Velodyne Lidar Odometry

Name: Yung Feng Chang

Since the website only provides 11 sequences (00 - 10) with ground truth trajectories and 11 sequences (11 - 21) without ground truth for evaluation, I select sequence 00 and 01 for comparison between output from odometry and ground truth, and plot sequence 11 directly to show the result. I applied the following formulas to calculate translation error rate and rotation error.

$$Translation\ Error\ Rate = \frac{ll\ T_{ground\ truth} - T_{odometry}\ ll_2}{ll\ T_{ground\ truth}\ ll_2} \times 100$$

$$Rotation\ Error\ Rate\ = \frac{ll\ Theta_{ground\ truth} - Theta_{odometry}\ ll_2}{ll\ Theta_{ground\ truth}\ ll_2}$$

Where

$$R\ = \begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{31} & r_{32} & r_{33} \end{bmatrix}$$

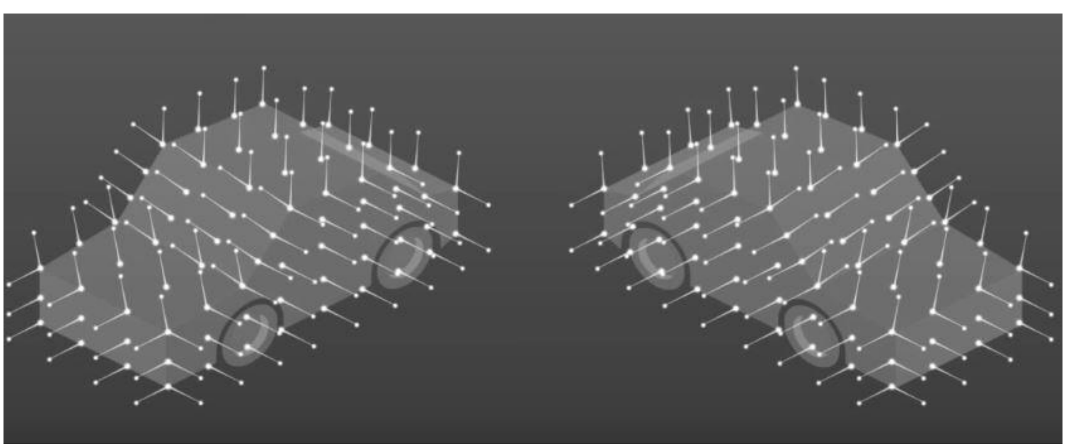
$$\theta_X = atan2(r_{32}, r_{33})$$

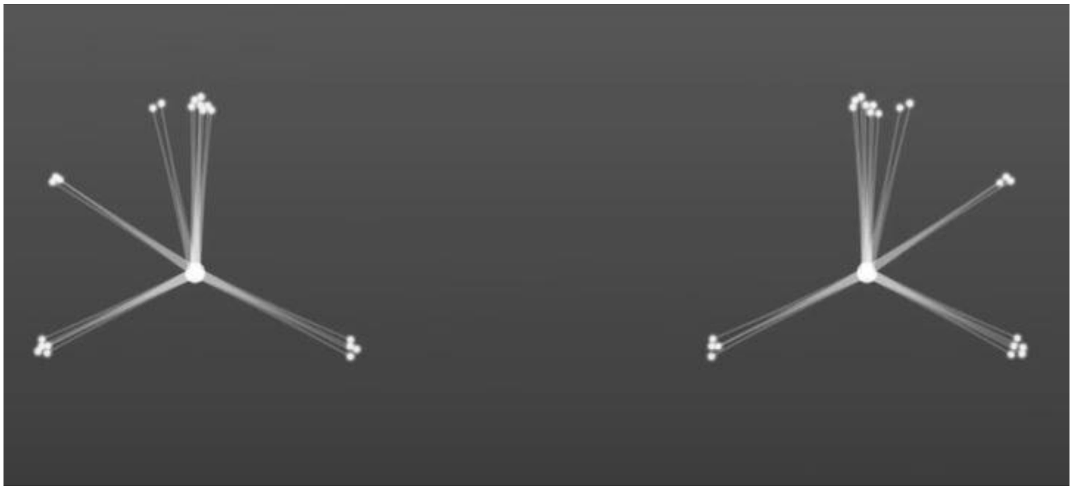
$$\theta_y = atan2(-r_{31}, \sqrt{{r_{33}}^2 + {r_{32}}^2})$$

