General Motors: Understanding US Dealership Visitation through Automated Geofence Creation

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Objective: To develop automated methods for creating geofences for GM dealerships and apply the geofences to visitation-related business use cases

Data

Telemetry data	Dealership location data	Maintenance records	Sales data
The location data where a car is turned on and turned off	The location of 500+ MI and TX dealerships	Information on each dealership's car repairs performed	Sales records for each dealership

Methods

Clustering algorithm	Validation metrics	Compare to "true" geofences	Business use cases
DBSCAN algorithm: good at outlining shapes	Measure geofence quality for tuning	Manual shapes drawn by Arrivalist	Sales prediction Conversion rates Service analysis

Automated geofence generation

1. Clustering

Grouping points near a dealership together
➔ **clustering**

Clustering algorithms: **DBSCAN** is best at outlining shapes

DBSCAN hyperparameter epsilon (ε)

Small ε Big ε

Dense clusters   Less dense clusters

Legend:
- Point matching service record (Blue)
- Not matching service record (Red)
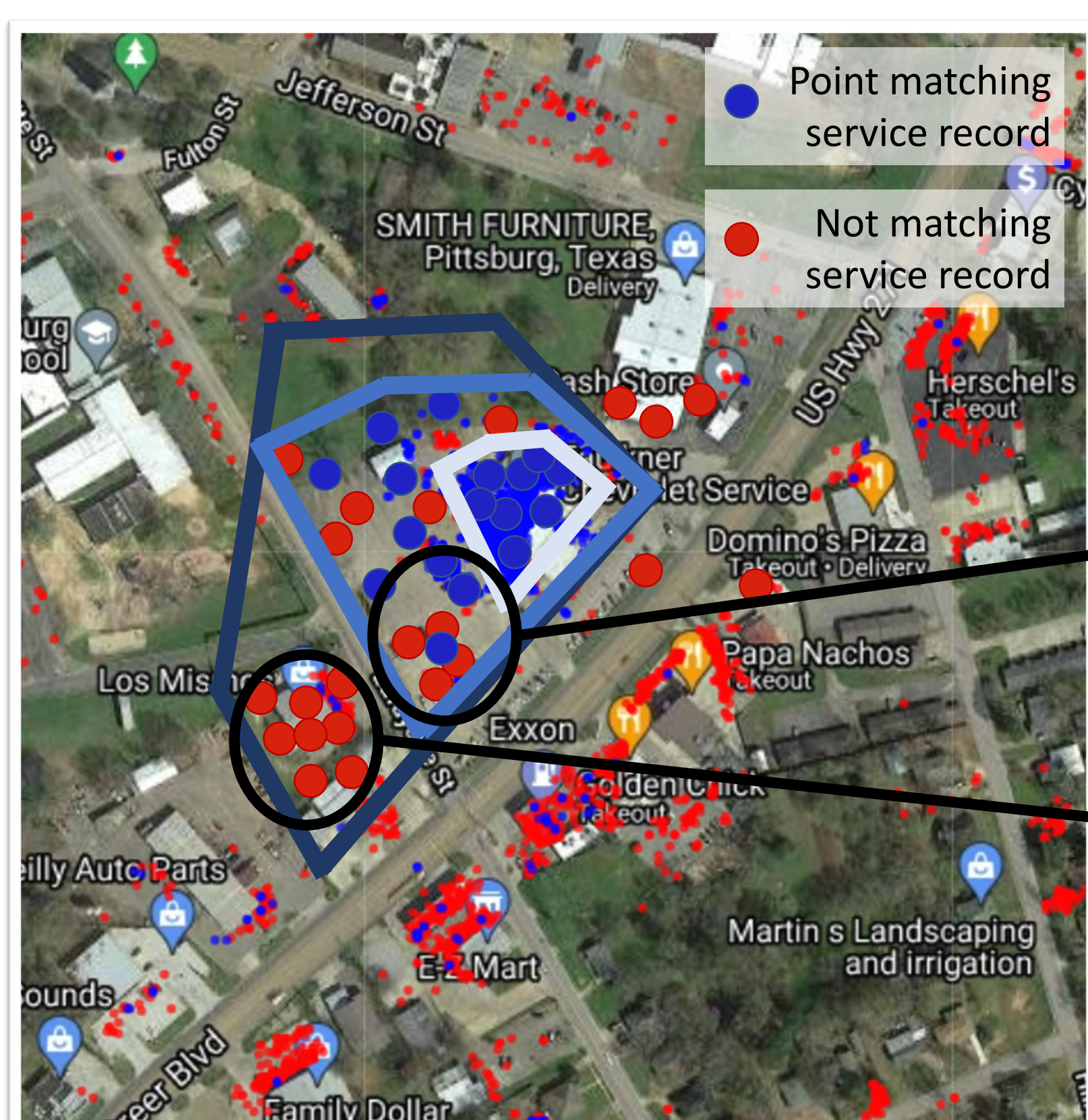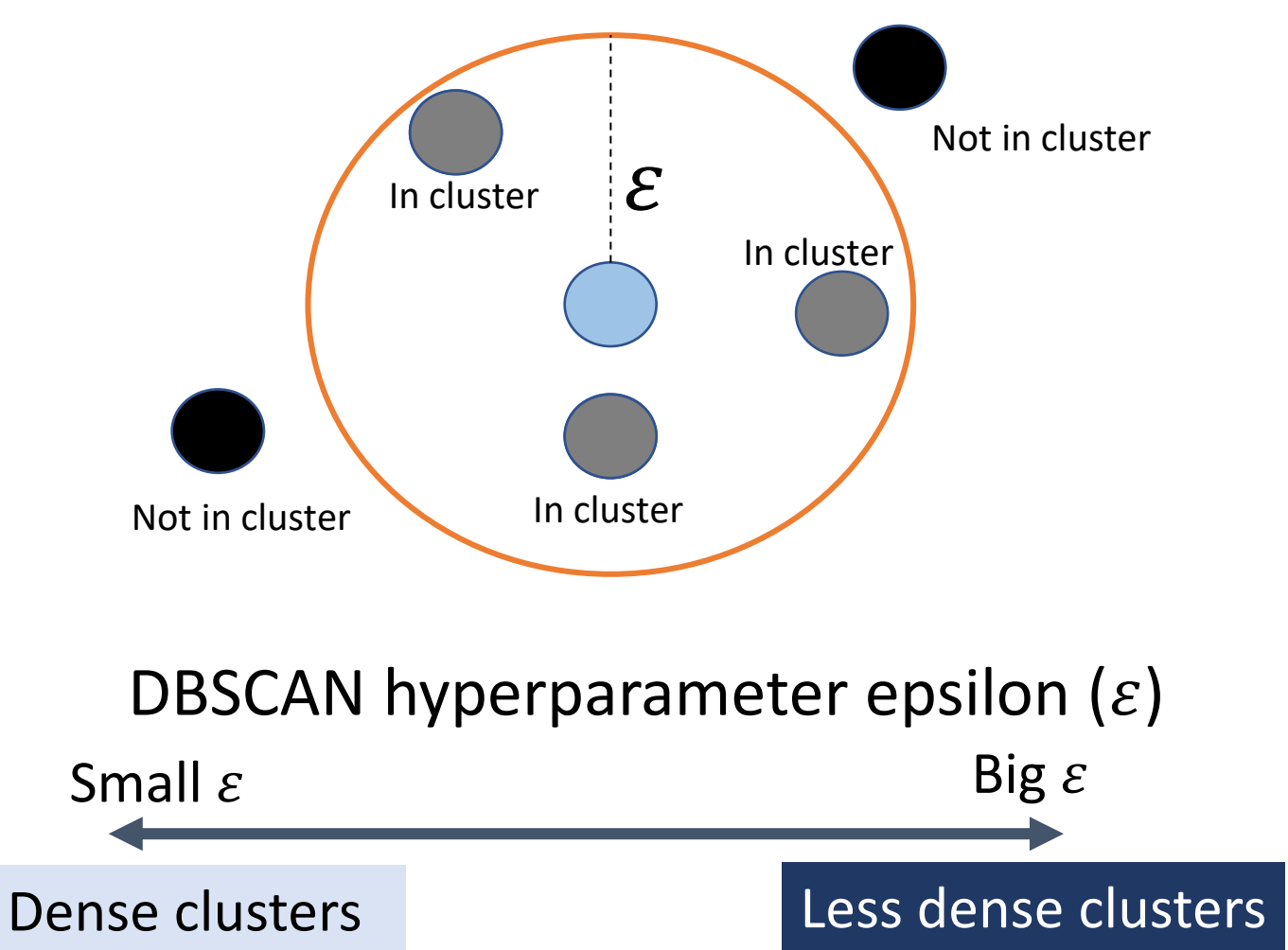
2. Tuning hyperparameters

