of the Stanford repository. See

<http://graphics.stanford.edu/data/3Dscanrep/>

Assume the initial alignment is

$$\mathbf{A} = \begin{pmatrix} 0.98106 & -0.172987 & 0.0871557 \\ 0.173648 & 0.984808 & 0 \\ -0.0858317 & 0.0151344 & 0.996195 \end{pmatrix} \quad \text{and} \quad \mathbf{t} = \begin{pmatrix} 10 \\ 0 \\ 15 \end{pmatrix}$$

Estimate an affine transformation (even though the actual transformation is only rigid). Use face point features and robust estimation.

Using face points requires that you compute surface normals in the “fixed” data set (though not in the moving data set). You can do this by finding a small set of nearest points to each point in the data set and then computing the surface normal using orthogonal least-squares. Storing the points in a k-d tree will make this more efficient. Finally, range data registration generally does not use all data points from the moving image. Sampling every 10th or even every 50th point should work here. You may run `rgrl/examples/estimate_normals_3d.cxx` to compute the surface normals, but be sure to understand the mathematical concept behind.

Please do not simply copy/modify “`rgrl/examples/registration_range_data*.cxx`”, else no point will be given.