Mapping, Localization and Path Planning for Image-based Navigation using Visual Features and Map Supplementary Material

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1. Additional Experiments

This section contains additional experiments which—due to space restrictions—were not included in the main publication.

Anchor and Sensitivity Ablation Study Fig. 1 contains accuracy vs. distance plots produced with the same sequences and settings as Fig. 5 in the original paper. However, we selectively switched off anchors and sensitivity. The plots in Fig. 1 show that enforcing both geometric representation and visual representation is essential to obtain good localization results.

Impact of Number of Landmarks Fig. 2 shows the accuracy vs. distance plots for three sequences of the Oxford Robotcar [2] dataset for different numbers of selected landmarks, N. With the exception of N, all parameters and sequences are identical to the settings used for Fig. 5 in the original paper.

More COLD-Freiburg Sequences Fig. 3 contains accuracy vs. distance plots for nine sequences from the COLD-Freiburg [3] database. As in the original paper, we use 50 landmarks from the second sunny sequence of the extended part A as a reference. Fig. 5 of the original paper only had space for three of the nine sequences—cloudy 1, night 1 and sunny 1.

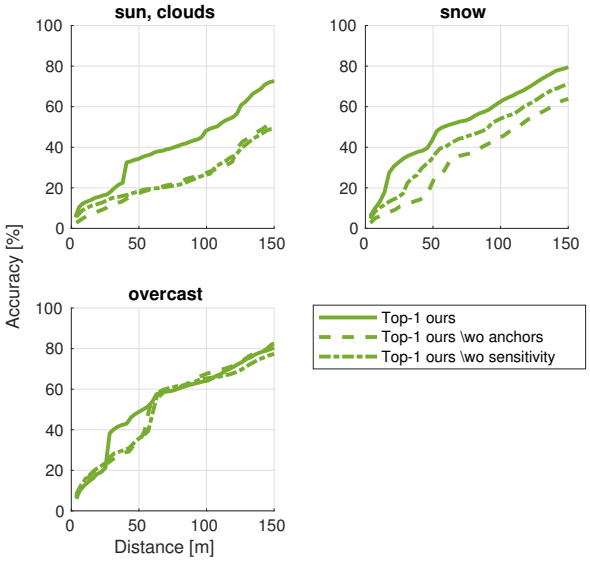

Figure 1. Accuracy vs. distance plot for three sequences of the Oxford Robotcar dataset. All curves show our method, but once without anchors (enforcement of geometric representation) and once without sensitivity (enforcement of visual representation). The experiments were conducted using NetVLAD [1] features.

References

[1] Relja Arandjelovic, Petr Gronat, Akihiko Torii, Tomas Pajdla, and Josef Sivic. Netvlad: Cnn architecture for weakly supervised place recognition. In *CVPR*, 2016. 1

[2] Will Maddern, Geoffrey Pascoe, Chris Linegar, and Paul Newman. 1 year, 1000 km: The oxford robotcar dataset. *The International Journal of Robotics Research*, pages 3–15, 2017. 1

[3] Andrzej Pronobis and Barbara Caputo. COLD: COsy Localization Database. *The International Journal of Robotics Research*, pages 588–594, May 2009. 1

