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Accurate Global Trajectory Alignment using Poles and Road Markings

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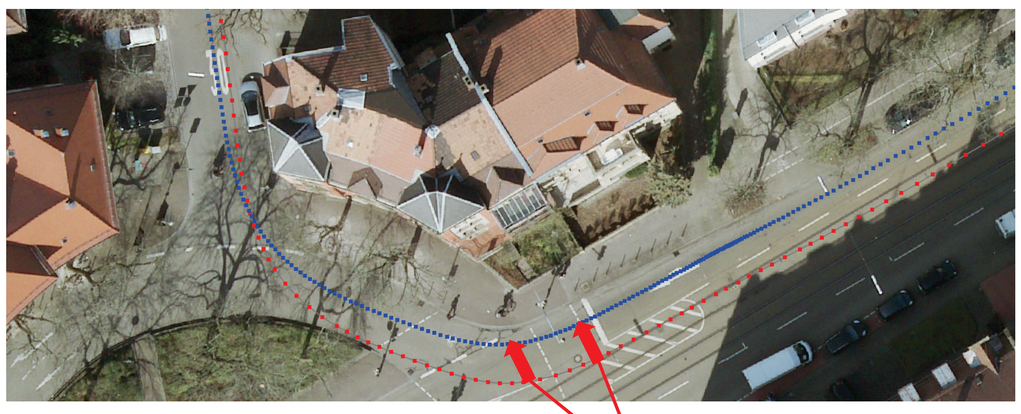
1. Motivation

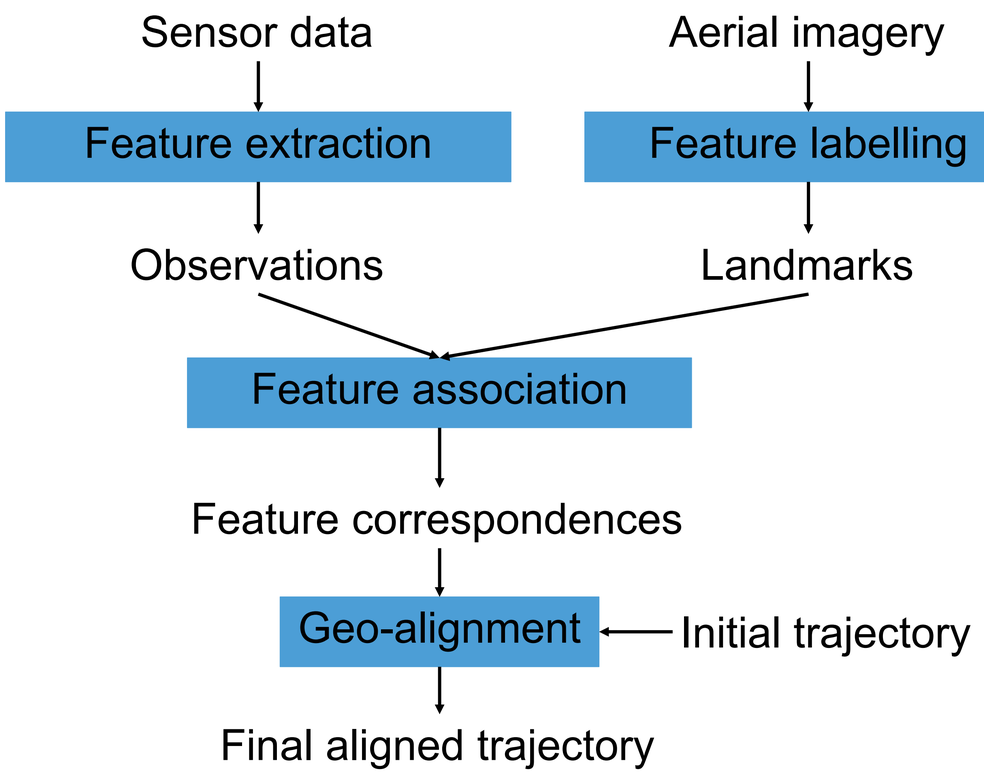


Miss-aligned trajectory

Aligned trajectory

Trajectory geo-alignment ?

2. Approach overview



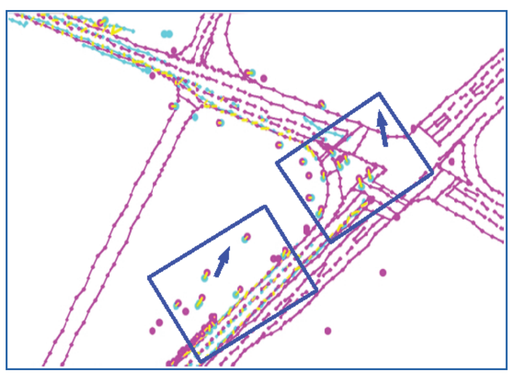
3. Feature selection and extraction

- Selected geometric features:

- **Road marking features** from stereo cemara.

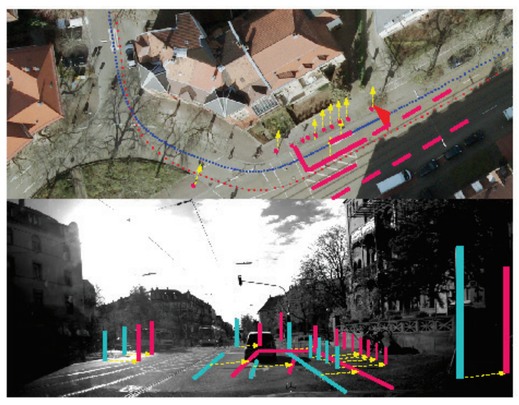
- **Pole features** from LiDAR and classified with semantic image.

