3DP Lab 3 - Cloud Registration

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1 Goal

The goal of this laboratory is: given a source and a target point cloud, find the alignment transformation of the source to the target cloud.

2 Introduction

The request of the assignment was to complete the code of the `Registration.cpp` file in order to complete different steps of the pipeline needed:

1. **Point cloud preprocessing**
   - cloud filtering
   - downsampling
   - normals computation
2. **Global registration**
   - Feature (FPFH) extraction and matching
   - Registration based on feature matching
3. **Registration refinement**
   - ICP
4. **Point clouds visualization**

3 Implementation Details

The implementation has been done in C++ by using Open3D library.
In order to complete the methods:

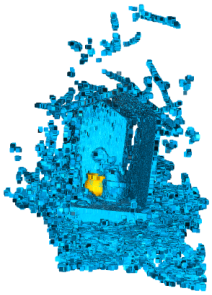
- $Registration(...)$: constructor.
- $draw_registration_result(...)$: method to visualize target and source with two different colors.
- $preprocess(...)$: method to downsample, estimate normals and compute FPFH features.
- $execute_global_registration()$: method to execute the global registration. I decide to use (and keep into the code) RANSAC for global registration but I also tried Fast global registration.
- $execute_icp_registration(...)$: method to refine the result.

4 Results

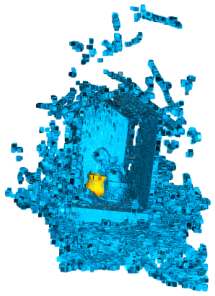
Here all the results, both qualitative and quantitative, obtained for the 2 datasets are reported.

4.1 Dataset 1

a) Initial Point Clouds



b) After Global Registration



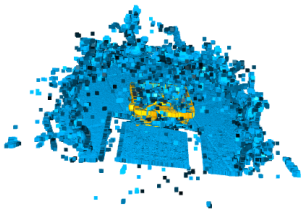
c) After ICP Registration

d) Merged Cloud

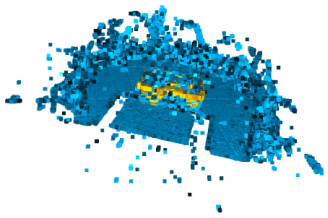
Fitness: 0.869718
Inlier RMSE: 0.00396817

4.2 Dataset 2

a) Initial Point Clouds



b) After Global Registration



c) After ICP Registration

d) Merged Cloud

Fitness: 1
Inlier RMSE: 0.00185114