



# Octantis' Sustainable Growth - T800

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Quantitative Methods for the Social  
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# Driving Good Growth in 2020

**Objectives**

**Sustainable growth:** optimizing media levers to maximize sales

**Data**

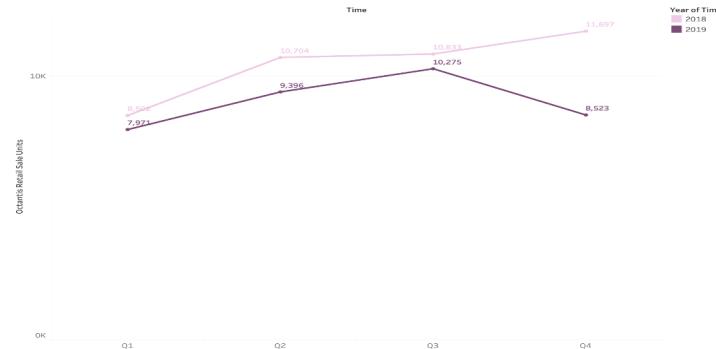
Historical **SUV T800**'s media related data (2018-19)

**KPI**

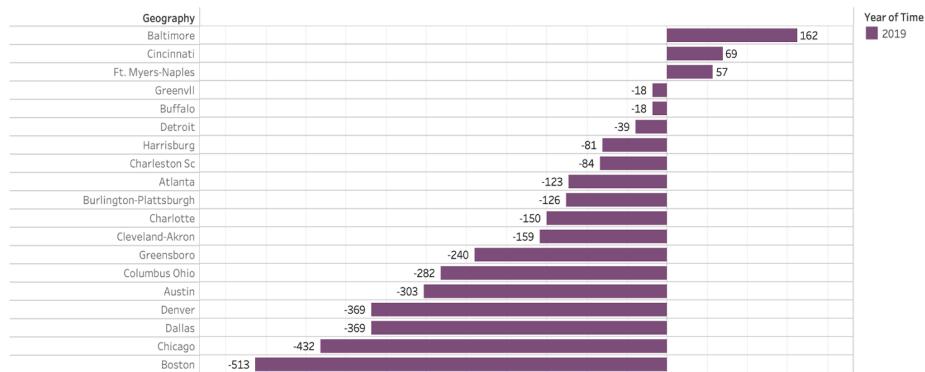
Increase month-to-month **Sales Unit** while maintaining a low media expense

# Exploratory Data Analysis

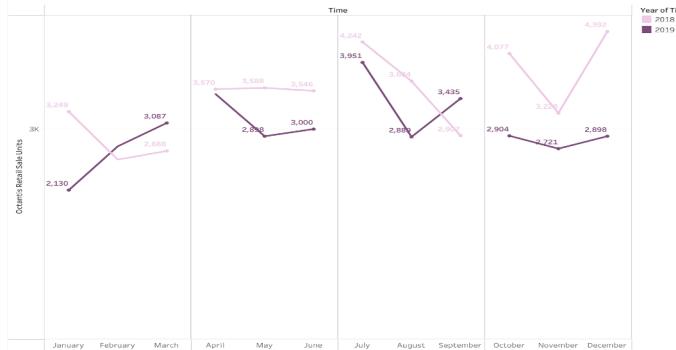
Sales Growth by Quarters Between 2018 and 2019



Sales Growth in 2019 among Geographical Areas



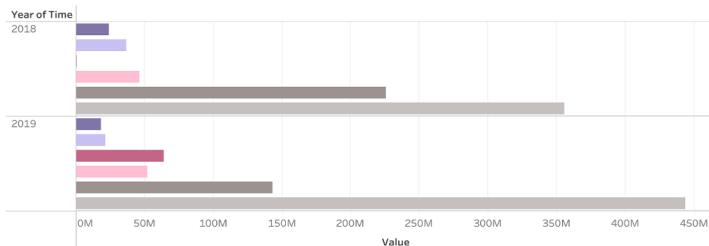
Sales Growth by Months Between 2018 and 2019



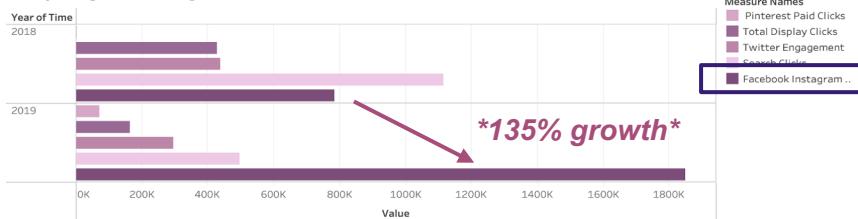
- From our first-hand exploration, the retail sales units of SUV T800 had been decreasing by yearly compared the previous year
- Taking a closer look, **9 out 12 months** in 2019 failed to surpass previous year's sales amount.
- However, interesting insight was found - three geographical areas have positive growth on sales compared to their 2018 sales

