3D Visual Computing:
Homework 3

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ICP

Experiments

I used the open3d library to perform the ICP. Following the instructions, I perform a global alignment first and then use ICP to fit the data. I tried to use 2 types of ICP (namely, Point2Point and Point2Plane) and found that pointwise achieved higher performance on training data (roughly 70 percent).

Analysis

The reason why Point2Plane ICP performed worse might be that estimating normals needs fine-tuned parameters. However, I don't have enough experience with normal estimation settings so I just made use of those offered in their documents. The task they want to accomplish in their documents is an alignment of a scene rather than a single object. So the parameters may not be compatible with this task.

Results

I attached 2 json file in "outputs/". **ICP.json** is for submission.

PointNet

Method and Experiments

I split all instances in terms of labels and trained 79 models independently. During test time, each model predicted the poses for the corresponding instances in the test set, and all predicted results are combined finally.

I have had a hard time dealing with the model, since the accuracy remains zero for the first few days, no matter how I change the loss, data loader, etc. The problem was finally found to be that the coordinates are relatively small compared to the RGB data and that the model always tries to fit the pose with the color information, which doesn't contain many clues. Scaling the coordinates to 10 times the RGB resolved the problem.

I have tried two distinct methods of aligning pointcloud inside a batch, interpolating the pointcloud to the maximum length and padding them with 0. The first way acts significantly worse than the second one. The reason might be that interpolating is not compatible with data like a pointcloud, because some outliers might be created since the mid point between two points on a pointcloud may not be on the pointcloud, neither is the color. Padding acts like a activating function (e.g., ReLU) and will not affects the classification too much.

Results and Analysis

The accuracy is very different for distinct instances. The instances with the label "inf" are the easiest to fit. That's because the loss for "inf" is much simpler than those with finite symmetries.

I attached 2 json file in "outputs/". **PointNet.json** is for submission.