

**3D Photography**  
**Project I**  
**Topic: 3D Point-Based Registration: the ICP**  
**algorithm Due: March 9**

The goal of this homework is the experimentation with the ICP algorithm for the registration of two point clouds.

The **first** task is to use a range image  $R_1$  and then create the range image  $R_1'$  by applying a known rotation  $R$  and translation  $T$  to it (use the formula that provides a rotation matrix from a set of three angles-see online notes). Select now a random set of points from  $R_1$ . Since points between  $R_1$  and  $R_1'$  are in one to one correspondence, you have now a set of perfect correspondences between the two images. Using the algorithm described in the online notes you can now compute the rotation and translation between  $R_1$  and  $R_1'$ . Verify you're your computation is correct (you can easily compare it with the known  $R$  and  $T$ ).

Now you are ready for implementing a simple version of ICP. Since you have a method for the computation of a transformation from a set of correspondences, your **task** now is to automatically determine the set of corresponding points. You can use any of the variations described in class. The fastest would be the one that given a random set of points from  $R_1$  computes the closest points in  $R_1'$  based on a simple projection. You can then do a pruning by discarding correspondences whose distance is larger than a threshold, and whose normals do not agree (again you need to use a threshold). Document on a readme file which variation you are using.

Experiment with different sets of random selection of points from  $R_1$  and display the final result by showing the two point clouds after registration (use a different color for each cloud). Also display the set of correspondences with its own color.

Finally, experiment with point-to-plane vs. point-to-point distance [extra credit].