# Exploratory Data Analysis - Baltimore Area

Comparing Media Impression at Baltimore



Comparing Media Engagement at Baltimore



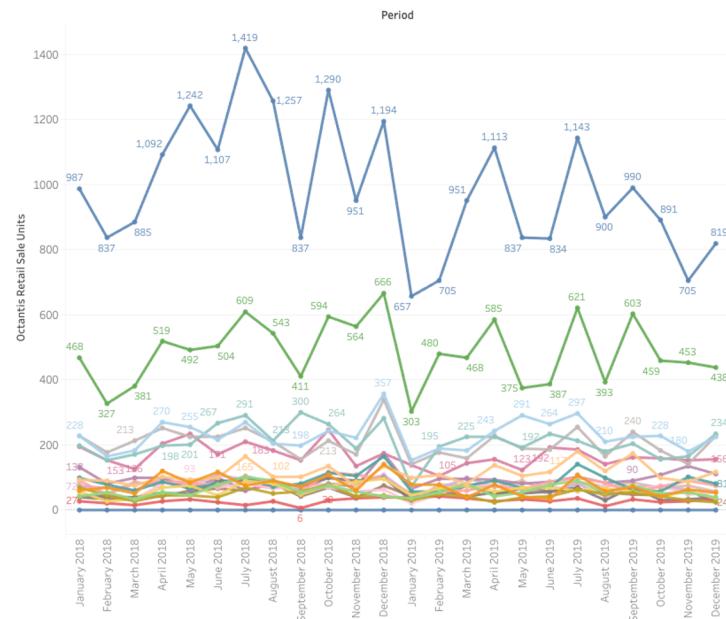
Total Display Media Funnel at Baltimore (18 vs 19)



- Around **25% more impressions** were received among Facebook & Instagram, which lead to **over 135% engagement** growth from Facebook & Instagram.
- New impressions/engagements gained from Pinterest compared to year of 2018
- Display Media conversion rate improved from 2018 based on the media funnel

