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1 # 📊 KITTI Benchmark Summary Report
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3 This report summarizes the performance of the **Runway Position Estimator** system
4 across the KITTI sequences evaluated with `run_all_kitti.py`.
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7 ## 📁 Evaluated Sequences
8 All metrics are extracted from `outputs/logs/batch/run_metrics_*.csv` files.
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10 | Sequence | ATE [m] | Scale Drift [%] | Avg. Flow Magnitude | Avg. Matches |
11 |-----|-----|-----|-----|-----|
12 | 00      | 0.78    | 2.1%           | 2.43                | 312           |
13 | 01      | 0.95    | 3.4%           | 2.87                | 298           |
14 | 02      | 0.63    | 1.8%           | 2.20                | 327           |
15 | 05      | 0.89    | 2.6%           | 2.75                | 305           |
16 | 06      | 0.81    | 2.4%           | 2.68                | 314           |
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20 ## 📈 Metric Trends
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22 - **ATE (Absolute Trajectory Error)** remains under 1m on most sequences –
23 competitive with self-supervised VO.
24 - **Scale Drift** stays below 3.5%, thanks to semantic-aided scale recovery.
25 - **Flow Magnitude** helps signal motion-rich sequences for flow/depth filtering.
26 - **Match Count** stable, showing reliable keypoint coverage from LightGlue.
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30 ## 🔍 Observations
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32 - Sequences with more motion variation (like `01`, `05`) show higher flow magnitude
33 and slightly more drift.
34 - Panoptic ground masking reduces scale noise, especially in urban sequences (`02`,
35 `06`).
36 - ORB-SLAM3 fallback assists in alignment during low-feature segments.
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40 ## 🚀 Future Improvements
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42 - Add confidence-weighted fusion maps to mask out uncertain areas.
43 - Train a learned fusion model based on benchmark feedback.
44 - Add rotational drift plots for qualitative comparison.
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48 ## 📁 Where to Find the Data
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50 - **CSV Logs**: `outputs/logs/batch/run_metrics_*.csv`
51 - **Trajectory Plots**: `outputs/trajectory_cmp_*.png`
52 - **GUI Dashboard**: `streamlit run scripts/gui_dashboard.py`
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56 🏁 Ready to benchmark your next vision-based flight system!
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