

EVALUATION OF CROWDSOURCED EVENT REPORTS FOR REAL-TIME IMPLEMENTATION – SPATIAL AND TEMPORAL ACCURACY ANALYSIS

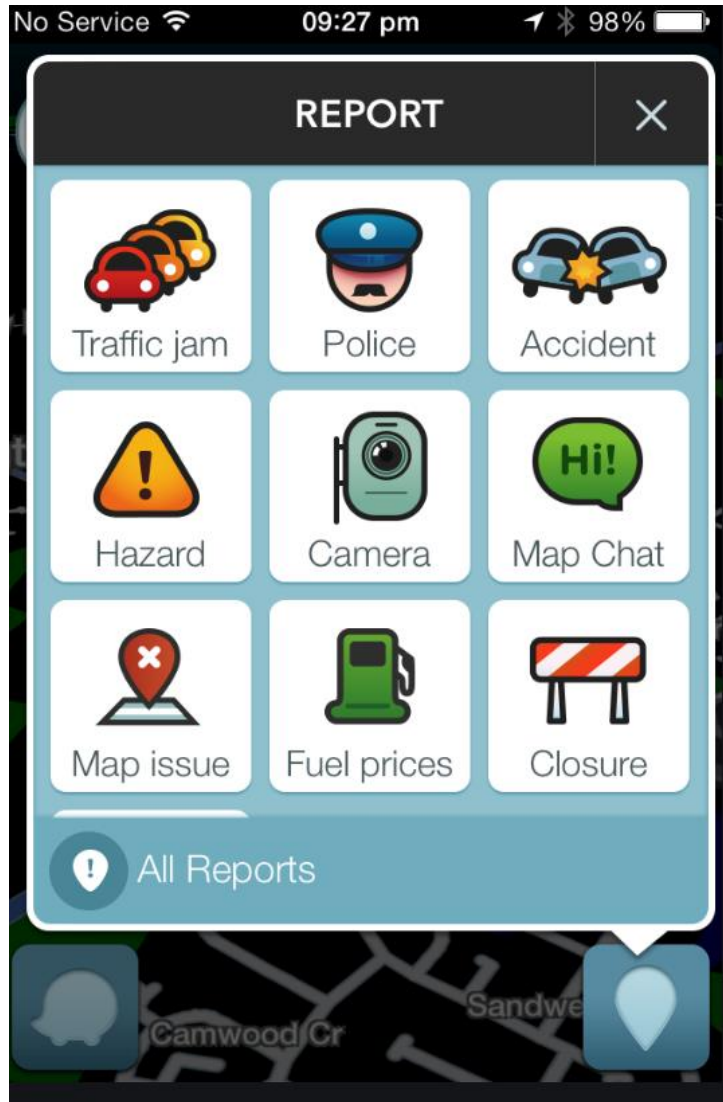
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Introduction & Background

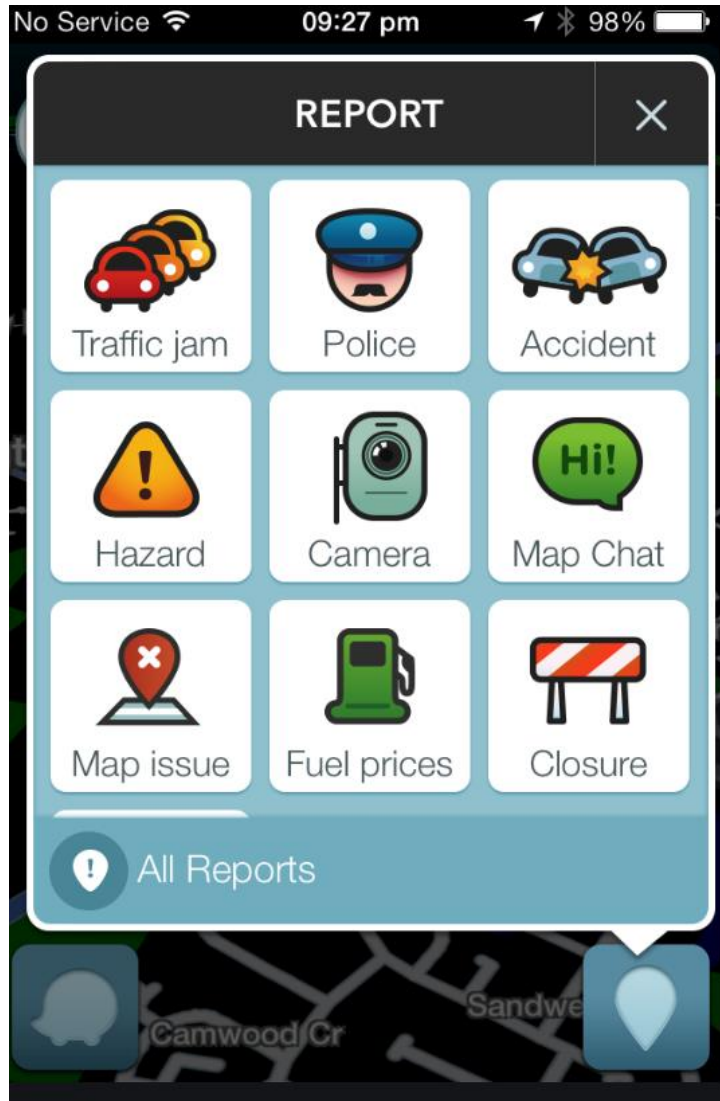
Crowdsourced data

- **Speed data**

Users allow their location information to be collected while do not share any information actively. such as google, INRIX, Waze.

- **Event reports**

Users actively report geo-tagged real-time traffic status on social media, such as twitter.