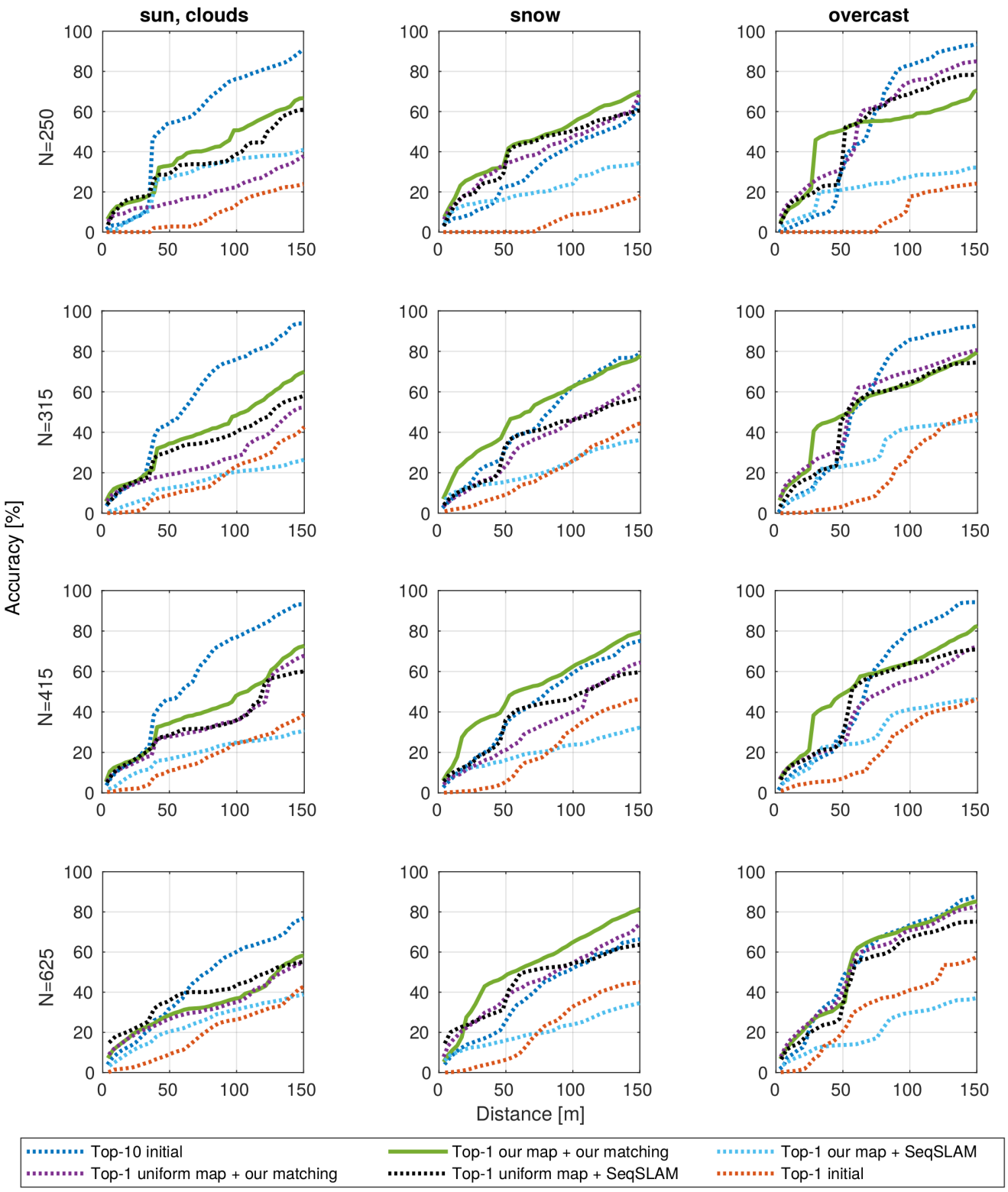

Figure 2. Accuracy vs. distance plot for three sequences of the Oxford Robotcar dataset for different numbers of selected landmarks, N. Red and dark blue: Unrefined top-1 and top-10 matches on a uniformly summarized reference set. Black: State of the art SeqSLAM baseline on a uniformly summarized reference set. Purple: Our self localization on a uniformly summarized reference set. Light blue: State of the art SeqSLAM baseline on our network flow based map. Green: Our method, with network flow based map construction and self localization. The experiments were conducted using NetVLAD features.

