Extracting Maps from the INTERACTION Dataset

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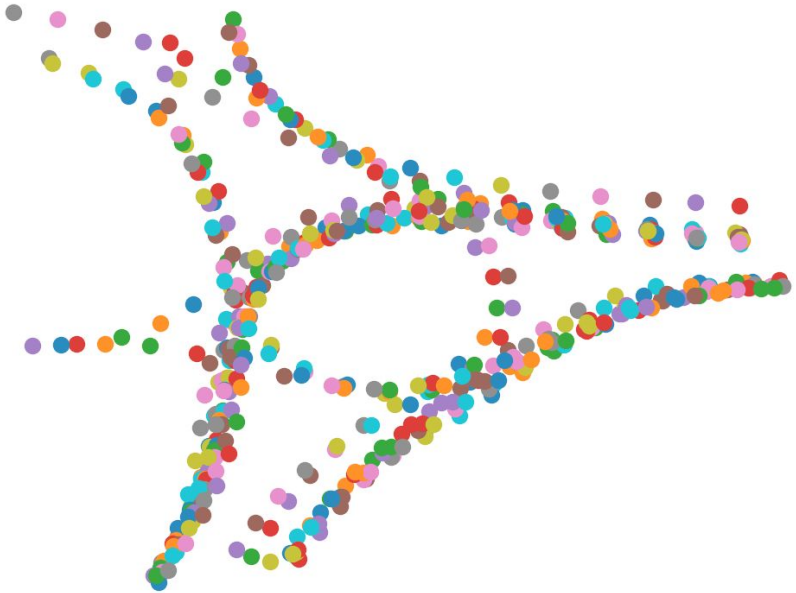
Problem Overview



Can we create a routable map from a collection of points like these?

Data Format

Dataset contains information about timestamps, position, velocity, heading, etc.

track_id	frame_id	timestamp_ms	agent_type	x	y	vx	vy	psi_rad	length	width
1	1	100	car	13.856	38.136	0.098	-0.583	-1.405	4.67	1.98
1	2	200	car	13.865	38.079	0.088	-0.566	-1.417	4.67	1.98
1	3	300	car	13.874	38.023	0.078	-0.547	-1.429	4.67	1.98
1	4	400	car	13.881	37.97	0.07	-0.527	-1.439	4.67	1.98
1	5	500	car	13.888	37.918	0.063	-0.505	-1.448	4.67	1.98
1	6	600	car	13.894	37.869	0.056	-0.483	-1.455	4.67	1.98
1	7	700	car	13.899	37.821	0.051	-0.462	-1.461	4.67	1.98
1	8	800	car	13.904	37.776	0.048	-0.445	1.775	4.67	1.98
1	9	900	car	13.909	37.732	0.049	-0.433	1.802	4.67	1.98
1	10	1000	car	13.914	37.689	0.052	-0.427	1.782	4.67	1.98
1	11	1100	car	13.919	37.646	0.06	-0.426	1.786	4.67	1.98
1	12	1200	car	13.926	37.603	0.069	-0.43	1.786	4.67	1.98
1	13	1300	car	13.933	37.56	0.08	-0.44	1.794	4.67	1.98
1	14	1400	car	13.942	37.515	0.092	-0.456	-1.371	4.67	1.98
1	15	1500	car	13.952	37.468	0.107	-0.479	-1.351	4.67	1.98
1	16	1600	car	13.963	37.419	0.123	-0.509	-1.334	4.67	1.98

Approach

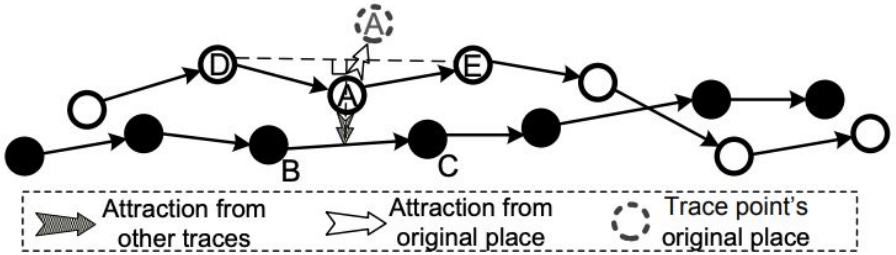
Clarify GPS Traces

Simulate **attractive force** between traces to aid the fusing of **similar traces**

Generate Graph

Merge similar traces together to generate a clean, **routable**, **directed graph** to analyze vehicle behavior