Research Question

Reliability of WAZE reports

1. *What is the likelihood of having a Waze report if an incident happened(coverage of Waze)?*
2. *If a report is made, does it represent an actual event? (false report, duplicate report, retained report)*
3. *How accurate are Waze event reports in terms of time and space?*

Data

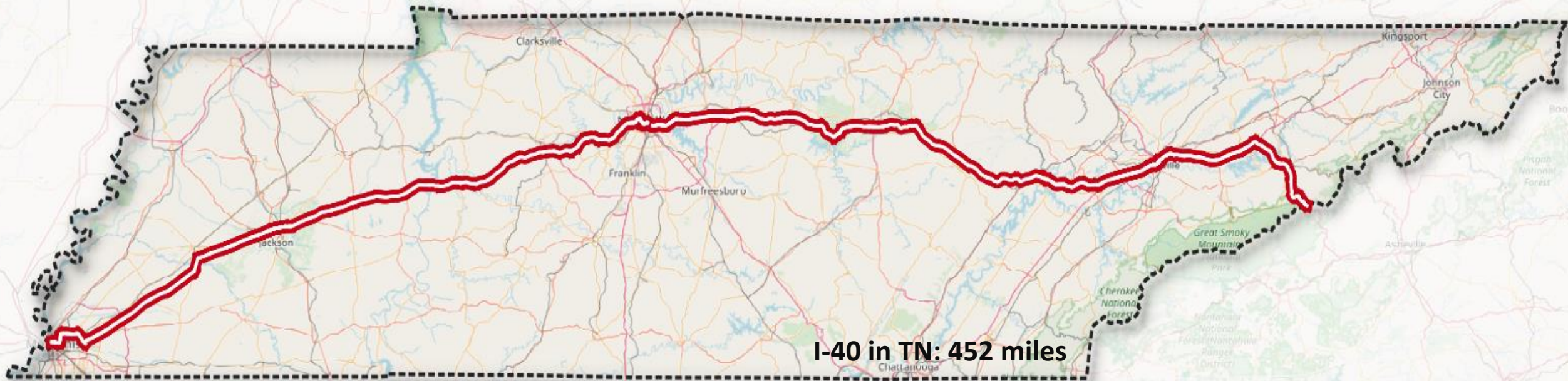


Waze Data: Reported by Waze User.

LocateIM Data: Official records maintained by TDOT (Tennessee Department of Transportation)

Type	Waze		LocateIM		Analysis Period
	<i># of reports</i>	<i>terminology</i>	<i># of reports</i>	<i>terminology</i>	
Accident	8,068	Accident	2,052	Crash, Overturned vehicle, Vehicle on fire	Aug.1 st – Dec. 27 th
Stopped vehicle	93,707	Stopped vehicle	5,459	Disabled vehicle, abandoned vehicle	Aug.1 st – Oct. 15 th

Study Area: I-40 In Tennessee State



I-40 in TN: 452 miles

Matching Methodology

Pseudocode

For each report in LocateIM:

For each report in Waze:

Compute $\Delta T = T_{WAZE} - T_{LocateIM}$

If $\text{abs}(\Delta T) < T_{thre}$:

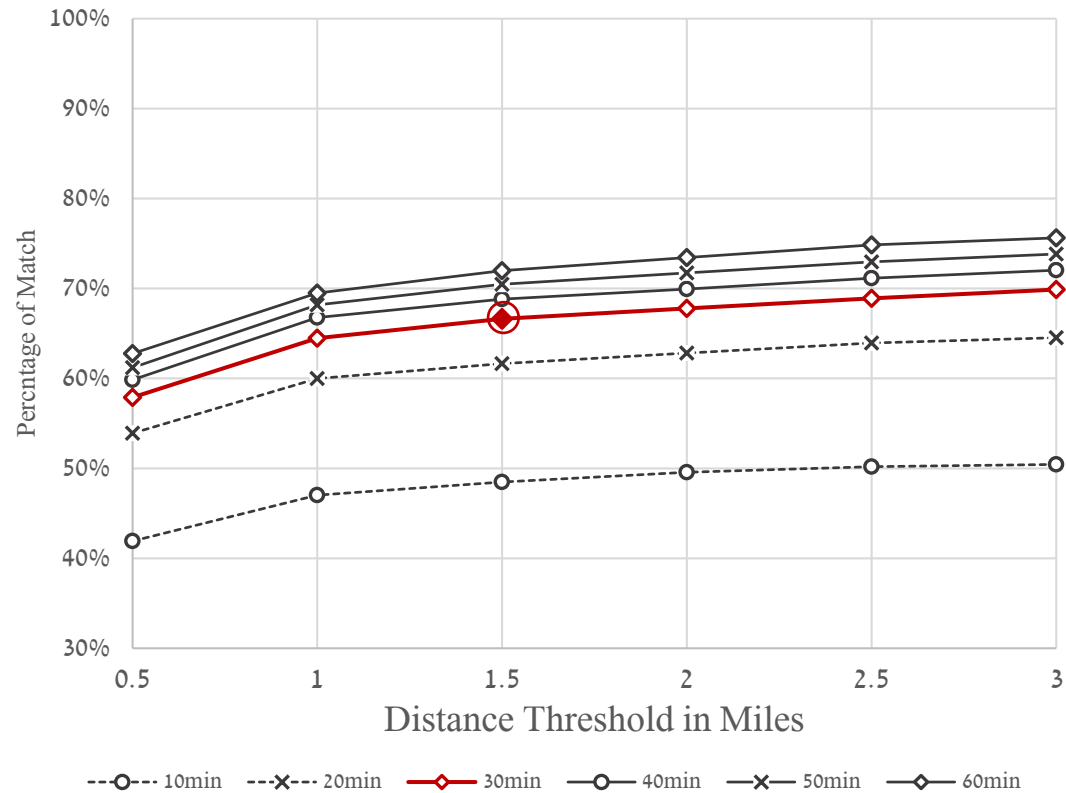
Compute $\Delta D = D_{WAZE} - D_{LocateIM}$

If $\text{abs}(\Delta D) < D_{thre}$:

