COMPM080: Coursework #1

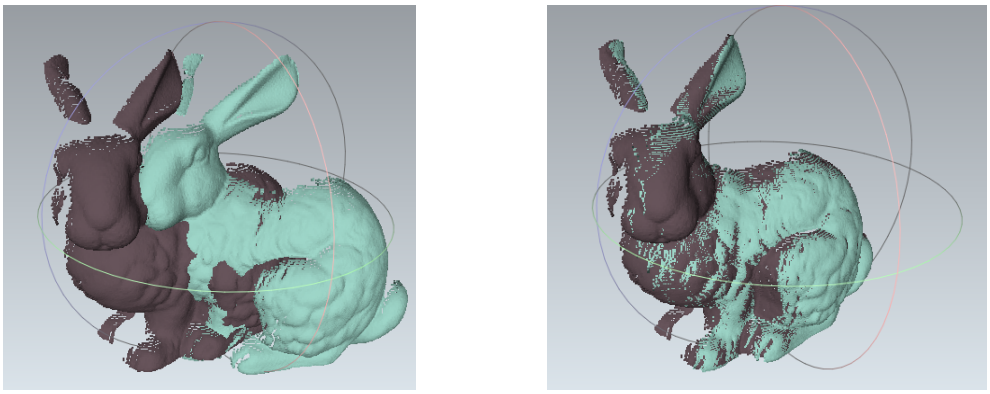
Due on Friday, February 12, 2016

Maria Ruxandra Robu- 14042500

Introduction

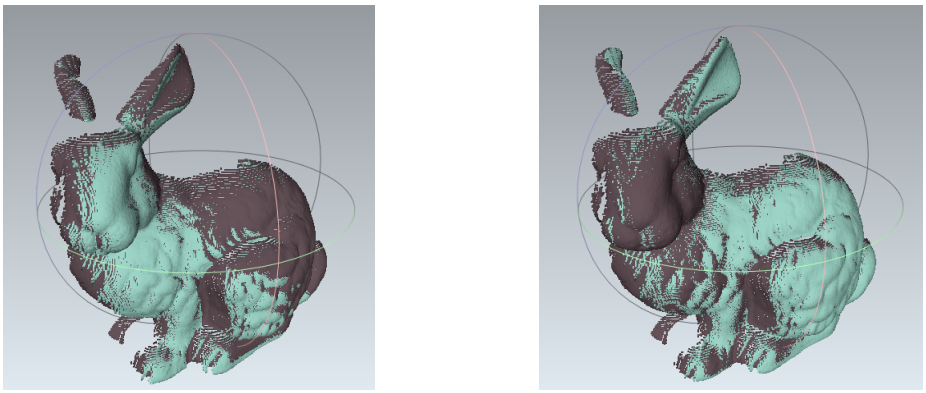
Task 1

Basic ICP algorithm



(a) (b)

Figure 1: Task 2 - no initial alignment - 27 iterations - error = 0.11854



(a) (b)

Figure 2: Task 2 - no initial alignment - 11 iterations - error = 0.116692

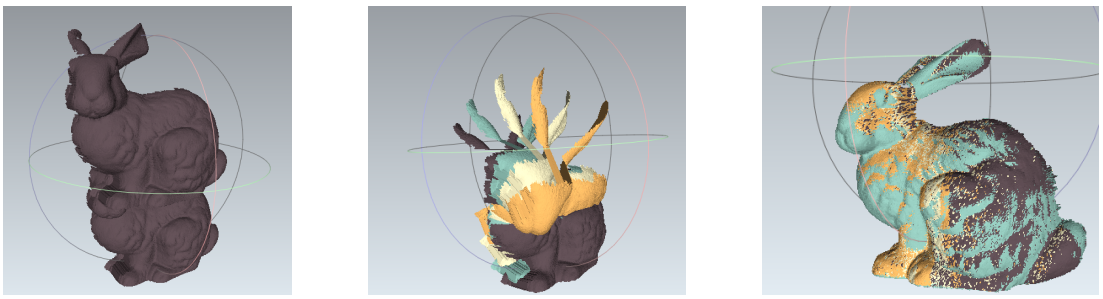
Task 2

Vary rotation

The mesh M1 was centered at its origin by subtracting the mean $\bar{p}$ from all its points p, as shown in Figure 3a. Once its position is set, incremental rotations are applied to the mesh in the x, y and z axes. Figure 3b shows an example for 3 rotations along the x axis. Once we have the initial M1 and the rotated M3, ICP is ran for each iteration. Figure 3c illustrates the results for the 3 rotations in the example.

