

Topometric Localization on a Road Network

Objectives

Long-term localization is a central problem for autonomous vehicles that is often addressed using global positioning systems (GPS). But the GPS signal may be unavailable for various reasons.



NavLab 11

GPS-denied scenarios

In our previous work, we introduced a long-term vehicle localization system (Badino et al., 2012) based on **topometric localization**. Yet the localization was constrained to non-branching routes. In this study, we:

- Expanded the non-branching route representation to a **road** network.
- Incorporated **road curvature feature** as a belief update measurement.

Topometric Localization

Metric localization: the coordinates of the locations (e.g. GPS). **Topological Localization**: localization in a finite set of locations. **Topometric Localization**: Fine-grained topological map with ground truth metric location.



A non-branching route



Fig.2.1 Fine-grained topometric map

A Bayesian filter is used to update the belief of the position of the vehicle. The algorithm iterates two step in updating belief probability:

Predict: predict the current position of the vehicle based on speed and time interval.

Update: update the belief probability with measurements of a number of features. We currently use Whole-Image-SURF feature and curvature feature.

WI-SURF: encodes entire image in a 64-vector.





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network branches can be either **split** or **merge**.









a portion of the belief probability density function. State translation can only occur in one direction on an edge.



References:

• H. Badino, D. Huber, and T. Kanade. Real-time topometric localization. In International Conference on Robotics and Automation, 2012.