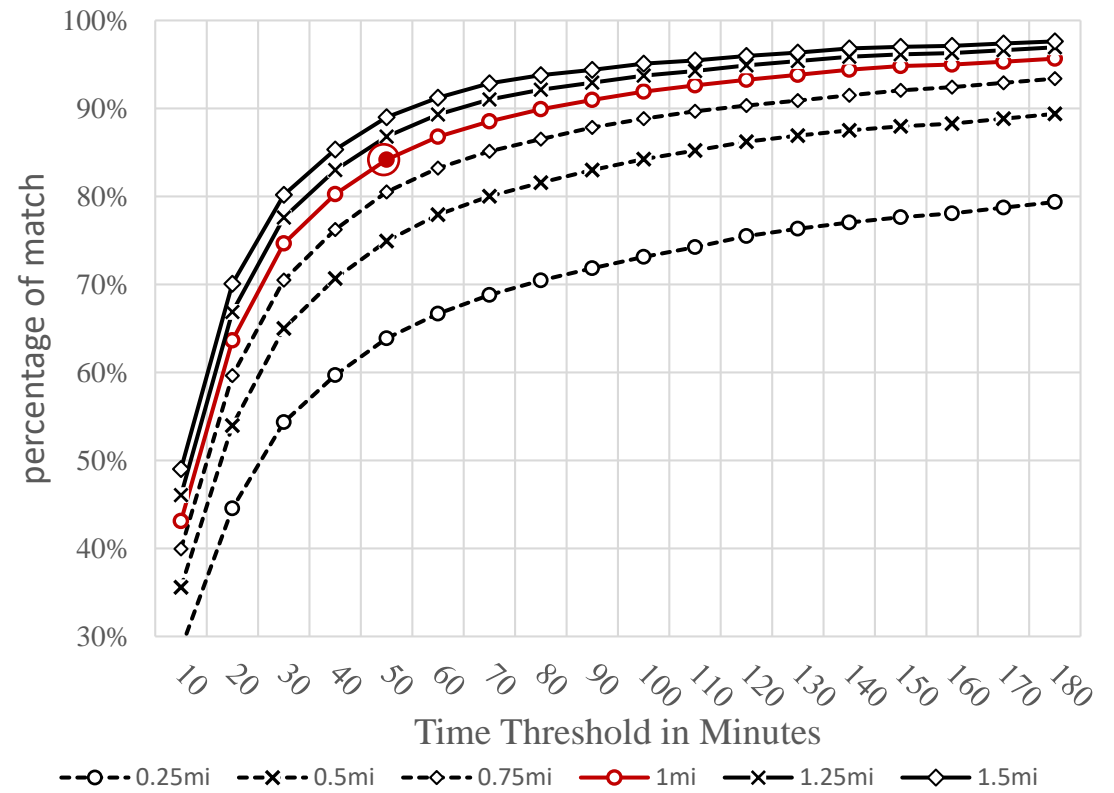
Add the Waze reports to the matching list of LocateIM reports