4. Trajectory Alignment



- RANSAC-based sliding window algorithm for features association.

Pole detections
Pole landmarks
Road marking detections
Road marking landmarks
Sliding window

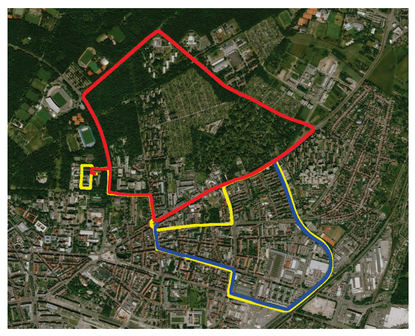


- Levenberg-Marquardt nonlinear pose optimization.

Sensor detections
Labelled landmarks
Optimization

5. Results

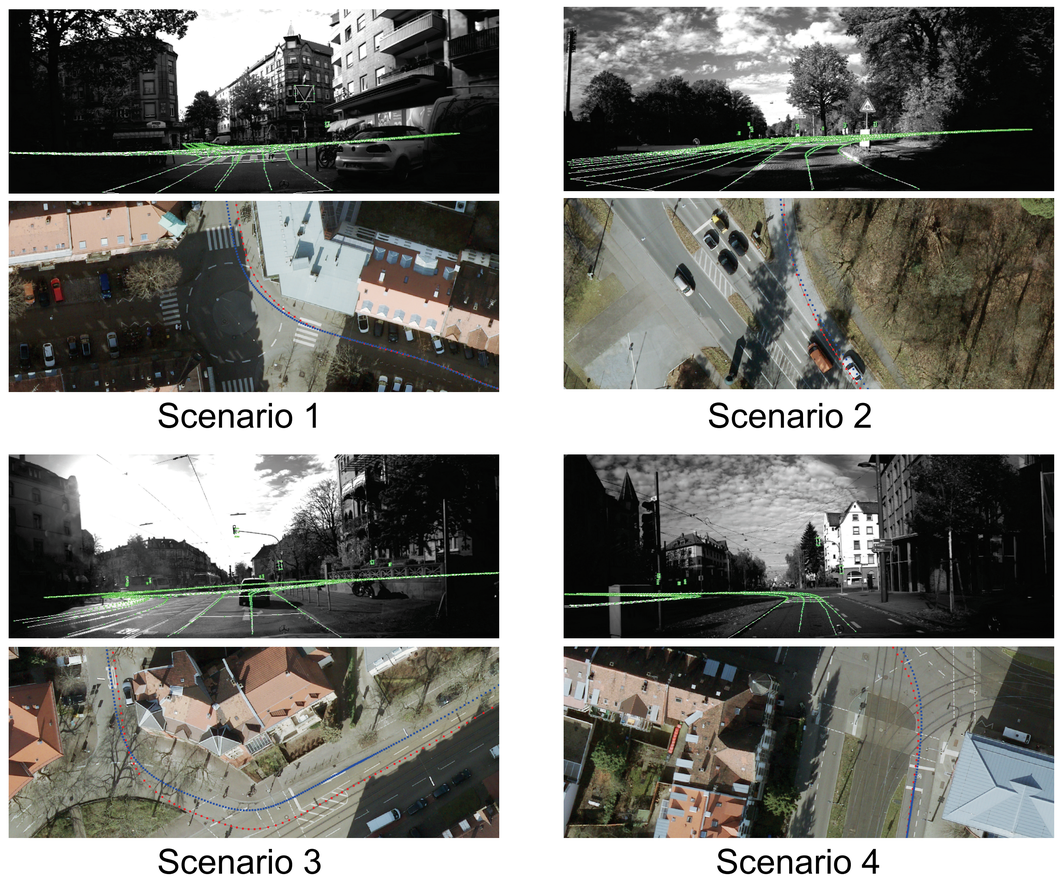
- Three passes (red, blue, yellow) with a driven distance about 19.7 km.



- The number of detected features of all our driven trajectories and the quote of inlier features.

Session	red	blue	yellow
Curb lines	1282(89.7%)	1627 (92.2%)	1854 (94.4%)
Dashed lines 12cm	408(80.9%)	645 (86.8%)	450 (69.3%)
Poles	210(58.1)	361 (51.8%)	163 (61.3%)
Dashed lines 25cm	46(82.6%)	89 (84.3%)	115 (69.6%)
Lines 12cm	38(86.8%)	36 (83.3%)	25 (76.0%)
Arrow lines	15(86.7%)	19 (78.9%)	32 (78.1%)
Lines 25cm	15(80.0%)	20 (85.0%)	14 (78.6%)
Stop lines	9(77.8%)	11 (72.7%)	19 (78.9%)
Pedestrian road lines	8(75.0%)	9 (77.8%)	20 (75.0%)
Zebra lines	0(0.0%)	14 (78.6%)	15 (73.3%)
Bicycle road lines	3(100%)	9 (66.6%)	6 (83.3%)

- Trajectory alignment results in four typical scenarios with the re-projection of a external HD-map into the recorded images.



Scenario 1

Scenario 2

Scenario 3

Scenario 4

Miss-aligned trajectory
Aligned trajectory result
Re-projection of the HD-map into the recorded images