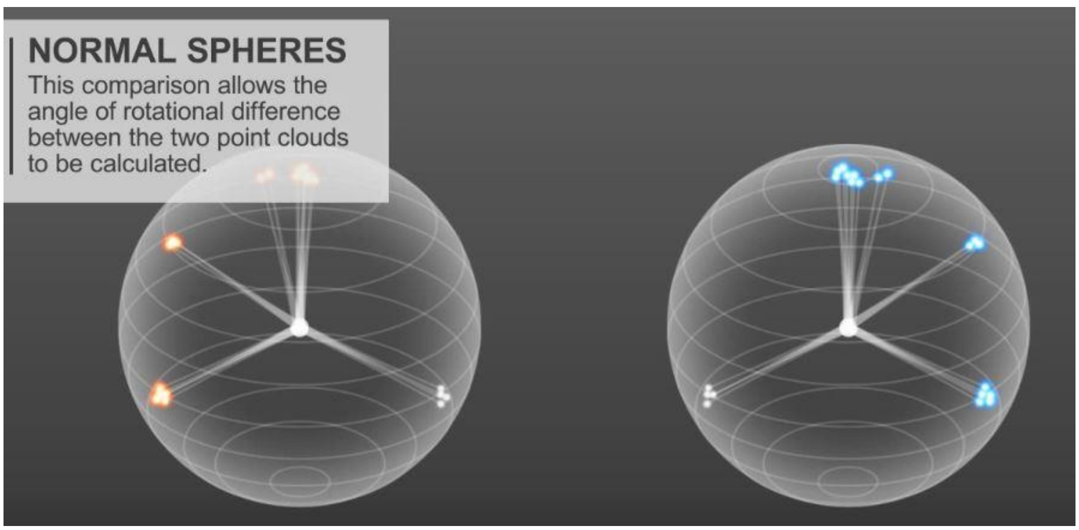
$$\theta_X = atan2(r_{21}, r_{11})$$

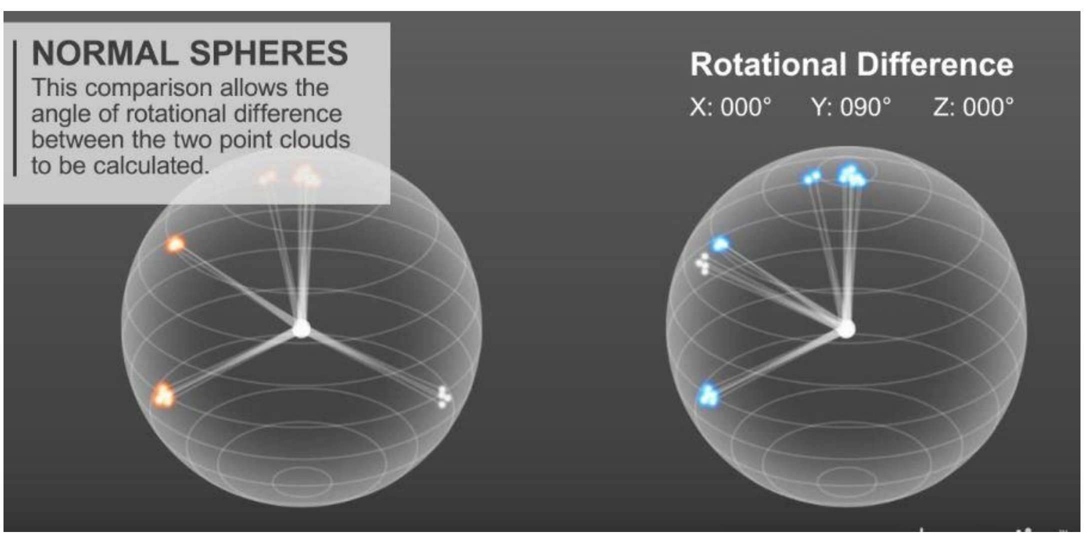
I applied the following steps to apply Lidar Odometry:

1. downsampling points through voxel grid filter.
2. calculate normal vectors from every points to form normal spheres.