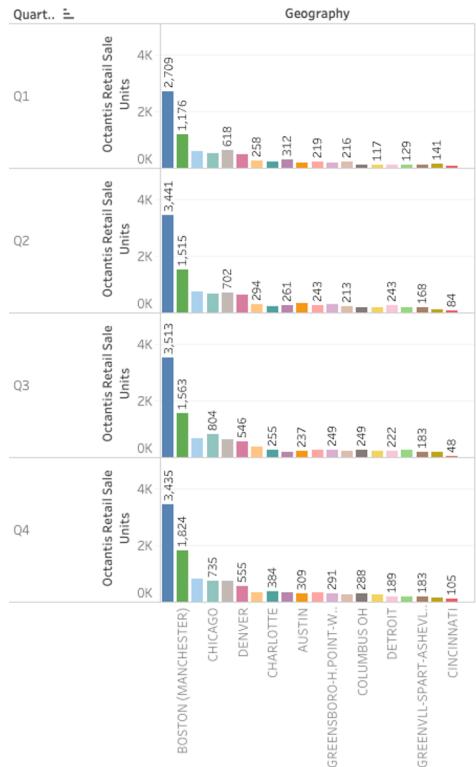
# Exploratory Data Analysis

2018-2019 Monthly Sale

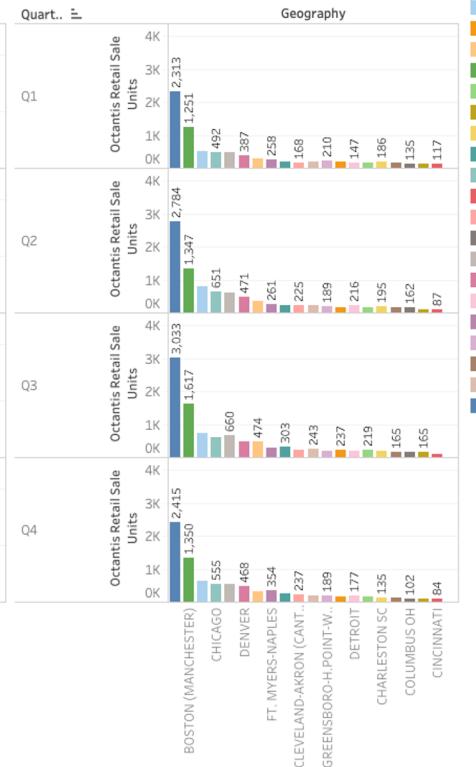


2018 Grand total sale unit 41,736  
 2019 Grand total sale unit 36,165

2018 Octantis Retail Sale

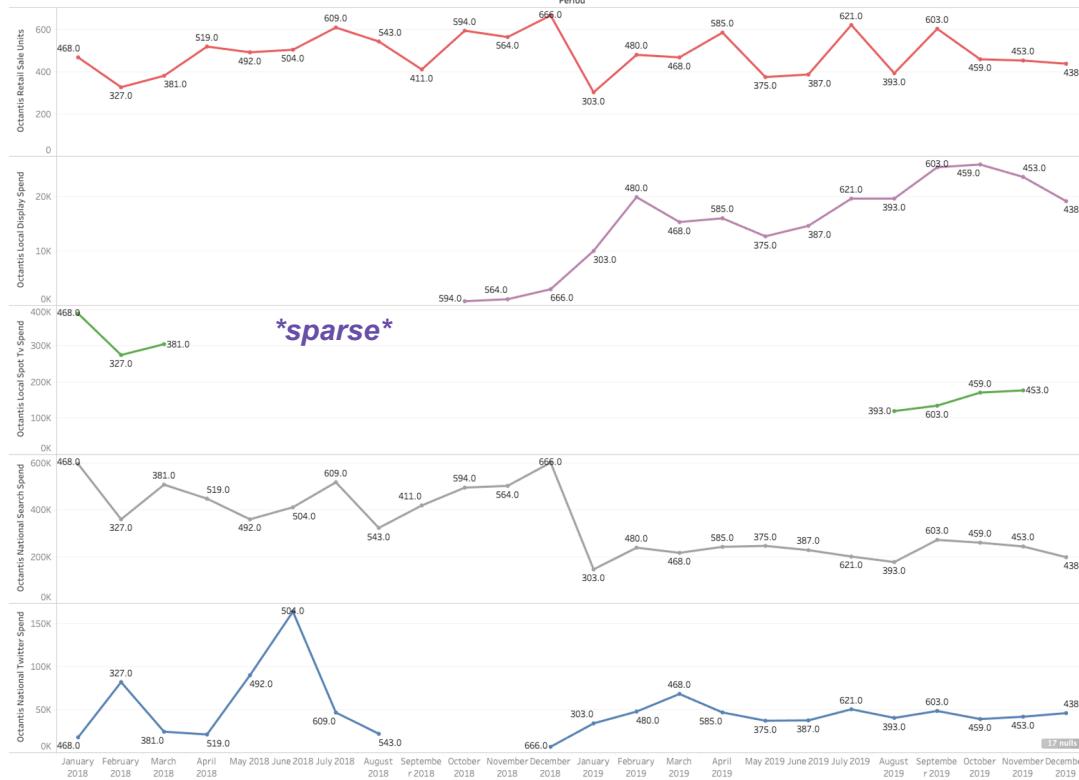


2019 Octantis Retail Sale



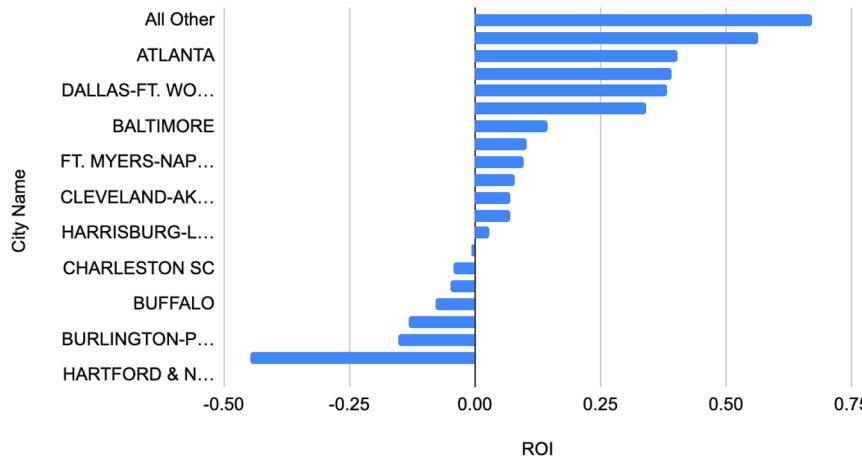
# Exploratory Data Analysis - Boston

2018-2019 Monthly Boston Sale vs Ad Spend

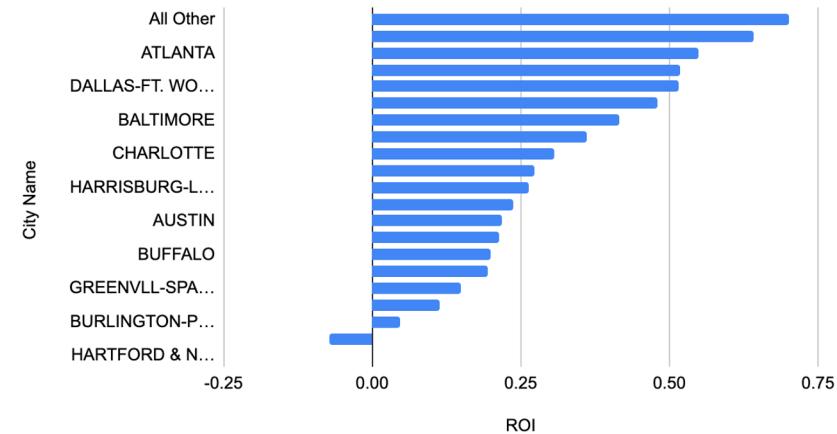


