

Introduction

A company specializing in delivery services approached our organization to research a way to distinguish between DSP drivers, customers that take-out food from a restaurant, and those that dine in at the restaurant based on a visitor's device location data. Delivery Services is interested in the River North neighborhood in downtown Chicago, IL as a possible location for expanding their business. This location is in a very dense and urban location, filled with high rise buildings and packed with restaurants. Within this neighborhood, the DSP also chose a handful of businesses to study in order to make an assessment on our ability to distinguish between devices. The DSP provided this list of businesses along with a list of DSP provider rankings and peak hours of business for the location to aid in this study. In order to go about the study, there was research done on the neighborhood, DSP driver habits, and the restaurants provided to create a complete profile of who makes up the River North neighborhood.

Initial Research Insights

As mentioned before, River North is a densely populated region in the heart of Chicago that gives some challenges to the study. High rise buildings in the area interfere with the accuracy of the data that we can collect from devices and also add a challenge to identifying the exact location of some restaurants. For example, a restaurant on the bottom floor of an office building may not be able to be geofenced accurately. Another challenge is that the city has limited loading zones for restaurants and limited parking for customers to visit restaurants, where being able to geofence these areas to acquire location data would provide insight as to the visitation trends of visitors to the restaurants.

Research done on the delivery service providers in the area gave some insights as to how a potential driver will operate in the area. According to driver comments on forums dedicated to food delivery service drivers, River North is a suboptimal location for drivers because of the lack of parking making pickup/dropoff difficult and delays due to traffic. Therefore, there is a possibility that delivery might be done by couriers on foot in the area, where the lines between courier and take out customer can be blurred. UberEats and Door Dash have specified optimal waiting zones for orders and optimal areas for deliveries, which don't necessarily correspond to pickup locations nearby the restaurant where the consumer placed the order as well. According to UberEats and GrubHub/Eat24, busy times for their drivers is between 11am-2pm and 5pm -9pm, encouraging drivers to be active around those times for the most business.

Waiting zones in River North are:

Near a Starbucks on

At the Ohio Motel

At The Mart (451 Kinzie St.).

These areas have limited waiting areas, so drivers may not be stopped for very long until they get their next order. Another habit that DSPs such as UberEats encourages is driving customers around and delivering food in between trips during slower rideshare times. Depending on the DSP a customer uses, the driver will have different visitation patterns based on several factors. Restaurants such as McDonalds are connected with DSPs such as UberEats so they might not wait as long as a take out customer or go into the same areas that a take out customer may be in. The DSP driver will sometimes go into the place of business and order as a regular take out customer would, so that behavior can be used to differentiate a device these take out devices and someone that would dine in the restaurant.

The restaurants that Delivery Services provided are as follows:

Portillo's	100 W. Ontario
Lou Malnati's	439 N. Wells
Velvet Taco	1110 N State St
McDonalds	600 N Clark St
Maggiano's	516 N. Clark
T.G.I. Fridays	153 E Erie St
Tempo Cafe	6 E Chestnut St
Hooters	660 N. Wells
Seoul Taco	738 N. Clark
The Halal Guys	49 W. Division

These restaurants are scattered within and around River North and are considered to be top locations for DSPs in the area. These locations are a mix of Local, Regional and National chains with different features for each restaurant along with different features associated with their buildings. Some of these restaurants are part of high rise buildings, others are stand alone restaurants that may or may not have a drive through area. As mentioned before, many of these locations don't have dedicated parking areas for their restaurants and have limited street parking/loading zones. Customers are potentially arriving through ride share apps or are utilizing DSPs due to these factors.