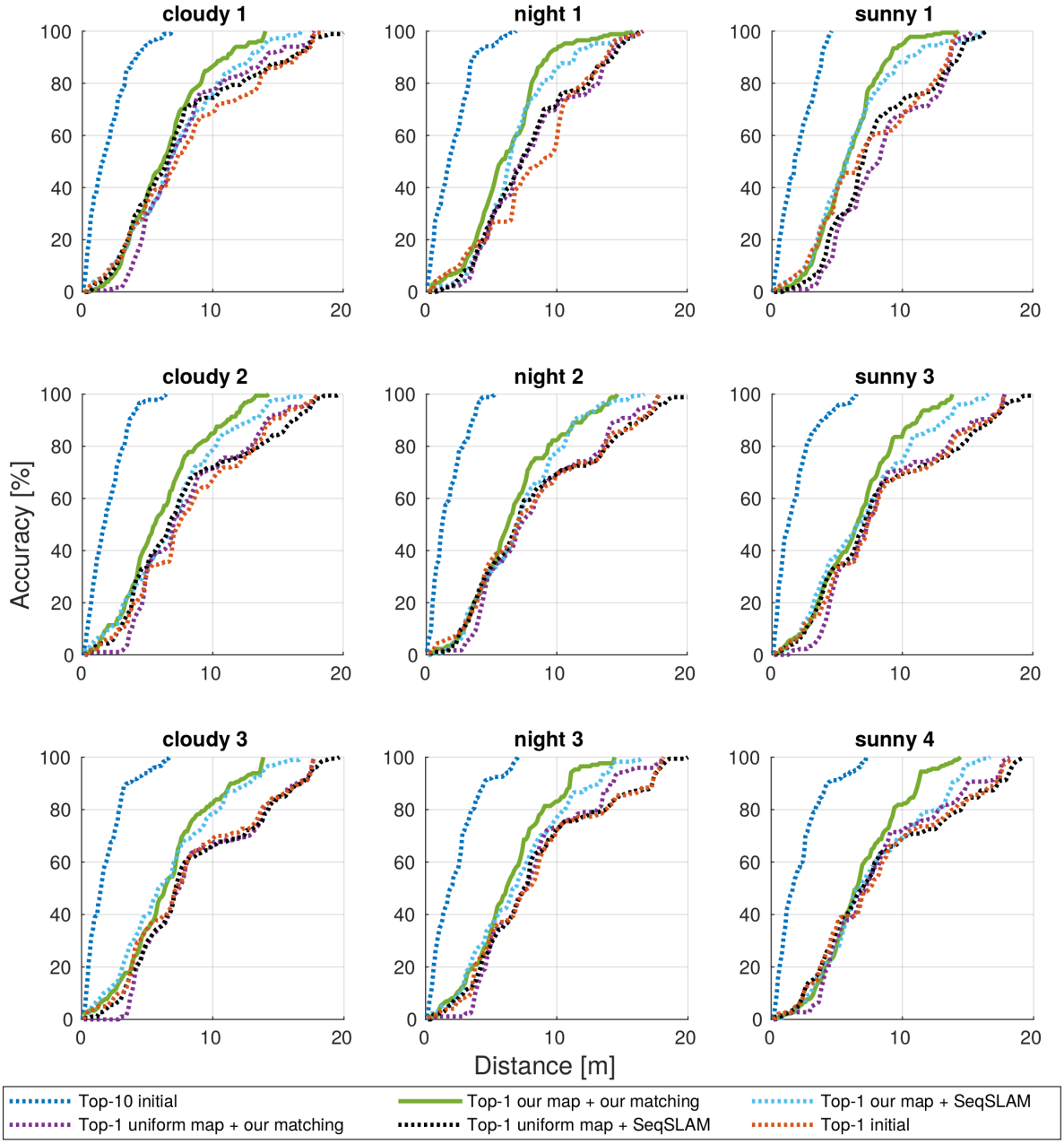

Figure 3. Accuracy vs. distance plot for nine runs of the COLD-Freiburg part A extended path. Sequence sunny 2 was used as reference. Red and dark blue: Unrefined top-1 and top-10 matches on a uniformly summarized reference set. Black: State of the art SeqSLAM baseline on a uniformly summarized reference set. Purple: Our self localization on a uniformly summarized reference set. Light blue: State of the art SeqSLAM baseline on our network flow based map. Green: Our method, with network flow based map construction and self localization. The experiments were conducted using NetVLAD features.