APPENDIX

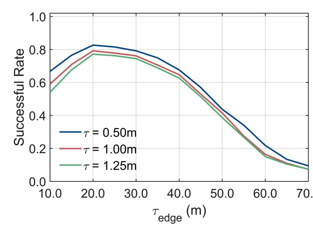
A. Parameter Tuning

To better understand the influences of k, τ_{edge}, τ, on the global localization performance, we also provide results for parameter tuning. Roundabout03 is selected as the query sequence with the instance-level map generated from sequence Roundabout01. For k, we keep τ_{edge} and τ unchanged (i.e., $\tau_{edge} = 20$ and $\tau = 0.5$) and change the value of k from 1 to 100. As shown in Tab. VI, as k becomes larger, the success rate gradually increases, and RTE and RRE gradually become smaller. This is because more correspondences are used for pose estimation when k is larger, which might introduce more inlier correspondences into $|\mathcal{A}_{raw}|$. However, more runtime is required to locate the vehicle when using a larger $\mathcal{A}_{raw}$.

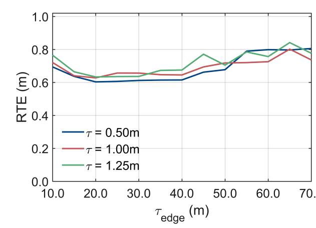
To investigate the influences of τ_{edge} and τ on our method, we set $k = 10$ and change values of τ_{edge} and τ. As displayed in Fig. 6, when $\tau_{edge} = 20$ and $\tau = 0.5$, the best performance is achieved. Intuitively, when τ becomes smaller, the resolution of $Des^d_{v_j}$ is smaller, which can improve the descriptive capability of the vertex descriptor. As a result, more inlier correspondences might be involved in $\mathcal{A}_{raw}$, providing more correct constraints during pose optimization. Differently, when τ_{edge} becomes smaller, the semantic graph will become more sparse, leading to a decline in the number of triplets extracted from the graph. So Des_{v_j} will also become more sparse (i.e., most elements will be 0), leading to the degradation of vertex matching performance. However, when τ_{edge} is larger, the localization performance will also degrade. This is because only partial instances in the reference map can be observed by the single query scan. When τ_{edge} is too large, edges that connect instances distributed along the margin of the query scan, are more different from edges that connect the same instances in the reference map, as shown in Fig. 4. Empirically, an appropriate τ_{edge} and small τ can generally result in a better performance.

TABLE VI: Influences of k on globalization localization performance. $|\mathcal{A}_{raw}|$ is the average size of $\mathcal{A}_{raw}$.

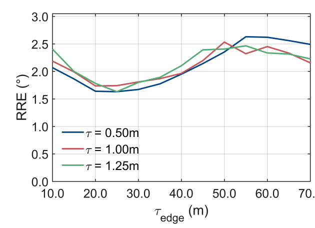
Top-k	P (%)	RTE (m)	RRE (°)	$\lvert\mathcal{A}_{raw}\rvert$	t_{ave}(ms)
1	75.00	0.71±0.60	2.10±1.78	52	**110.96**
5	81.28	0.67±0.57	1.86±1.62	263	116.57
10	82.62	0.60±0.47	1.63±1.41	527	124.93
15	81.95	0.58±0.39	1.49±1.22	791	131.66
20	83.52	0.57±0.40	1.52±1.31	1055	138.24
25	83.74	0.57±0.41	1.45±1.20	1319	154.76
30	84.19	0.57±0.41	1.45±1.21	1583	167.84
35	84.64	0.57±0.41	1.41±1.15	1847	184.98
40	84.53	0.55±0.40	1.40±1.14	2111	202.11
45	84.98	0.55±0.41	1.38±1.11	2375	225.19
50	**86.10**	0.55±0.41	1.39±1.13	2639	239.51
100	85.87	**0.54±0.44**	**1.28±1.05**	**5278**	523.09



(a) Success rate with different τ_{edge} and τ



(b) RTE with different τ_{edge} and τ



(c) RRE with different τ_{edge} and τ

Fig. 6: Global localization performance with different τ_{edge} and τ for query sequence Roundabout03. All experimental results are obtained when $\alpha = 5°$ and $k = 10$.