The parameters used for this section are:

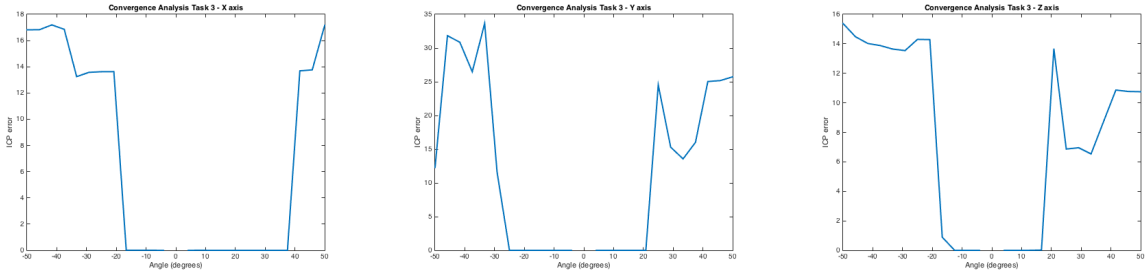
Task 2 continued on next page...



(a) (b) (c)

Figure 3: Task 3 - Introduction

- number of different rotations = 25
- interval of degrees [-50, 50]
- maximum number of iterations for ICP = 50
- error threshold for ICP = 1e-04
- threshold for the bad points rejection = 70%



(a) (b) (c)

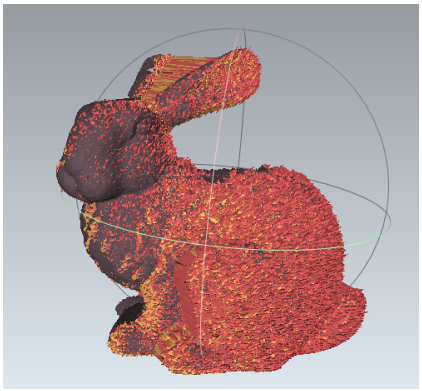
Figure 4: Task 3 - Convergence Analysis for the 3 axes of rotation

For each iteration, the final error and number of iterations were saved in a file and plotted with Matlab. The figures 4 show the basins of convergence for the ICP algorithm by varying the rotation angle on the 3 axes. The minimum error obtained (1.48e-11) was for the z axis at -4 degrees and the maximum (33.64) on the y axis for -33 degrees.

Task 3

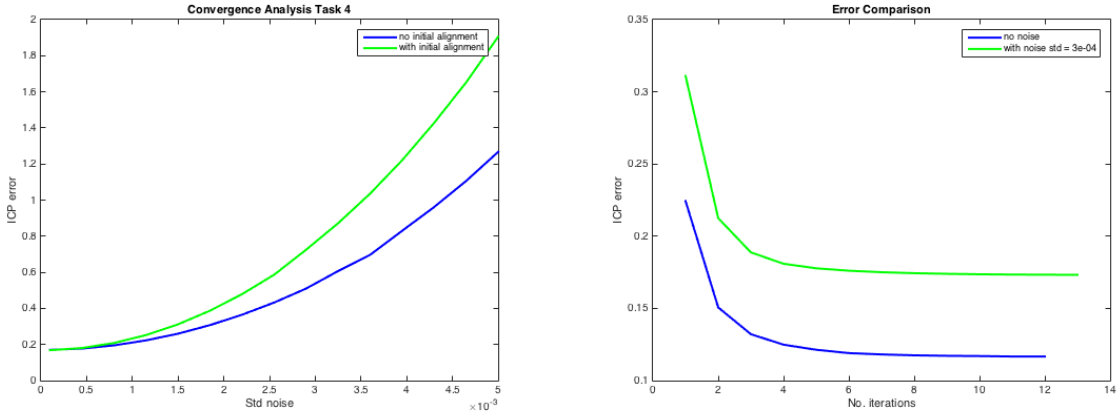
Noise

mnoisy2 - 0.01 bunny on fire - orange 0.00055, red noise 0.001
between 0.0001 and 0.005 - 15 samples



(a)

Figure 5: Task 4 - Bunny with different levels of noise. Orange corresponds to 55e-04 standard deviation and red to 1e-03 standard deviation



(a) (b)

Figure 6: Task 4 - Noise analysis

Task 4

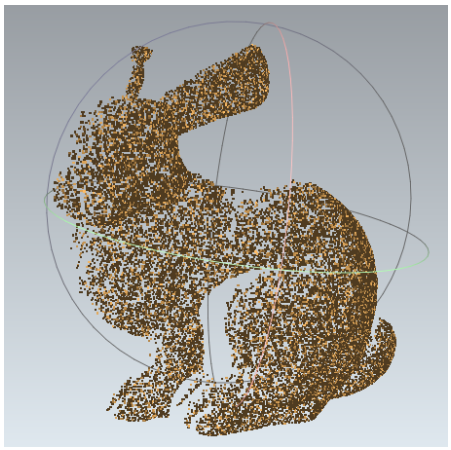
Subsampling

Task 5

Multi-body

Task 6

Normal estimation + improved icp



(a)

Figure 7: Task 5 - Example of subsampling - 35%