Restaurant Hours (can filter pings out by these hours)

- Tempo Cafe open 24/7, checked with GrubHub and it shows that they deliver those times as well.
- Velvet Taco open from 11am to 3am
- McDonalds open 24/7, delivery drivers will go through drive thru
- Portillo's open from 10am till 1am at the latest
- Maggiano's open from 11:30am to 11pm at the latest
- TGI Fridays open from 10:30 am - 2:00 am at the latest, normally closes at 1am
- Lou Malnatis open from 10:30 am - 12:00 am at the latest, normally closes at 11pm
- Hooters open from 11:00 am - 12:00 am at the latest, normally closes at 11pm
- Seoul Taco open from 11:00 am - 4:00 am Fri and Sat, normally open from 11:00 am - 10:00 pm
- Halal Guys open from 11:00 am - 4:00 am Fri and Sat, normally open from 11:00 am - 10:00 pm

Designing Experiment

With a profile of the area and the potential visitors to the restaurants of interest the study was defined with several assumptions in order to accommodate for the most use cases.

Assumption 1: a device that spends more than 7 minutes within a restaurant is most likely someone that is there to dine in. Devices less than that time period are those that are there to pick up an order, whether it is for take out or delivery to a location.

Assumption 2: A takeout customer will most likely return either to their home or work location after picking up their order. They may also be leaving their home/work location before arriving to the study polygon.

Assumption 3: A delivery driver will be assumed someone that has visited the location more than once a day and/or someone that has visited the location 80% of possible working days in a year (200 individual visits in a year)

Assumption 4: Individuals that use DSPs are using apps that are connected with the restaurant, such as Eat24 and UberEats meaning that their wait times should be similar to someone at a restaurant for take out.

Assumption 5: Individuals utilizing a drive thru at specific restaurants (Portillo's, McDonalds) will be considered take out customers/DSP drivers and categorized as a different type of customer.

Assumption 6: Devices that have less than 1 data point within the study polygon will be tagged as devices with unknown intentions, meaning that the intent behind the device being there

cannot be determined by the limitation on location data. All devices must have more than 1 datapoint within the study polygons in order to be categorized.

Assumption 7: Delivery Drivers after arriving will not be returning to their home or work location after picking up an order.

Assumption 8: If a customer is seen returning to a hotel and does not have a common evening location in Chicago, then they are take out visitors traveling back and forth to their hotel.

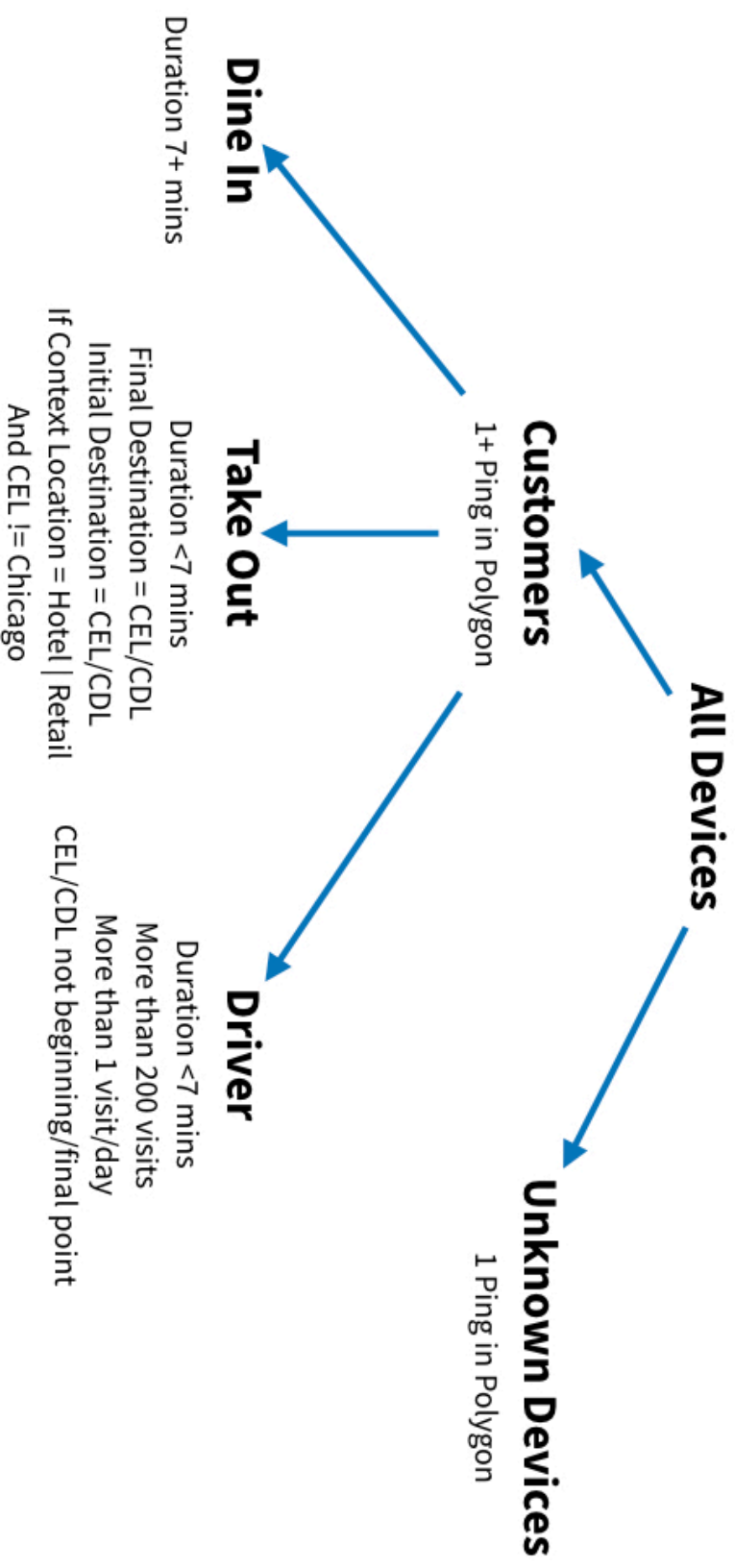
Assumption 9: A separation of data points of 1 hour will be used to track visits. So one individual visit will be a device that has more than 1 point within the study polygon, and having another point within that hour window will not count towards another visit. Someone that is either eating there or delivering for the restaurant will not be able to come back to the location within that hour due to traffic congestion and because someone won't usually eat again at the same location over an hour apart from the initial visit.