Clarifying Traces



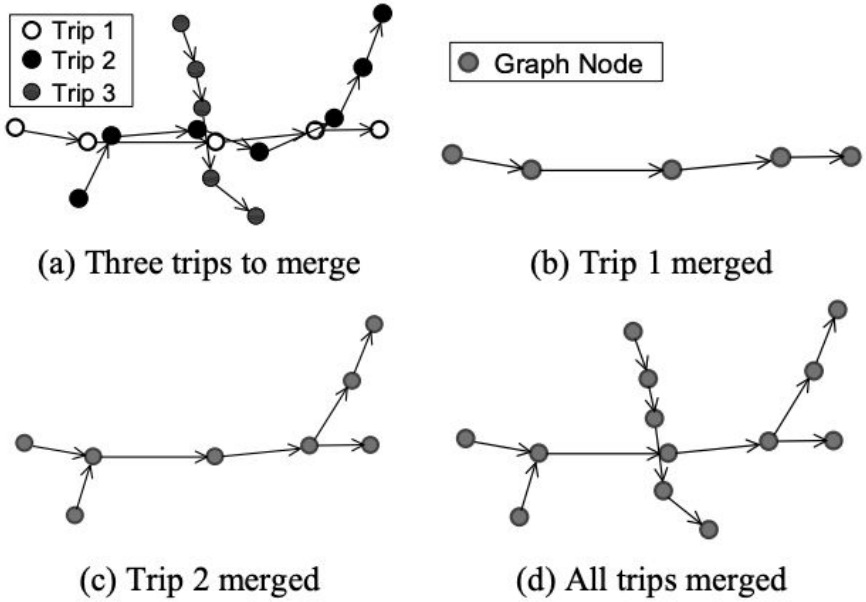
Simulate gravitational force from nearby traces with similar directions and spring force from a point's original position

The resultant force shifts the point's location

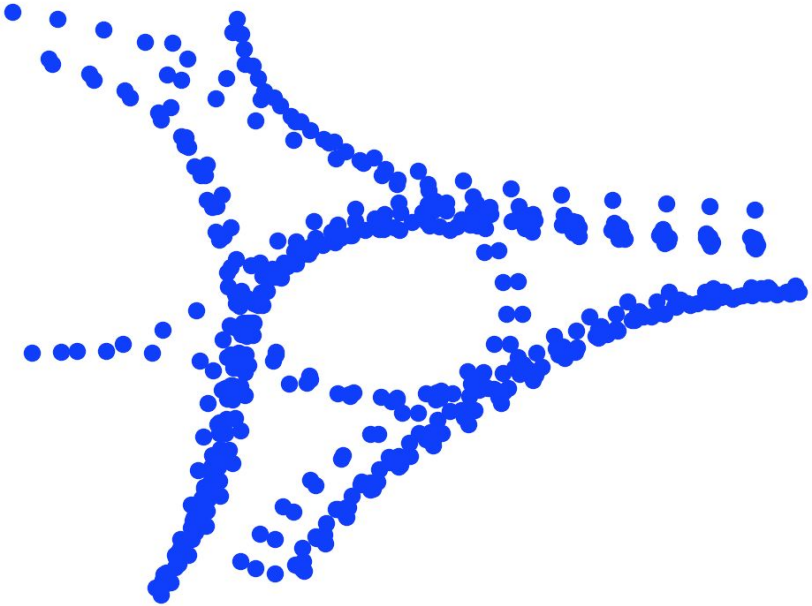
Generating a Graph

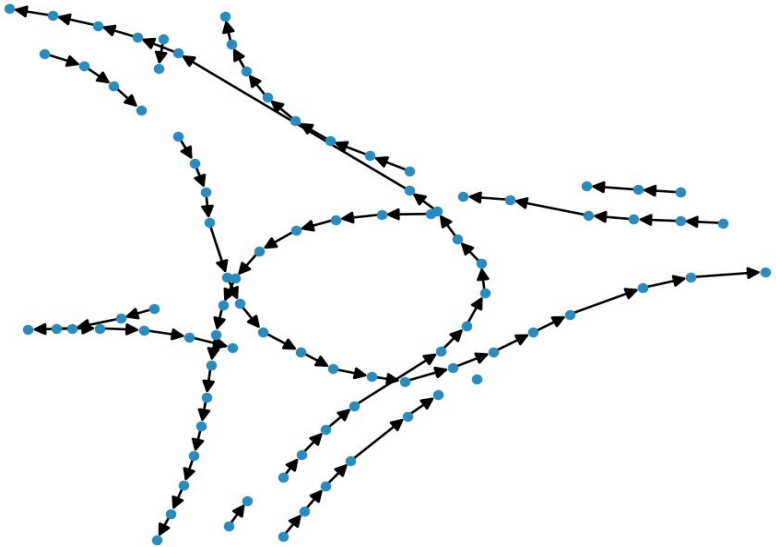
Iterate through the traces and merge a node to a nearby edge if the distances and differences in heading are small

If not, create new nodes and edges



Results





Analysis of Results + Next Steps

- Trace clarification yields minimal impact on traces
- Graph appears to capture most of road's features
- Imperfections at roundabout entrances

- Tune parameters to fit dataset
- Improve resultant force calculations
- Refine clarification to have a noticeable impact
- Account for lane splitting
- Improve runtime of preprocessing
- Proper number of iterations