Unsupervised Learning of Camera Pose with Compositional Re-estimation

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Abstract

In supplementary material, we provide the qualitative examples of camera pose estimation and the re-estimation process algorithm. We also explain the re-estimation process in detail.

1. Qualitative Examples

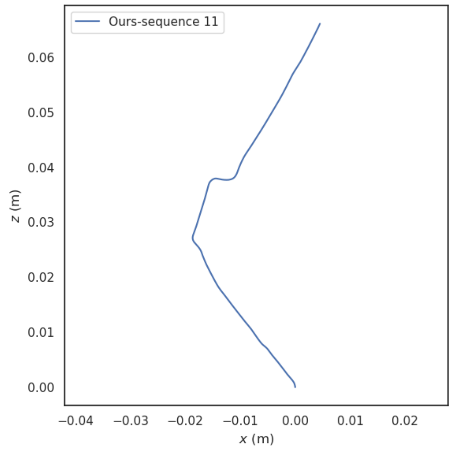
In Fig. 1, we provide additional qualitative examples of our approach on seq.11 and seq.15 of KITTI benchmark. Note that since the ground truth labels of these sequences are not publicly available, we only compare them qualitatively.

2. Re-estimation Algorithm

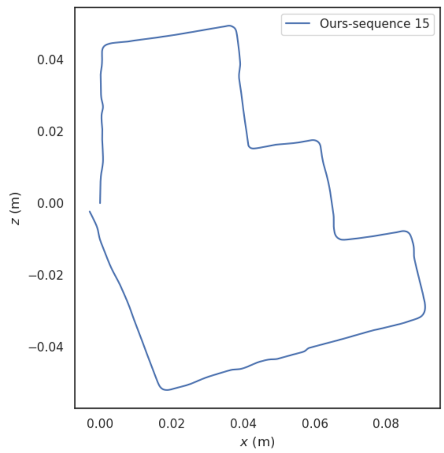
The pose re-estimation algorithm which is explained in approach section is shown in the following algorithm:

Algorithm 1 Re-estimation Process

$D_t \leftarrow$ depth-estimation(I_t)
Initialize $T^0_{t\to s}$
Camera intrinsics K
for $i = 1$ to r **do**
  $\Delta T^i_{t\to s} \leftarrow$ pose-estimation(I_t, I_s^{i-1})
  $T^i_{t\to s} \leftarrow \Delta T^i_{t\to s} \oplus T^{i-1}_{t\to s}$
  $I^i_s \leftarrow$ warp$(I_t, I_s, D_t, T^i_{t\to s}, K)$
end for
$\mathcal{L}_{final} = \lambda_{ph}\mathcal{L}_{ph} + \lambda_s\mathcal{L}_s + \lambda_c\mathcal{L}_c + \lambda_e \sum_{i=1}^{n} \mathcal{L}_{reg}(E^i)$
...



(a) Sequence 11



(b) Sequence 15

Figure 1: Qualitative examples of our method on seq. 11 and seq. 15 of KITTI odometry benchmark. Note that the ground truth is not available.

3. Re-estimation Process

In the SE(3) space, the composition process is as follows. Assume that displacement from A to B is:

$$A_B^A = \begin{bmatrix} R_B^A & t_{O'}^A \\ 0_{1\times3} & 1 \end{bmatrix}$$

and the displacement from B to C is:

$$A_C^B = \begin{bmatrix} R_C^B & t_{O"}^B \\ 0_{1\times3} & 1 \end{bmatrix}$$

Therefore, the displacement from A to C will be:

$$A_C^A = \begin{bmatrix} R_B^A & t_{O'}^A \\ 0_{1\times3} & 1 \end{bmatrix} \times \begin{bmatrix} R_C^B & t_{O"}^B \\ 0_{1\times3} & 1 \end{bmatrix}$$

We have the same process to add ΔT to T.