Evaluation of CosPlace and LoFTR-Based Reranking for Visual Place Recognition

1 Top-1 Accuracy Comparison

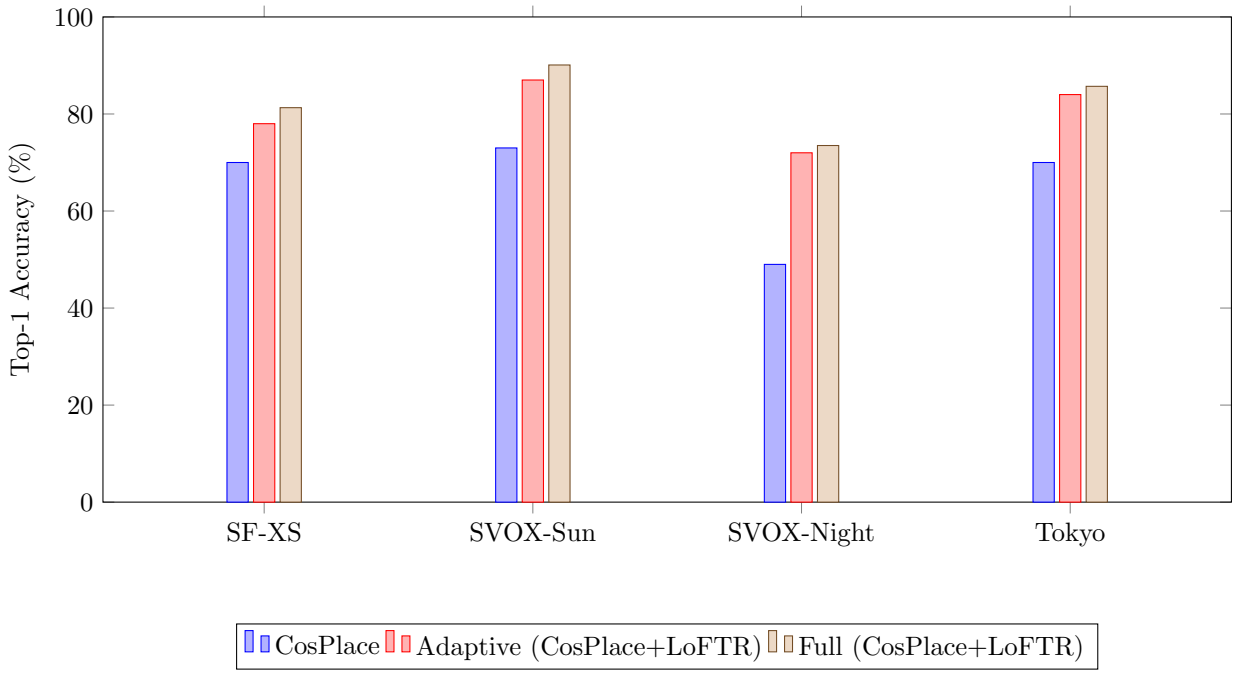

Figure 1: Top-1 accuracy of the three evaluated methods across all benchmarks.

2 Top-1 Accuracy

This experiment compares three setups:

- **CosPlace**: descriptor-only baseline.
- **CosPlace + LoFTR (Adaptive Reranking)**: LoFTR is applied only to a selected subset of candidates.
- **CosPlace + LoFTR (Full Reranking)**: LoFTR is applied to all top candidates.

Both reranking strategies improve the baseline on every dataset.

Table 1: Top-1 accuracy (%) and reranking time (minutes) for CosPlace (baseline), CosPlace+LoFTR Adaptive Reranking, and CosPlace+LoFTR Full Reranking across four VPR benchmarks.

Dataset	CosPlace	Adaptive (CosPlace+LoFTR)	Full (CosPlace+LoFTR)	Time (A / F)
SF-XS-test	70.0	78.0	**81.3**	10 / 39
SVOX-test-sun	73.0	87.0	**90.1**	9 / 32
SVOX-test-night	49.0	72.0	**73.5**	17 / 31
Tokyo-test	70.0	84.0	**85.7**	4 / 12

2.1 Overall Trends

CosPlace alone gives a solid starting point, but adding LoFTR always increases accuracy. Adaptive Reranking gives most of the improvement while keeping the runtime low. Full Reranking gives the highest accuracy but is much slower.

The biggest improvements appear on SVOX-test-night, where lighting changes make descriptor-only retrieval difficult.

2.2 Relative Improvements

The relative gain of Adaptive Reranking over CosPlace is:

- SF-XS-test: 11.4%
- SVOX-test-sun: 19.2%
- SVOX-test-night: 46.9%
- Tokyo-test: 20.0%