Temporal-Spatial Threshold Selection

Accident reports



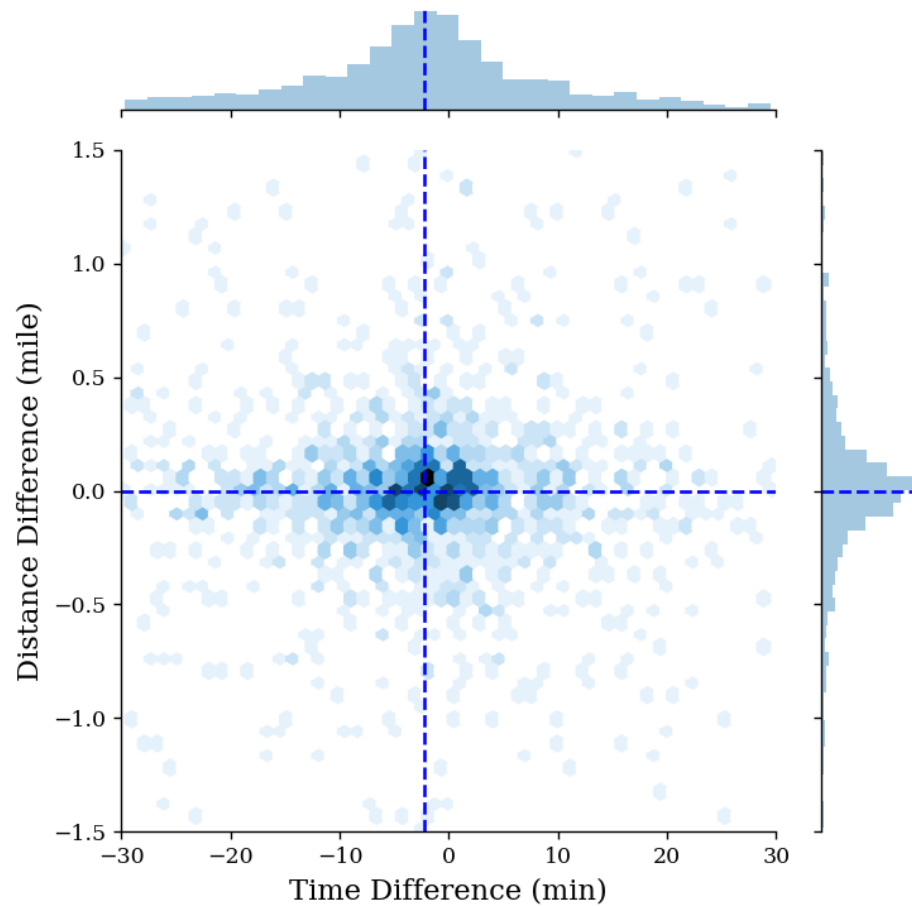
Stopped vehicle reports



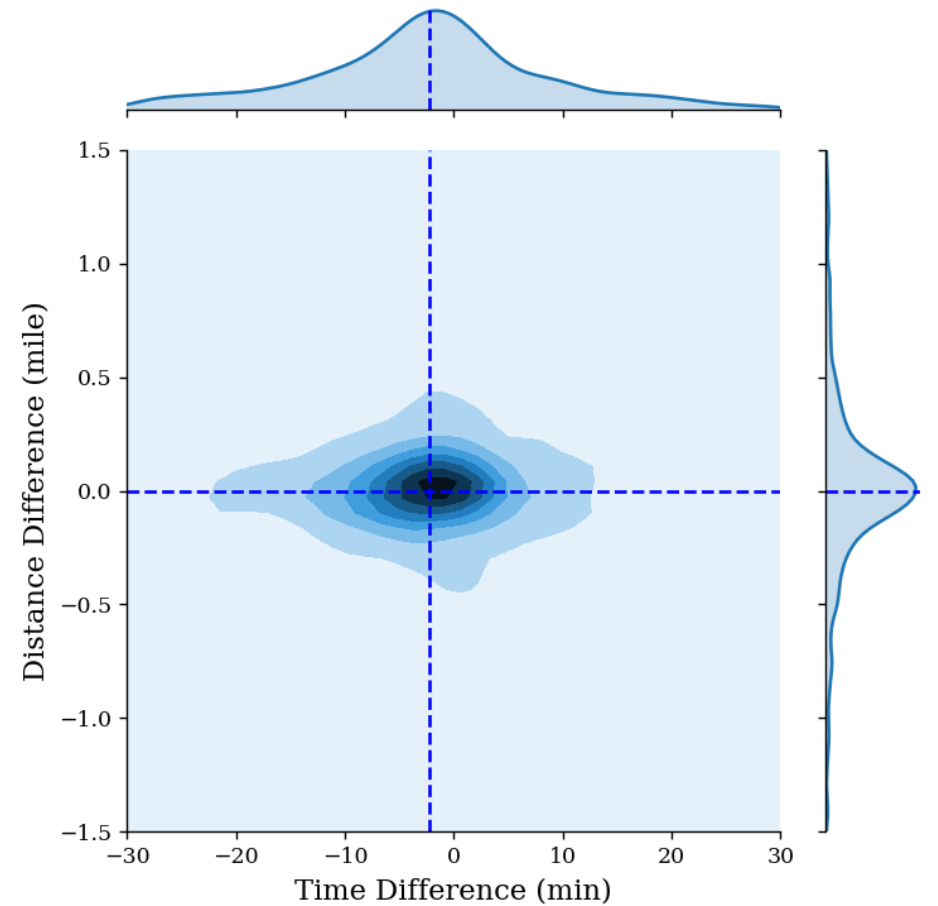
Crash Matching Results

-2.2 min

Threshold : 1.5 mile, 30minutes



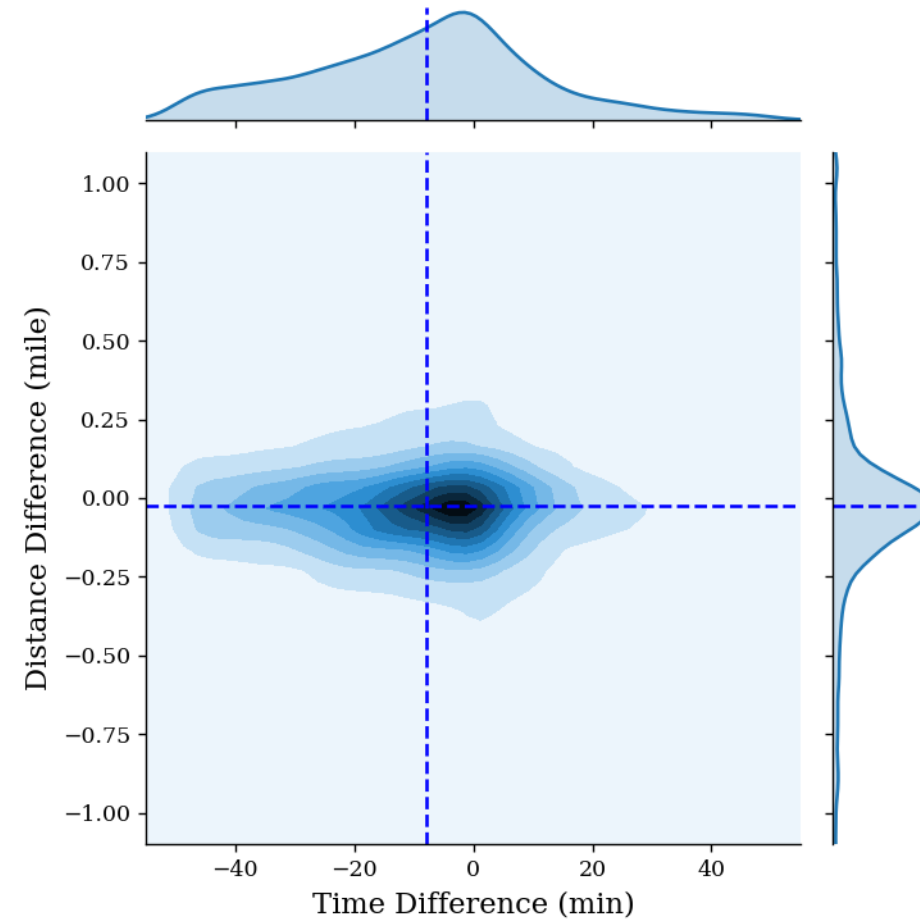
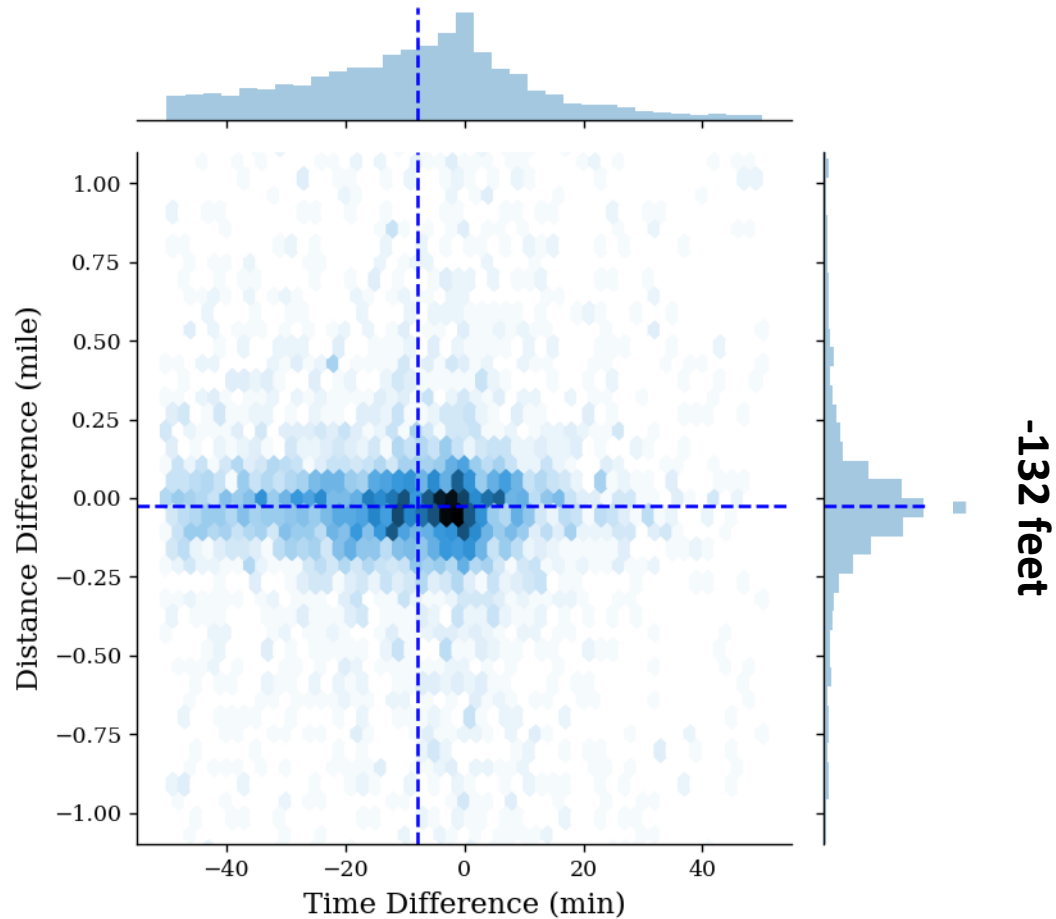
-6 feet



