AIRSAGE

O-D + Waypoint Data

Complementary datasets informing model development

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Agenda

- About AirSage
- Data Sources
- O-D + Waypoint for Model Development
- Q&A

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An Analogy Attempt

Data Providers

Data Sources

Data Products

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About AirSage

- The Location Data Pioneer

- Founded 20+ years ago
  - 2000: Began with Wireless Carrier data
  - 2012: Began working with Connected Vehicle (CV) Data
  - 2017: Transitioned to GPS data from Location Based Services (LBS) (i.e. mobile phone apps)

- What differentiates us?
  - We are not a Black Box provider.
    No synthetic input. No modeled output.

Data Sources

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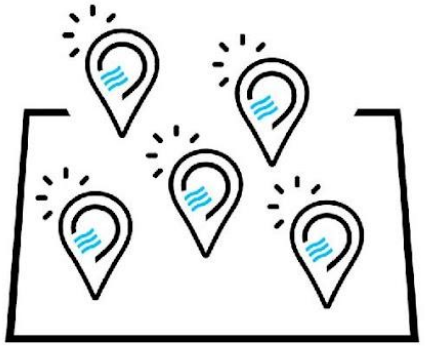
Data Sources - Mobile Devices

Mobile Apps

User Opt-in

Mobile App Ping

Location Data



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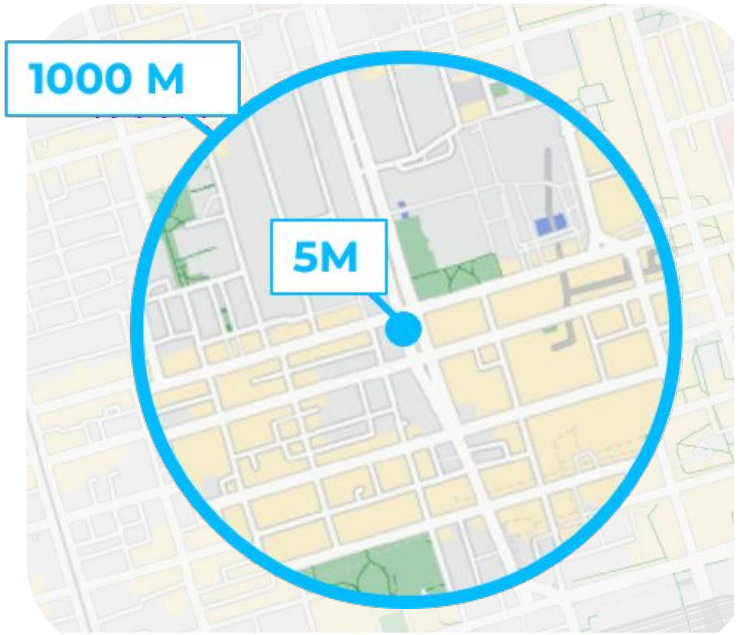
Data Sources - Mobile Devices



Mobile App Ping

5-15 M

Wireless Carrier Ping

1000 M

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Data Sources - Connected Vehicles

- GPS coordinates and associated attributes of connected vehicle movement (speed, heading, timestamp)
- Anonymized vehicle IDs to protect personally identifiable information
- Reporting rate between 3 to 15 seconds
- Available in near real-time (NRT) with a latency of <60 seconds in most cases
- Sourced from Original Equipment Manufacturers (OEMs), Fleets, and Telematics Service Providers (TSPs)

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Data Sources - Connected Vehicles

Raw Waypoint Attributes

- Vehicle ID
- Epoch time
- GPS coordinates (lat/lon)
- Heading
- Speed

```
vehicle_id,time__epoch,latitude,longitude,heading__angle,speed__value
e0f6970118475f3d8366d71b6ee56f0c,1650467155126,33.8244926,-84.3564529,257.48,0.0
27940edfa00a5b238ef101fde7fbf7a5,1650502391486,33.97528076171875,-84.09214782714844,189.52,0.
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e0f6970118475f3d8366d71b6ee56f0c,1650485702273,33.7175799,-84.3980194,210.97,120.7005
e0f6970118475f3d8366d71b6ee56f0c,1650459421768,33.812461299999995,-84.3739969,13.15,""
e0f6970118475f3d8366d71b6ee56f0c,1650485180206,33.7741714,-84.38310849999999,185.58,0.0
```

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Data Sources Overview

	Movement Captured	Location Accuracy	Sampling Rate	Full Trip O-D	Full Trip Trajectory	Persistent Identifier
Mobile Device (LBS)	People	High	Variable	Yes	No	Yes
Connected Vehicle (CV)	Vehicles	High	Very High	Yes	Yes	No