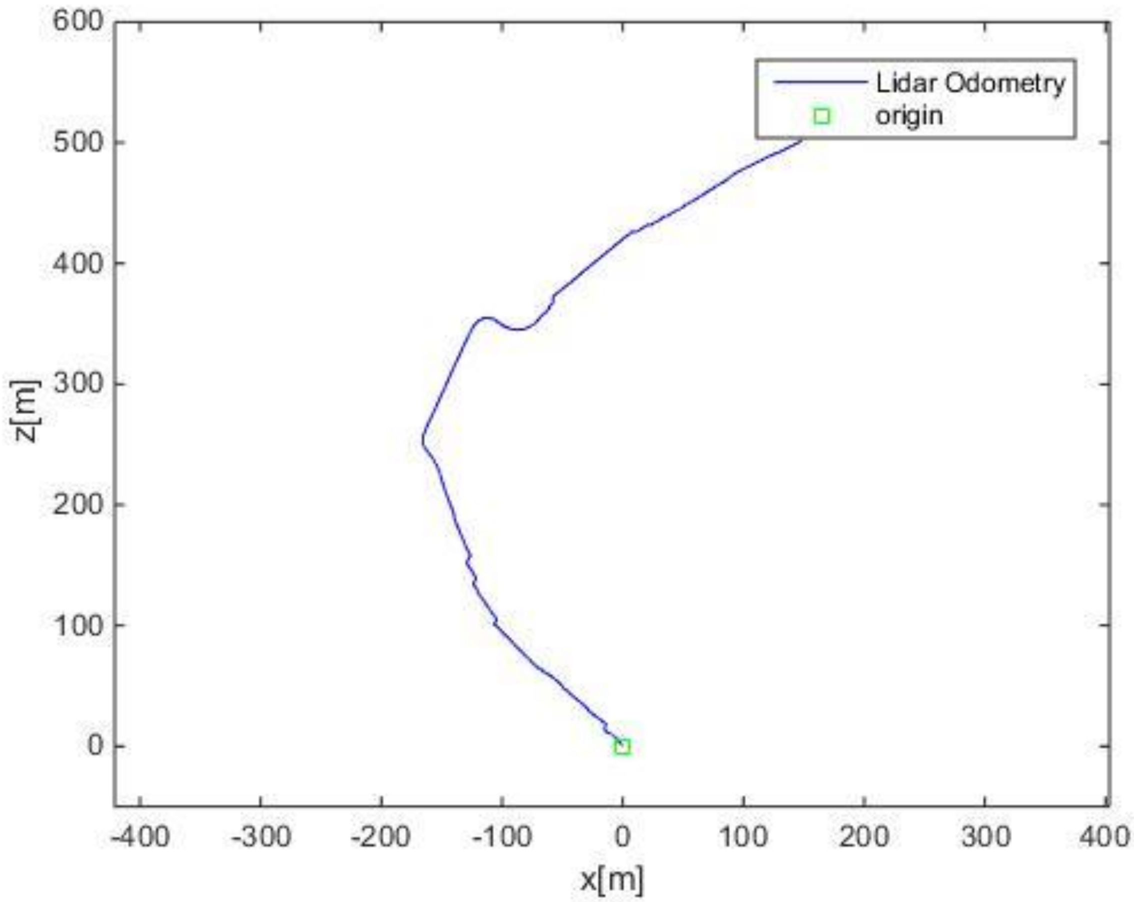




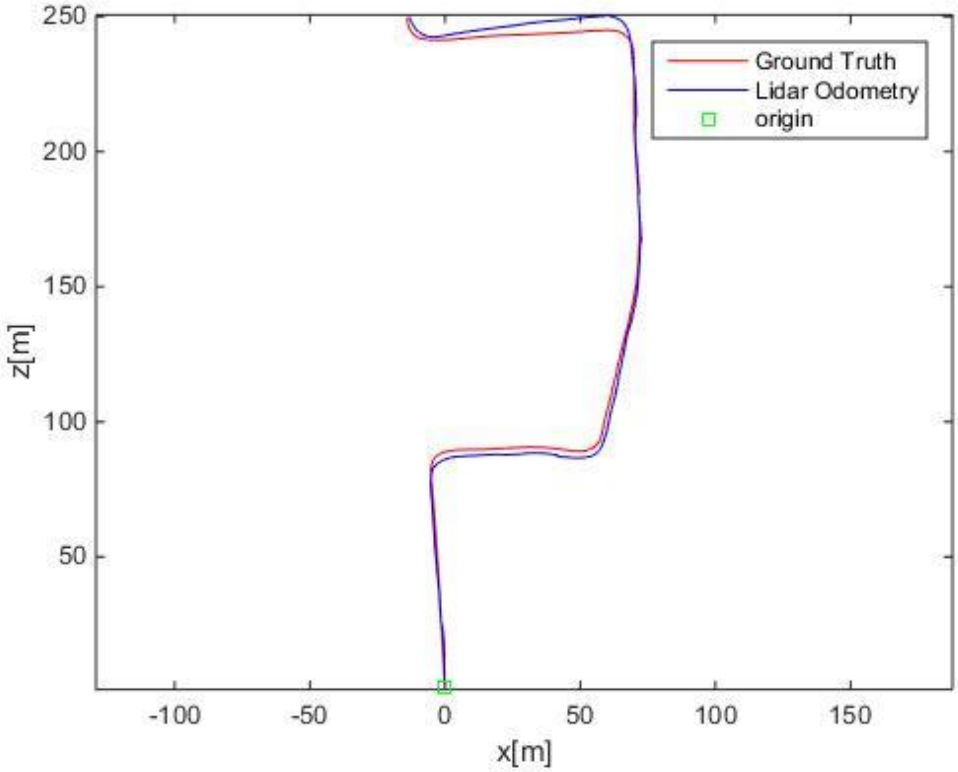
3. apply nonlinear ICP to keep iterating and get best rotation and translation.