Stopped Vehicle Matching Results

-7.8min

Threshold : 1 mile, 19minutes



Timeliness

On average, Waze reports are made **2.2 minutes** sooner than LocateIM reports for an accident, and **7.8 minutes** for stopped vehicles.

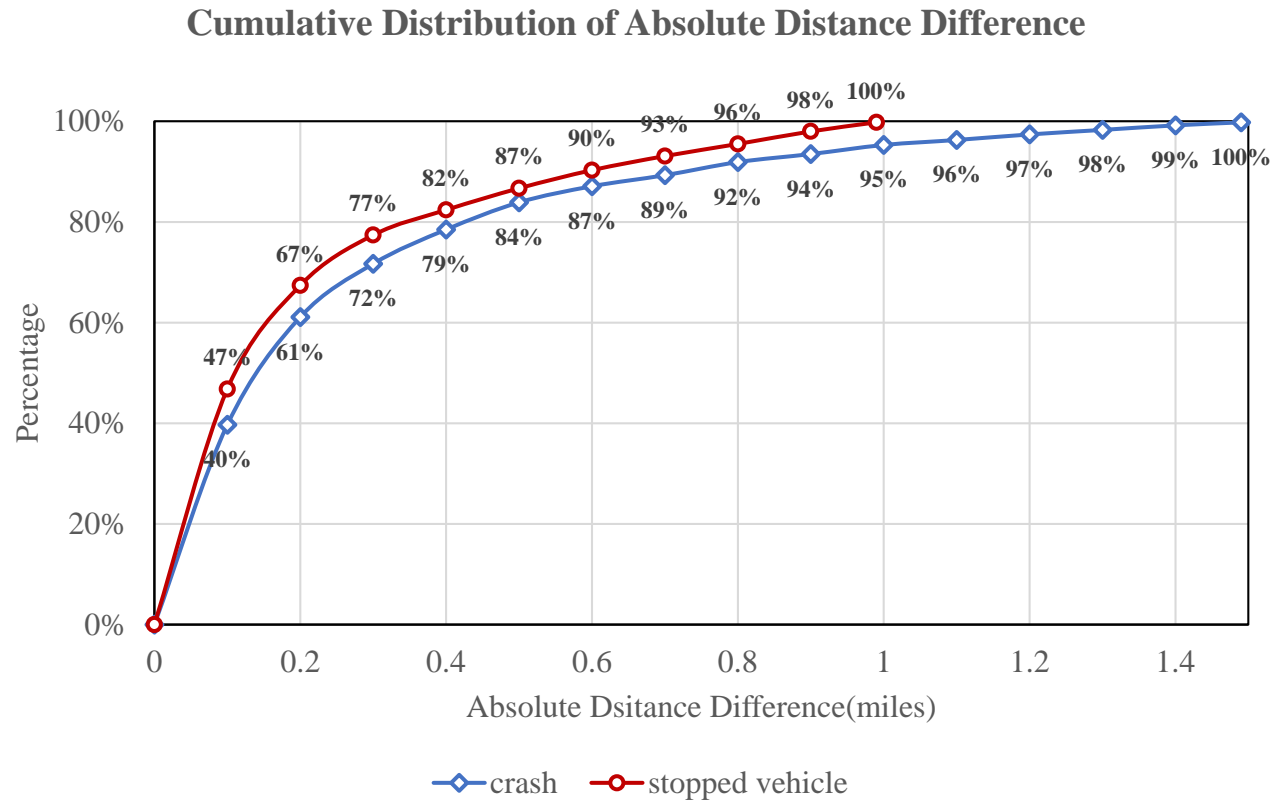
<i>Time difference(min)</i> ($T_{Waze} - T_{LocateIM}$)	<i>Number of Reports</i>	<i>Percentage</i>
(0, -3]	832	16%
(-3, -5]	611	10%
(-5, -10]	479	14%
(-10, -15]	287	9%
(-15, -20]	167	5%
<-20	96	7%

<i>Time difference(min)</i> ($T_{Waze} - T_{LocateIM}$)	<i>Number of Reports</i>	<i>Percentage</i>
(0, -5]	3090	13%
(-5, -15]	2498	18%
(-15, -20]	1618	14%
(-20, -35]	1003	10%
(-35, -45]	533	7%
<-45	172	4%