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O-D + Waypoint

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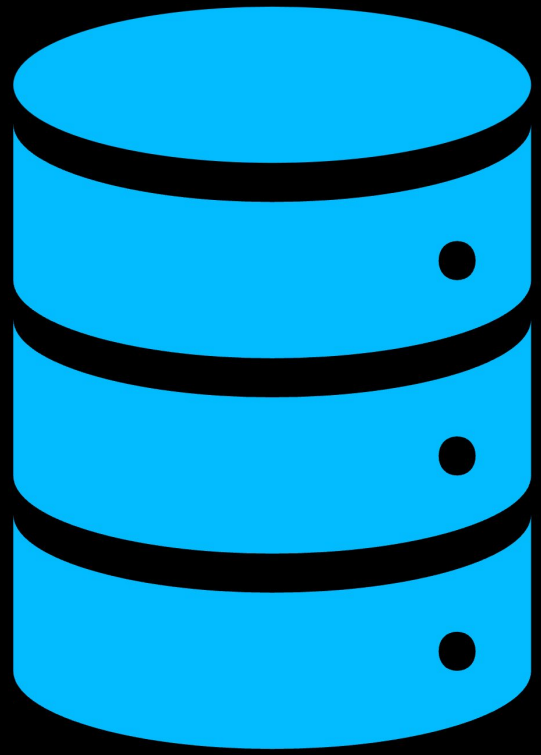
O-D + Waypoint for Model Development

AirSage's model development stack:

1. Origin-Destination Trip Matrices

1. CV Trip Waypoints

1. CV Trip Summaries



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Origin-Destination Trip Matrices

What is the frequency of origins or destinations of trips between each zone by trip purpose?

month	origin_zone	destination_zone	home_zone	aggregation	time_of_day	purpose	count
202203	219604	193778	219604	Mon_Tue_Wed_Thu	H07:H08	HO	23.7
202203	206934	213228	206934	Mon_Tue_Wed_Thu	H10:H11	HO	5.6
202203	206873	202006	211466	Mon_Tue_Wed_Thu	H12:H13	OW	5
202203	221975	190143	221975	Fri	H11:H12	HO	5
202203	197085	224995	190929	Mon_Tue_Wed_Thu	H15:H16	OO	10

Note: Output schema presented for demonstration purposes only

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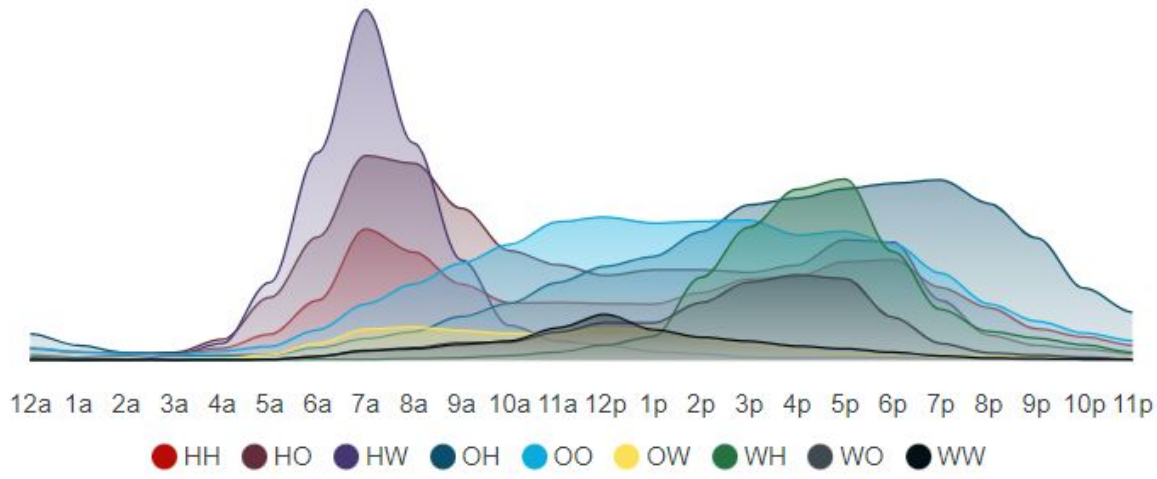
Origin-Destination Trip Matrices

- Sourced from Mobile Device (LBS) data
  - Presents person movement
  - Persistent ID to determine trip purpose

- Applicability
  - Base year model development
  - Trip generation
  - Trip distribution
  - Survey cross-validation
  - Survey fusion



Trip Purpose by Time of Day

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Connected Vehicle (CV) Trip Waypoints

What are the actual observed route choices between Origin-Destination pairs?