No existing metrics for this application
➔ **Create our own**

Blue points = match service records
➔ as close to ground truth as we have

Capture **red** points that are "close" to **blue** points (more likely to be at dealership)

Proportion of "close" points captured
= true positive rate

<u>Do not</u> capture **red** points that are "not close" to **blue** points

Proportion of "not close" points captured
= false positive rate

Final rule

$$\max_{\varepsilon} \quad true\ positive\ rate$$
$$s.t. \quad false\ positive\ rate = 0$$

3. Results
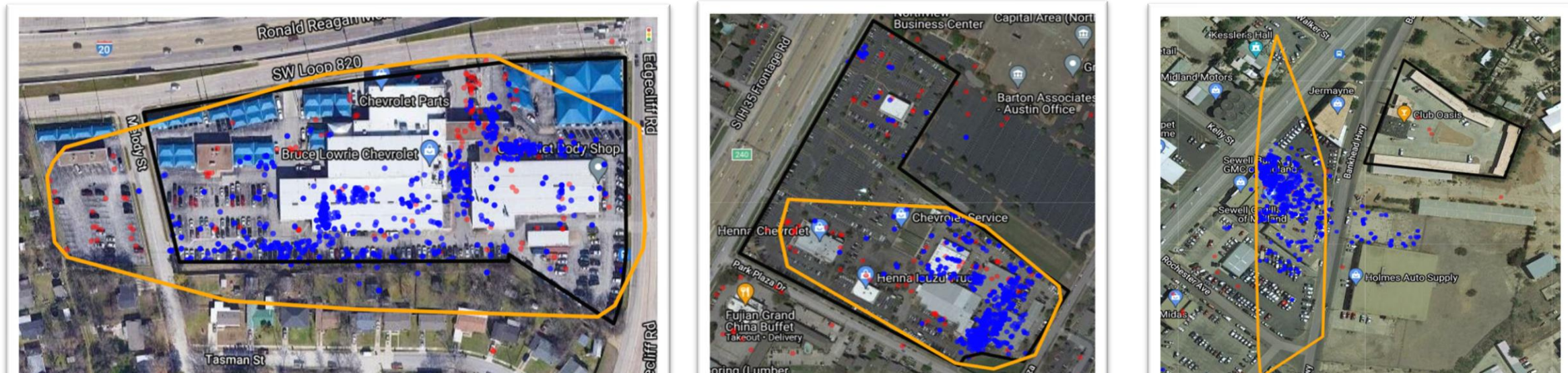
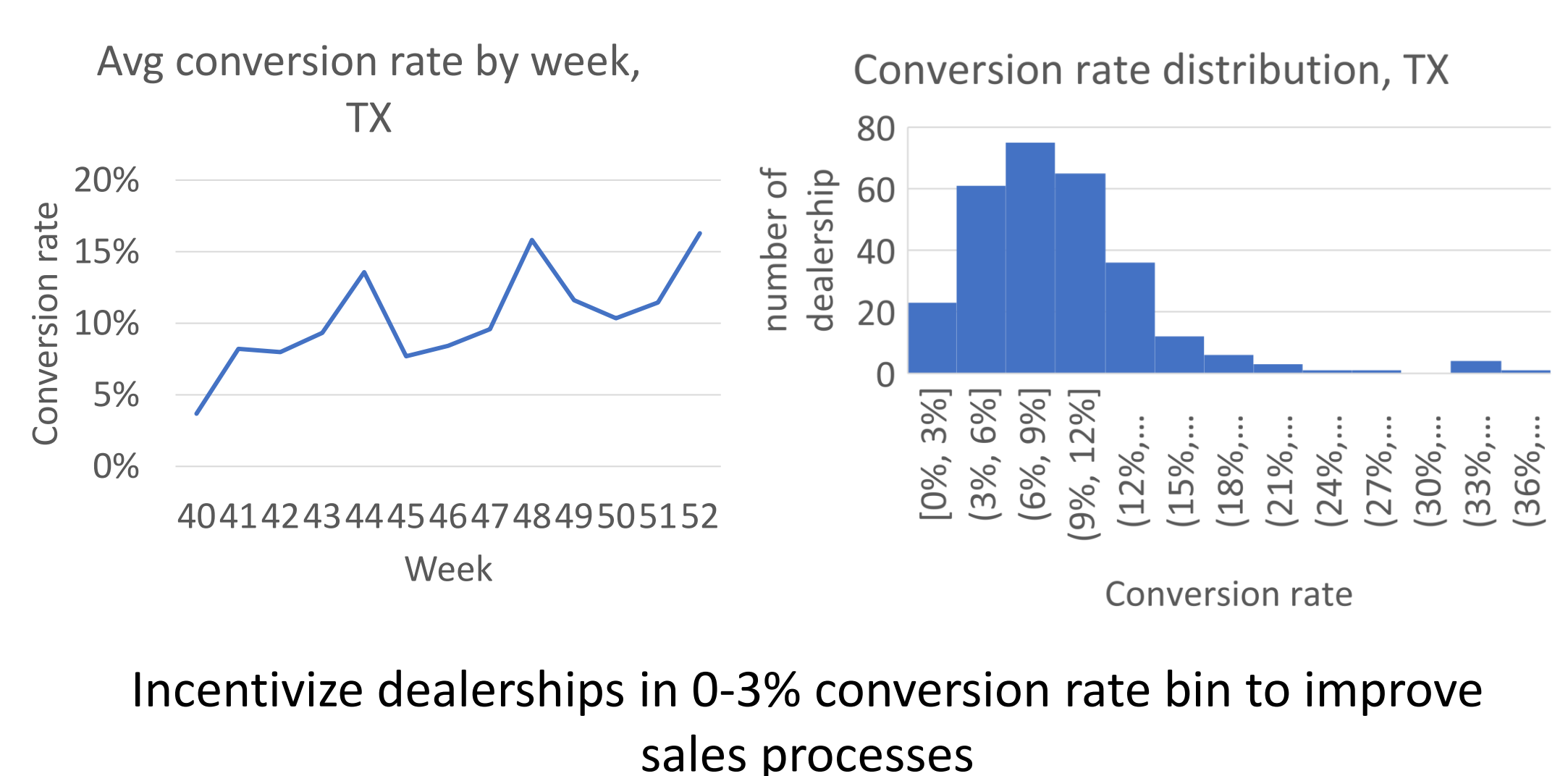| Geofence accuracy metric	Median value (MI & TX dealers)
Precision	0.9779
Recall	0.9861
Daily visit correlation	0.9947