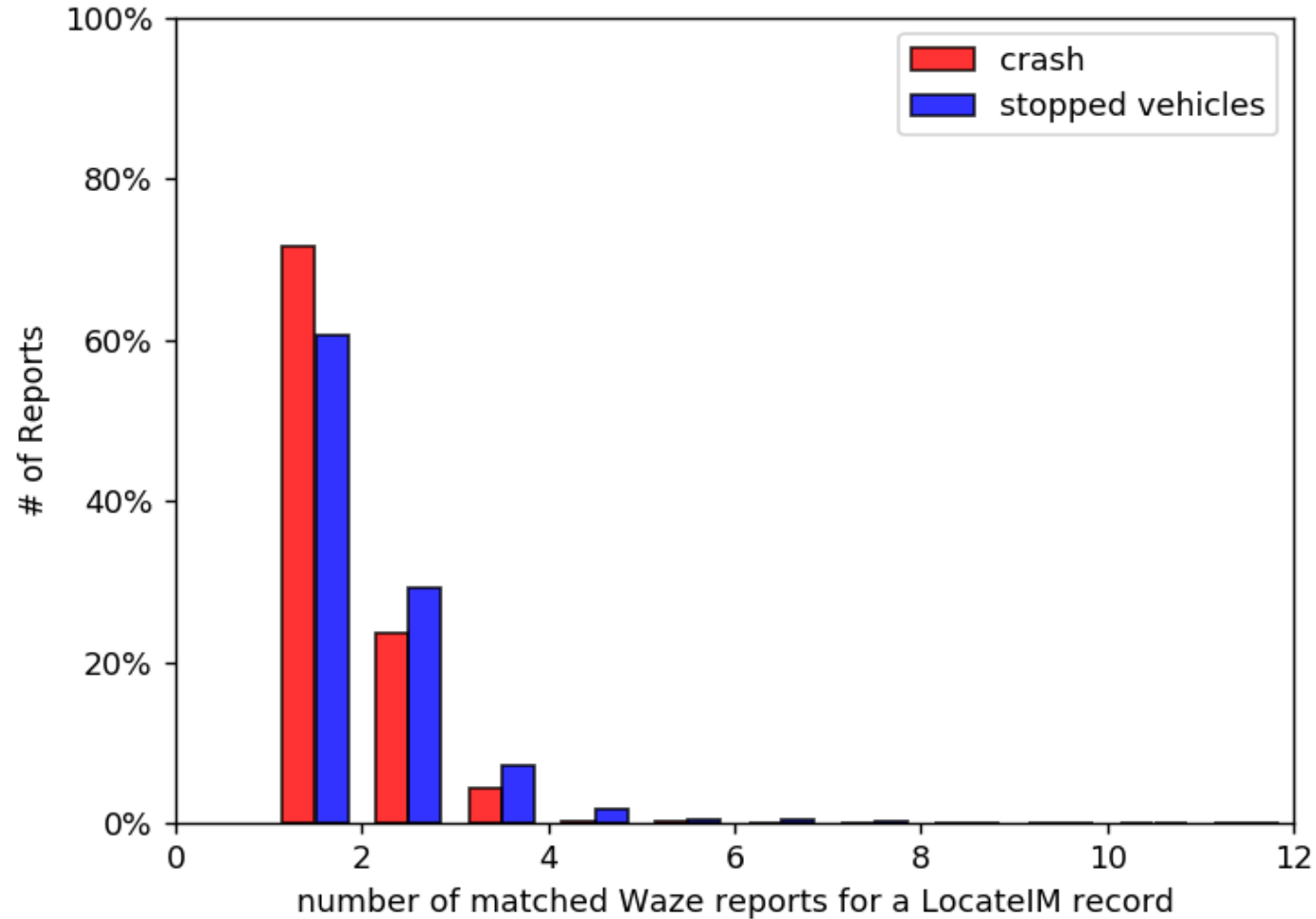
Note: *, negative indicate Waze reports were made earlier than LocateIM reports

Spatial Accuracy

On average, the distance between LocateIM reports and Waze reports is **-0.001 miles** for accidents and **-0.025 miles** for stopped vehicles

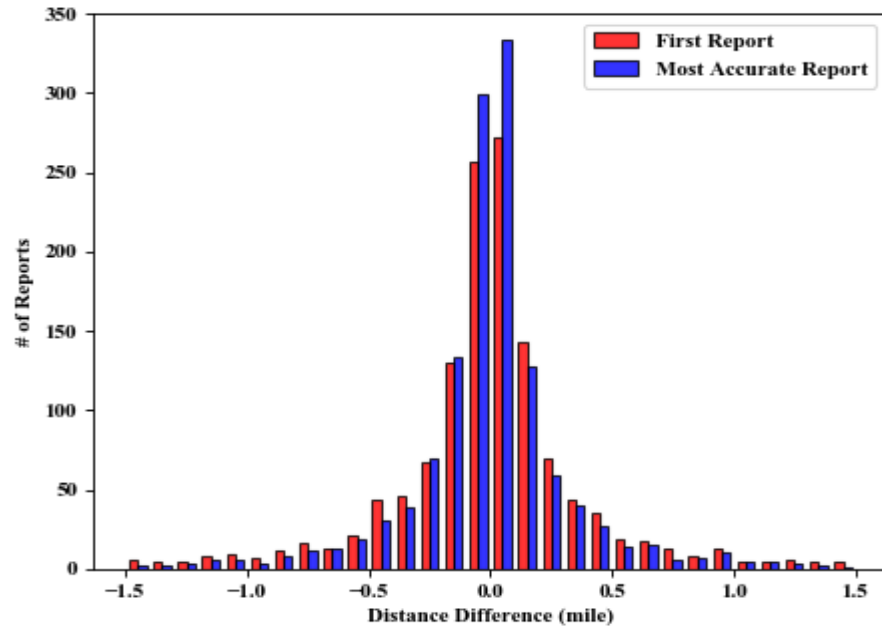
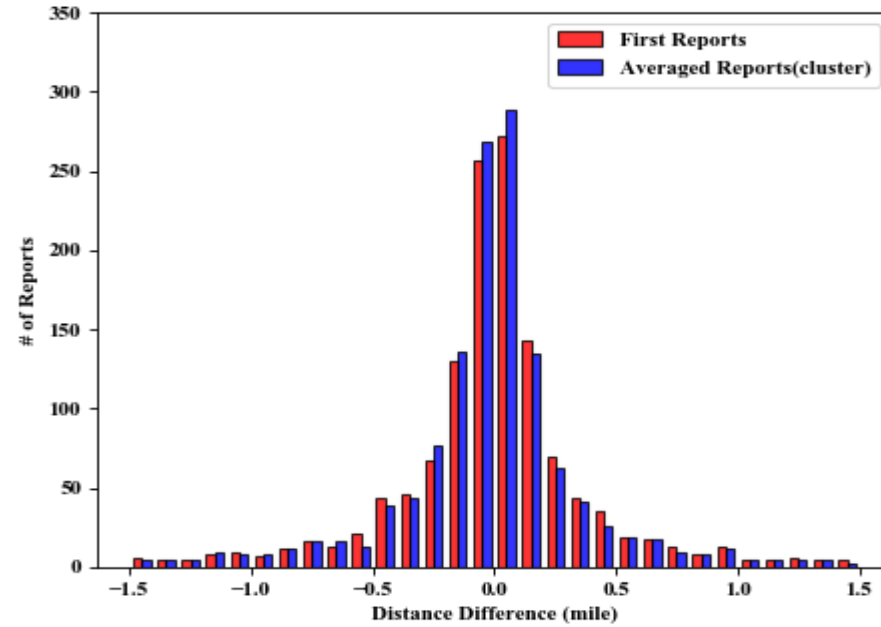
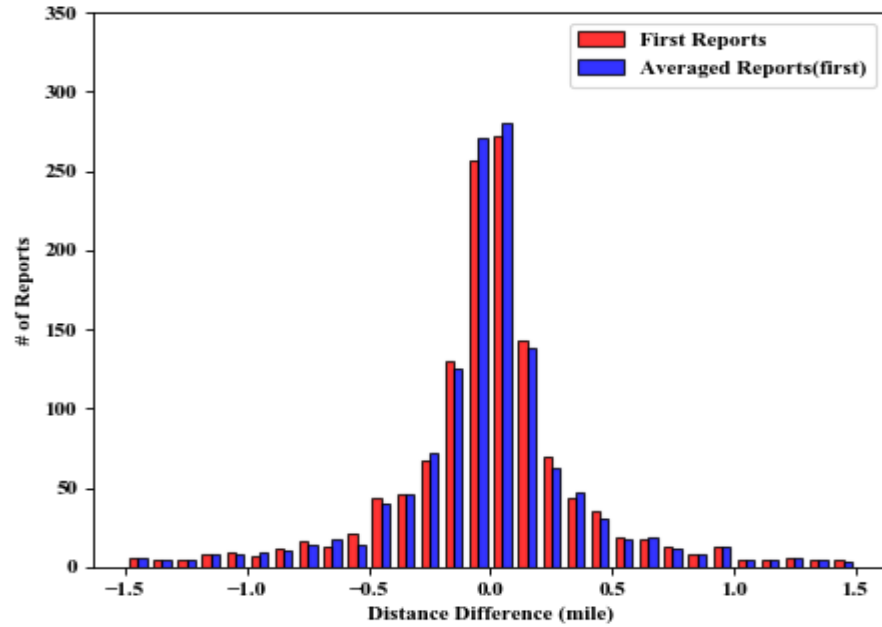