With these assumptions in mind, the study was designed as follows:

- Study will utilize data for the 10 locations throughout the year of 2018 (1/1/2018 – 12/31/2018)
- Path to Purchase Data, Common Evening/Daytime Locations, and Point In Polygon reports will be utilized for this study
 - Path to Purchase(Pathing X with Context): Will help in determining the route visitors to locations took to getting there.
 - With a window before and after arrival of 40 minutes, we can use this data to see how long someone was in the location and where they travelled to and from before/after arrival.
 - Since the downtown location is dense and congested with traffic, a visitor may not be able to travel very far from the study polygon and the window is adjusted to account for this.
 - Adding context locations to this dataset will also provide some insight as to what kind of locations a device is travelling to after their visit.
 - Common Evening/Daytime Location: Will help in providing a list of shift workers of study restaurants and residents that may live in apartments above the restaurant that commonly spend their afternoons and evenings within the bounds of the study locations.
 - Using this list, we can filter out those devices from the study since they are not customers.

- Another purpose of using this type of report is to contextualize the Path to Purchase data for devices to determine whether those devices are either returning to their home or work location after arriving to the study location or whether those devices are coming from their home/work location before arrival.
- Point in Polygon: This data will be used to provide location data on reports within the polygon to determine number of visits in a day and whether the amount of data for device can be identified as a customer, driver, or unknown device.
- Devices seen in drive thru will also be separated out for the study, using a geofence on the pick up window to identify the kinds of customers that utilize this restaurant feature.

Following flowchart summarizes the design of the study:



Research Findings

From our data, we were able to determine that the total amount of unique devices to the locations combined was 66,320 devices. From these devices, we were also able to determine which of the 10 locations of interest had the most unique device visit over the 1 year period. McDonald's had the most unique devices visit its location with 25,875 over 1 year. Upon filtering out for device pings, we initially were left with a pool of about 44,895 devices that were known customers of the location. 29,610 devices were deemed as unknown devices and were set aside for further screening of possible dine in customers.

Further screening of those ~45k devices was done to categorize the devices based on their behaviors using the methodology described above