Extension: service lane geofences

Service vs. non-service in real time

Use case 1 – Sales prediction

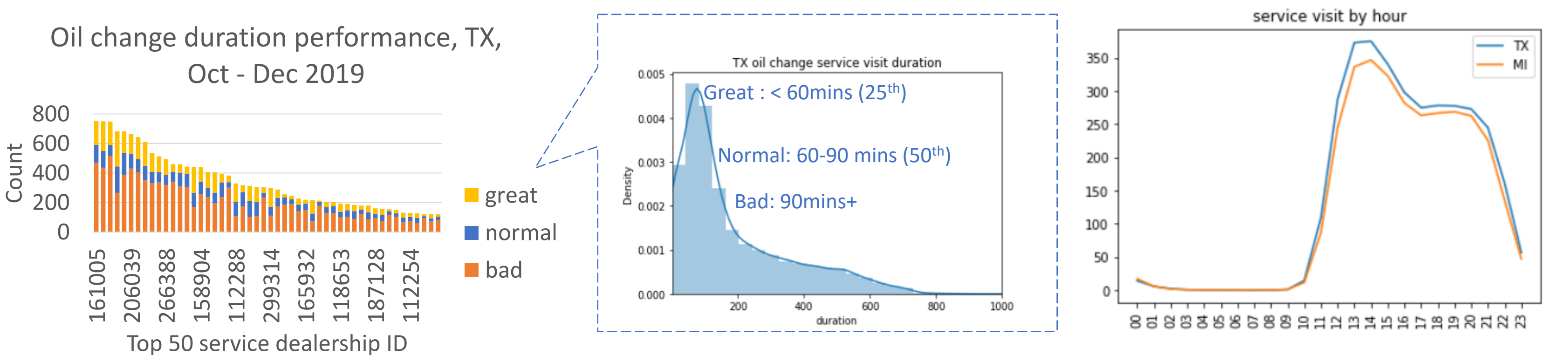Today: Dec 15
Goal: get the Dec 1-31 sales prediction