Further Analysis of Spatial Accuracy

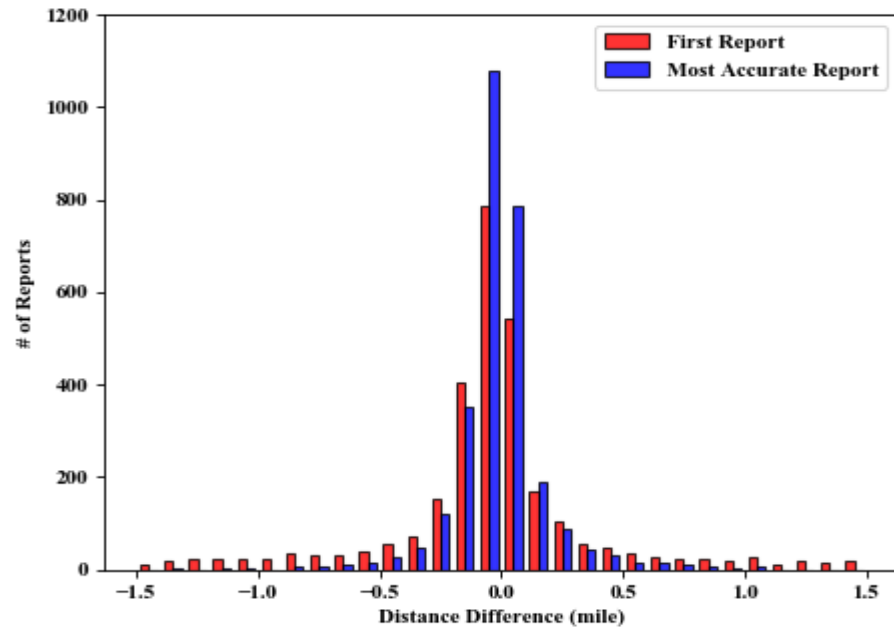
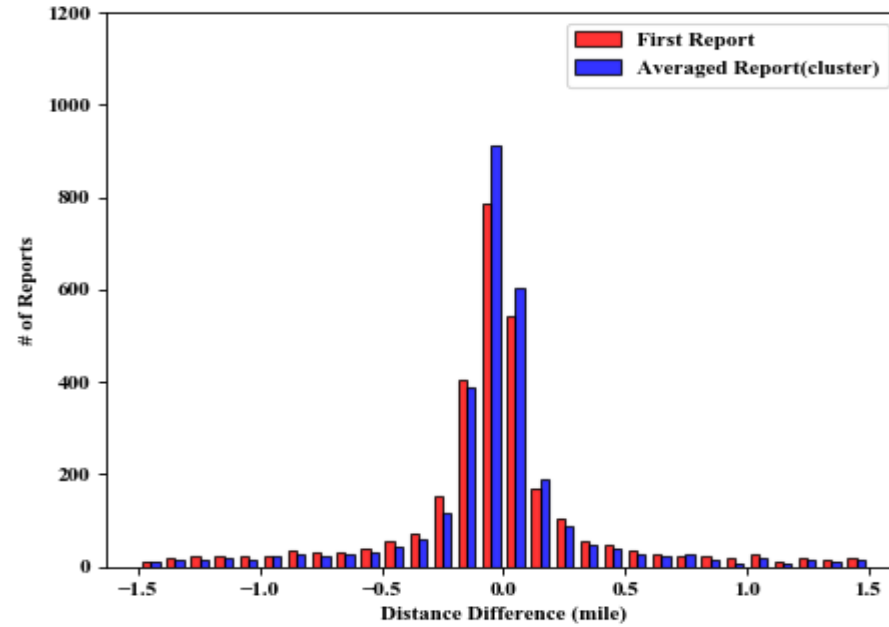
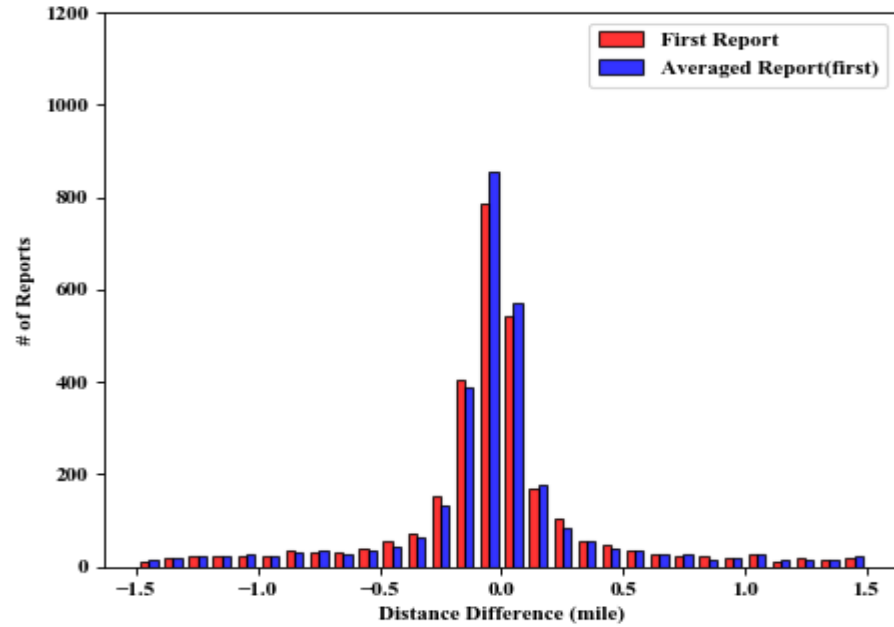


