



Introduction

Goal

- Construct evaluation framework for sensor-based multi-step pipelines
- Evaluate the interplay between trajectory segmentation and mode inference errors
- Propagate geospatial point error throughout a trip

NREL OpenPATH

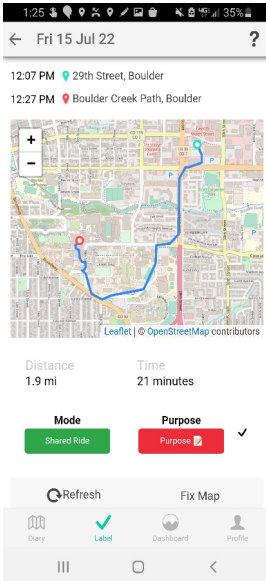
- Collects personal travel dairies
- Calculates energy/emissions impacts

$$\sum_{T \in H} \sum_{S^m \in T} E_{S^m} \times \alpha_{S^m} T.\ell$$

- Selected settings
- android:HAMFDC, ios:HAHFDC

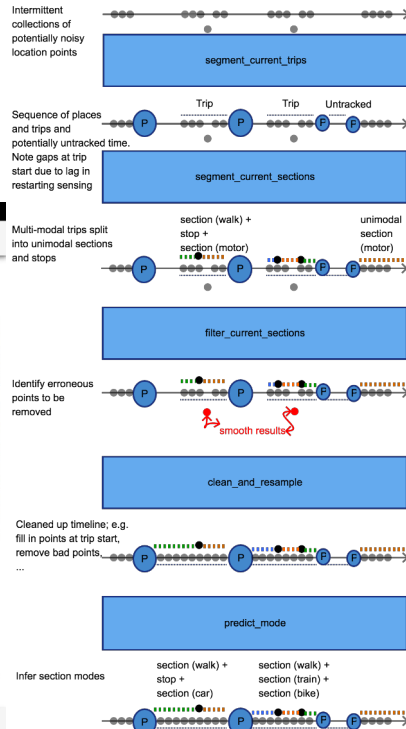
MobilityNet

- Multimodal public dataset
- >1080h on 3 artificial timelines



Sensor-based multi-step pipeline

- Deterministic stages
- Input: fused sensor data
- Output: mode inference/trip length

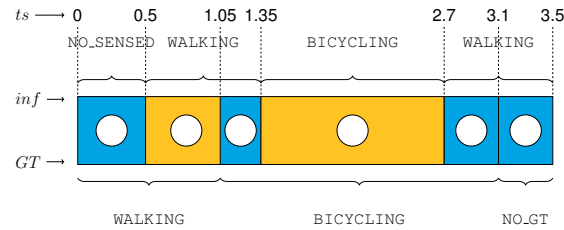


Shankari (2) Figure 5.1

Evaluation Framework

OpenPATH Travel Diary Histories

- trip length** Use *minimal histories* to avoid double counting and capture trip length error.
- mode inference** Use *temporally aligned histories* to capture the interplay between mode inference and segmentation error.



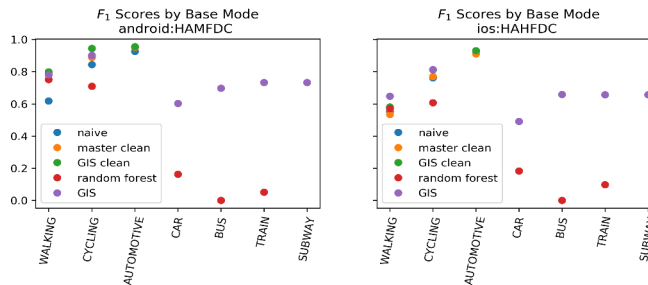
Temporal alignment for inferred (*inf*) and ground truth (*GT*) histories. Gold indicates section alignment while blue indicates misalignment.

Empirical Evaluation

Results

- trip length** Underestimation errors for trip length
- mode inference** rule+GIS based mode inference outperforms random forest

		\bar{x}	s^2	min	max	n
naive	android HAMFDC	0.197	0.217	-0.321	2.183	42
	ios HAHFDC	-0.0728	0.0559	-1.0	0.419	30
clean	android HAMFDC	-0.0438	0.00696	-0.363	0.0812	32
	ios HAHFDC	-0.0704	0.065	-1.0	0.001578	42



Observed Errors



As seen in Shankari (2). Green line is ground truth, red line is sensed data.

Future Directions

- Get error distribution of energy calculations
- Factor in missingness (1) to trip length errors
- Find correlations with trip length error
- Use temporal alignments to record arbitrary metrics
- Combine rule+GIS and random forest
- Apply to other pipelines
- Expand MobilityNet dataset

Codebase

NREL OpenPATH (née e-mission)
MobilityNet

<https://github.com/e-mission>
<https://github.com/MobilityNet>

Acknowledgements

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- KALYANARAMAN SHANKARI. *e-mission: an open source, extensible platform for human mobility systems*. PhD thesis, EECS Department, University of California, Berkeley, Dec 2019.