trip_id	index	lat	lon	heading	speed	time	Route	Dir	FromMeasure	ToMeasure
5	555	33.509246	-112.044334	198	49	3/10/2022 9:44:02	I_83	SB	11.43	11.43
5	556	33.52381	-112.044336	198	51	3/10/2022 9:44:05	I_83	SB	11.42	11.42
5	557	33.538374	-112.044338	196	52	3/10/2022 9:44:08	I_83	SB	11.41	11.41
5	558	33.552938	-112.04434	194	54	3/10/2022 9:44:11	I_83	SB	11.36	11.36
5	559	33.567502	-112.044342	194	54	3/10/2022 9:44:14	I_83	SB	11.33	11.33

Note: Output schema presented for demonstration purposes only

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Connected Vehicle (CV) Trip Waypoints

- Sourced from Connected Vehicle (CV) data
  - Presents vehicle movement
  - Limited insight into trip purpose
  - Visibility of full vehicle trajectory

- Applicability
  - Base year model development
  - Network assignment
  - Link level speeds
  - Congestion/delay

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Connected Vehicle (CV) Trip Summaries

What are the actual observed travel times, and trip distances between Origin-Destination pairs?

trip_id	fromLat	fromLon	fromTime	origin_zone	toLat	toLon	toTime	dest_zone	trip_time	trip_distance
1	33.46637	-112.032	3/10/2022 10:16:03	225343	33.523	-112.067	3/10/2022 10:33:33	207910	00:17:30	5.8032
2	33.53877	-112.045	3/10/2022 09:42:11	297072	33.483	-111.991	3/10/2022 09:58:34	280032	00:16:23	6.7012
3	33.48597	-111.910	3/10/2022 08:14:13	222002	33.545	-112.197	3/10/2022 08:56:33	205218	00:42:30	21.813
4	33.40944	-111.850	3/10/2022 10:01:40	171127	33.505	-111.915	3/10/2022 10:25:53	199219	00:24:13	11.431
5	33.29847	-111.859	3/10/2022 09:13:21	278565	33.439	-112.061	3/10/2022 09:41:33	217769	00:28:12	20.203

Note: Output schema presented for demonstration purposes only

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Connected Vehicle (CV) Trip Summaries

- Sourced from Connected Vehicle (CV) data
  - Presents vehicle movement
  - Limited insight into trip purpose
  - Summary of full vehicle trips

- Applicability
  - Trip length distribution
    - Observed trip times (hr/min/sec)
    - Observed trip distance (miles)

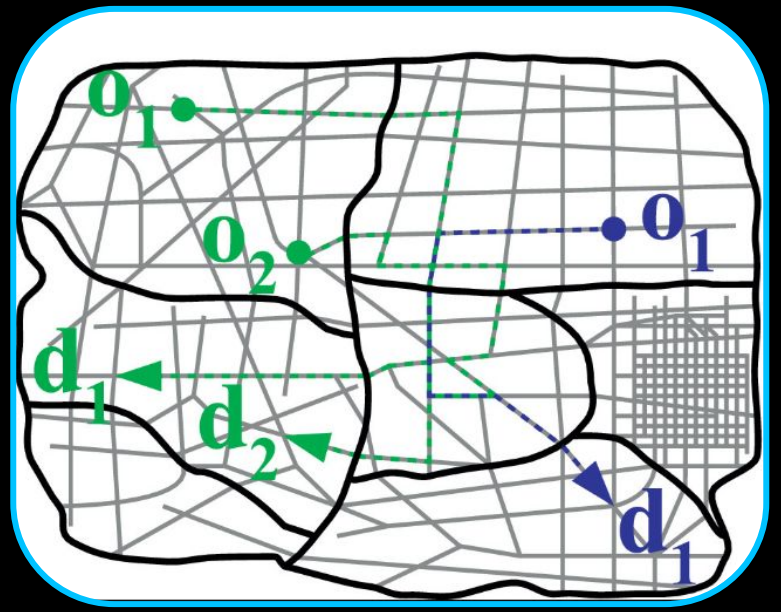

Image Credits: Batista et al

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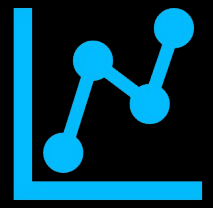
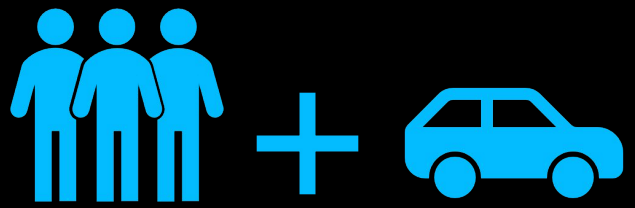
Summary



Deliverable stack ideally-suited for **travel demand model development**



Leverage the **strengths** of each data source

Calibrate and validate against **observations** rather than heavily processed or modeled output

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Questions?

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Turn to the most powerful Insights to Build a Better Future

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Thank you!

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