Further Analysis of Spatial Accuracy

- ❖ Use the first report to represent the location of the accident.
- ❖ Average reports around the first report to represent the location of the accident.
- ❖ Average reports that clustered together to represent the location of the accident.

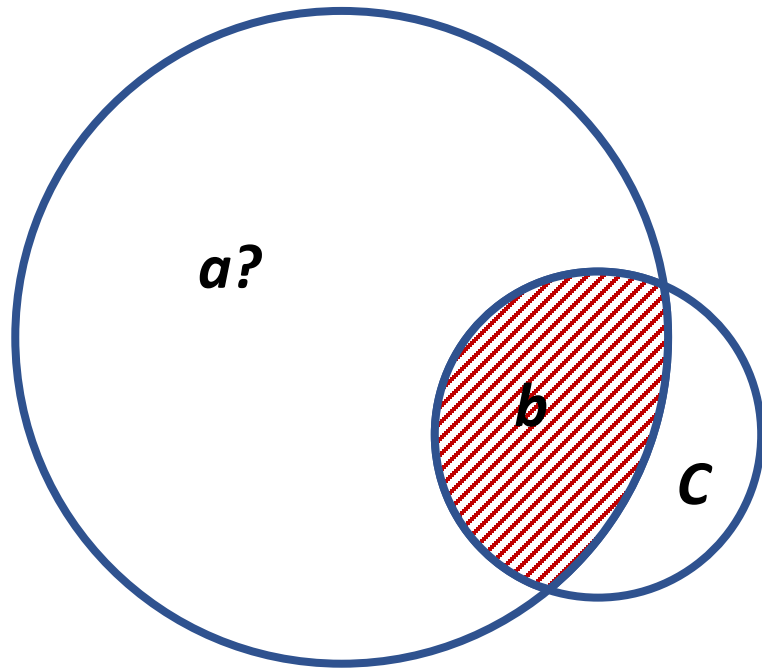


	Mean(feet)
Most accurate report	-8
First report	-5
Averaged report(first)	-8
Averaged report(clustered)	-11



	Mean(feet)
Most accurate report	-5
First report	-132
Averaged report(first)	-115
Averaged report(clustered)	-53

Coverage - Crash



	WAZE	LocateIM
Total Records	8068	2052
Matched	2066	1374
Percentage	26%	67%

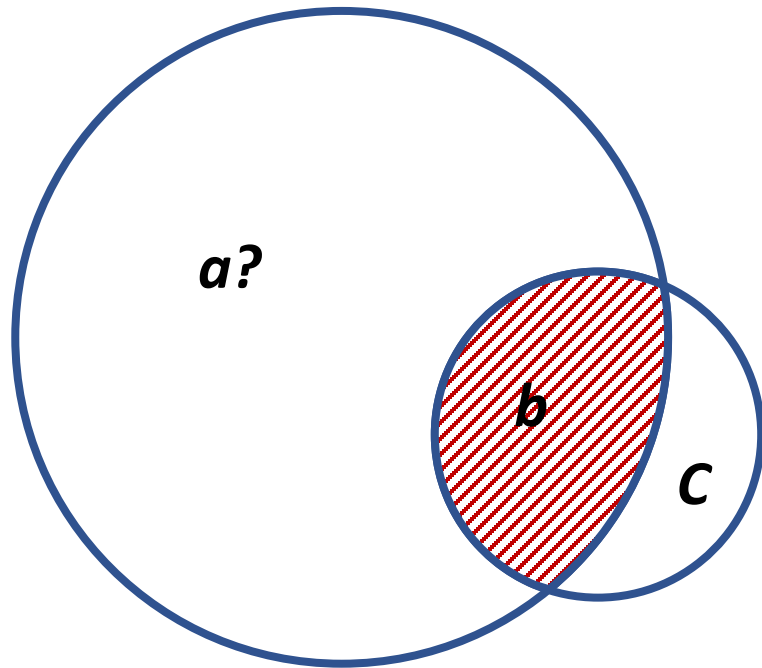
6002 reports in Waze that can not be matched to LocateIM:

%False report?

%Duplicate report?

%Event that not recorded by LocateIM?

Coverage – Stopped Vehicle



	WAZE	LocateIM
Total Records	93707	5459
Matched	13203	4674
Percentage	14%	85%

80194 reports in Waze that can not be matched to LocateIM:

%False report?

%Duplicate report?

%Event that not recorded by LocateIM?

Findings

- ❖ **WAZE Coverage:** WAZE Covers 67% of crashes recorded by TDOT and 85% of stopped vehicles recorded by TDOT.
- ❖ **Timeliness:** Waze reports are made **2.2 minutes** sooner than LocateIM reports (**7.8** minutes for stopped vehicle). **Forty percent** of the crash reports (57% of stopped vehicle reports) in LocateIM are reported **earlier** by Waze than LocateIM.
- ❖ **Spatial Accuracy:** On average, the distance between LocateIM reports and Waze reports is **-0.001 miles(-6 feet)** for crashes and **-0.025 miles(-132 feet)** for stopped vehicles.

Future Study:

- ❖ Improve the location estimation accuracy.
- ❖ Propose method to remove Waze duplicate reports and analyze the percentage of reports reported by Waze but not recorded in LocateIM(contribution of WAZE).

THANKS
Q&A