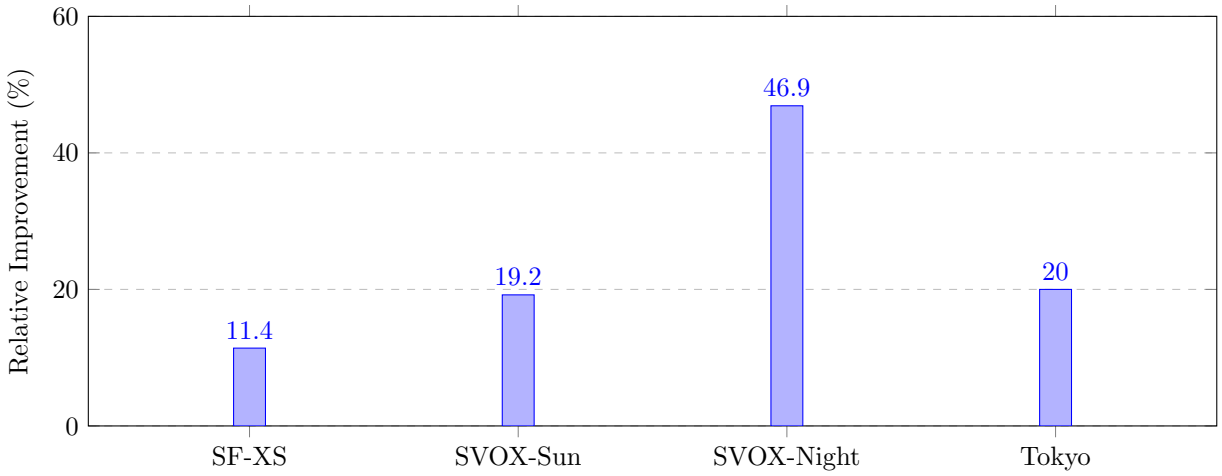

Figure 2: Relative improvement of Adaptive Reranking over CosPlace across all datasets.

Nighttime data shows the strongest improvement, confirming that LoFTR helps when appearance cues are unreliable.

2.3 Recovery Ratio

Adaptive Reranking recovers most of the accuracy that Full Reranking provides:

- SF-XS-test: 73%

- SVOX-test-sun: 80%
- SVOX-test-night: 93%
- Tokyo-test: 88%

2.4 Dataset Observations

- **Nighttime sequences**: largest gains, LoFTR helps resolve descriptor failures.
- **Daytime datasets**: strong but smaller improvements.
- **Simpler datasets**: smaller gains, consistent with lower difficulty.

3 Reranking Runtime Comparison

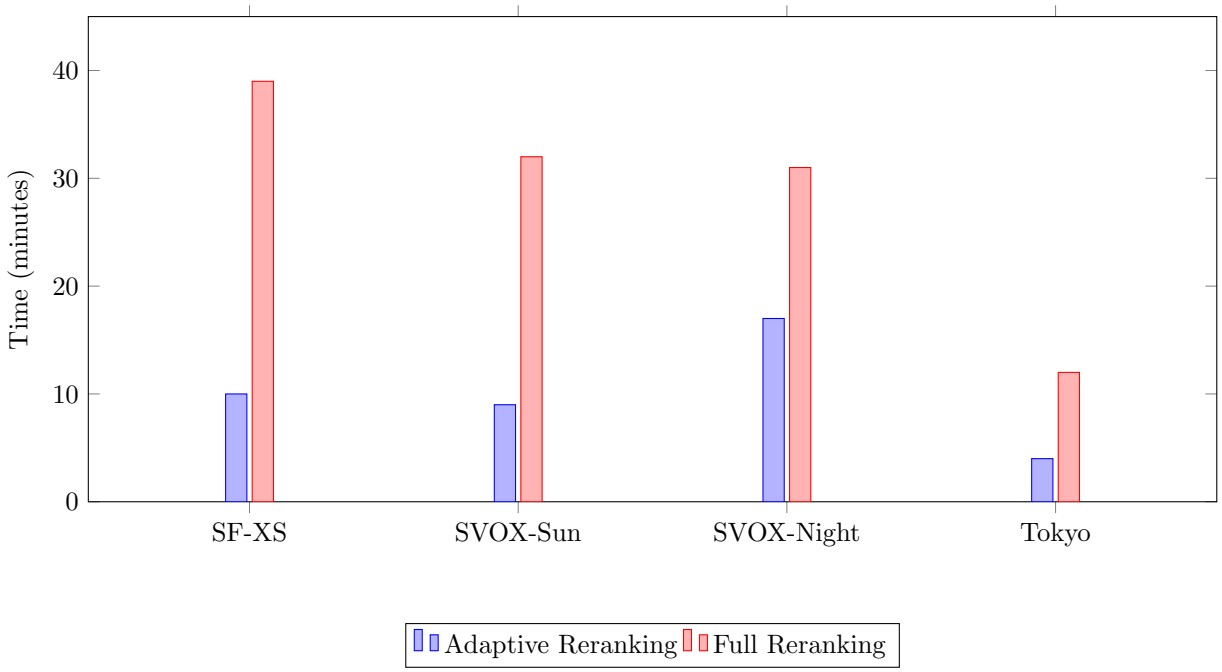

Figure 3: Runtime of the two LoFTR-based reranking strategies.

4 Analysis

The results show a clear trade-off between accuracy and runtime. Full Reranking gives the best accuracy but is slow because LoFTR is applied to all candidates. Adaptive Reranking is much faster and still recovers most of the accuracy gain.

Across all datasets, the ranking is consistent:

$$\text{CosPlace} < \text{Adaptive Reranking} < \text{Full Reranking}$$

This makes the evaluation reliable and easy to extend with more methods in the future.

5 Summary

We evaluated CosPlace, CosPlace+LoFTR Adaptive Reranking, and CosPlace+LoFTR Full Reranking across four benchmarks. Both reranking methods improve the baseline, with the largest gains appearing in difficult visual conditions. Adaptive Reranking offers a strong balance between accuracy and speed, while Full Reranking provides the highest accuracy at a higher cost. This framework can be extended with additional reranking or matching methods in future work.