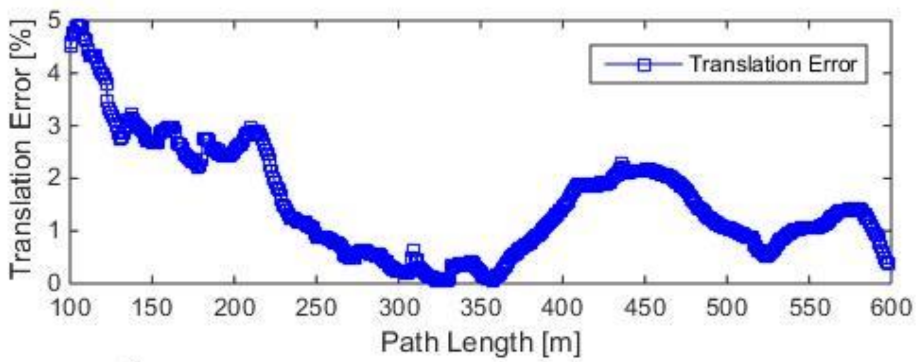
[Result]

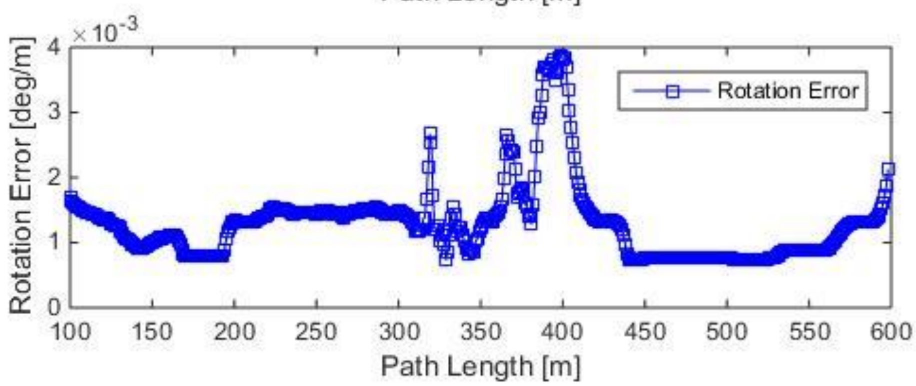
Sequence 11 (Without Ground Truth):



Sequence 00 (600 frames):







Sequence 01 (300 frames):