Get the visit for Dec1-15 by geofence	Predict the visit for Dec 16-31	Predict the sales by using Dec1-31 visit	Generate the early warning list

Linear regression

Early detection

gap ↓ sales → goal
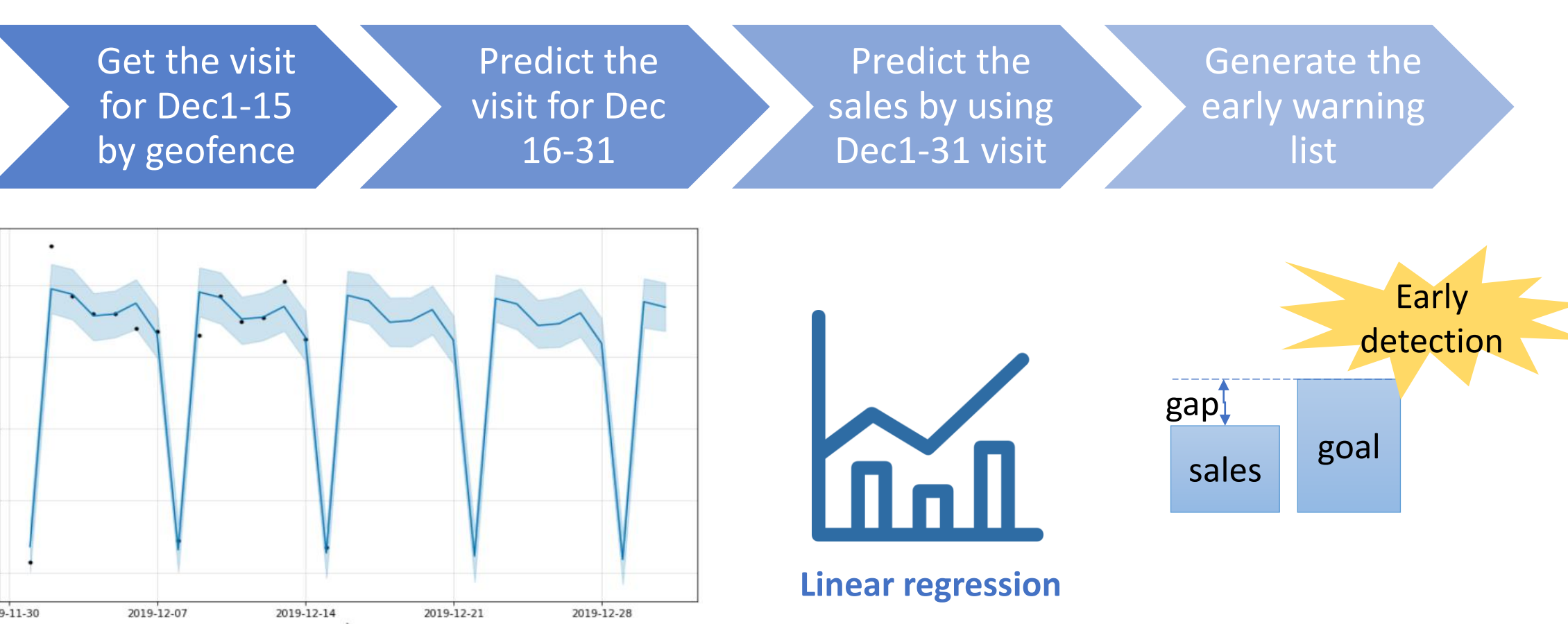
Use case 2: Conversion rate = sales/visits

Avg conversion rate by week, TX

Conversion rate distribution, TX

Incentivize dealerships in 0-3% conversion rate bin to improve sales processes

Use case 3 - Oil change duration

Incentivize poor-performing dealerships to improve service processes

Oil change duration performance, TX, Oct - Dec 2019

- great (yellow)
- normal (blue)
- bad (orange)

Top 50 service dealership ID

TX oil change service visit duration

Great : < 60mins (25th)
Normal: 60-90 mins (50th)
Bad: 90mins+

service visit by hour

Impact

Immediate   Near term   Long term

$20K — Cost of purchasing geofences

$20M/yr — Early detection + resource reallocation to boost sales

Unlock full potential of location data — Real-time personalized promotions

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