# Exploratory Data Analysis - ROI 2018 vs 2019

ROI vs. City Name



ROI vs. City Name



2018 Product Unit Price: \$72,280

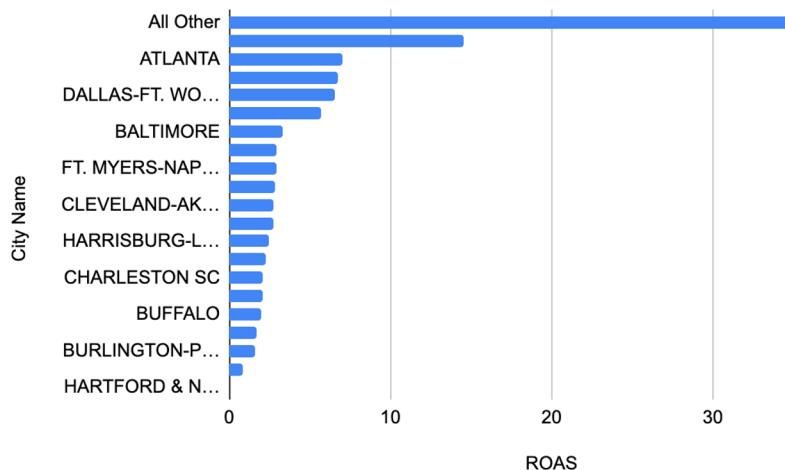
2018 Product Unit Cost: \$41,199

2019 Assume Product Price: \$74,332

2019 Assume Product Cost: \$42,369

# Exploratory Data Analysis - ROAS 2018 vs 2019

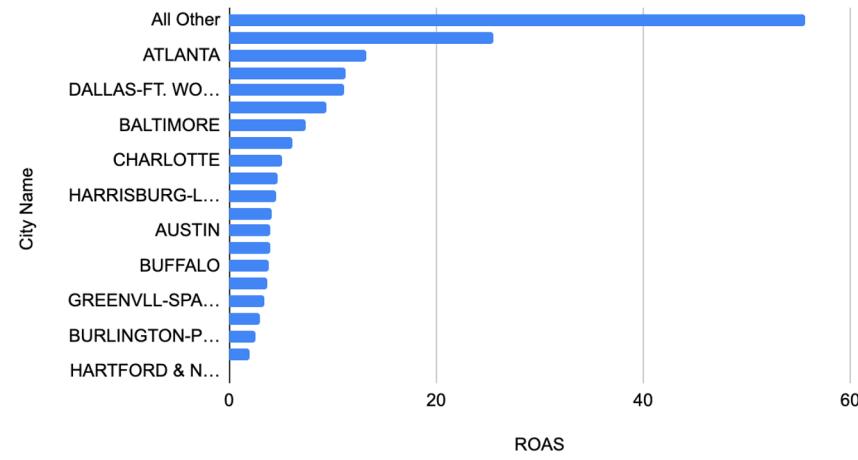
ROAS vs. City Name



2018 Assume Product Price: \$72,280

2018 Assume Product Cost: \$41,199

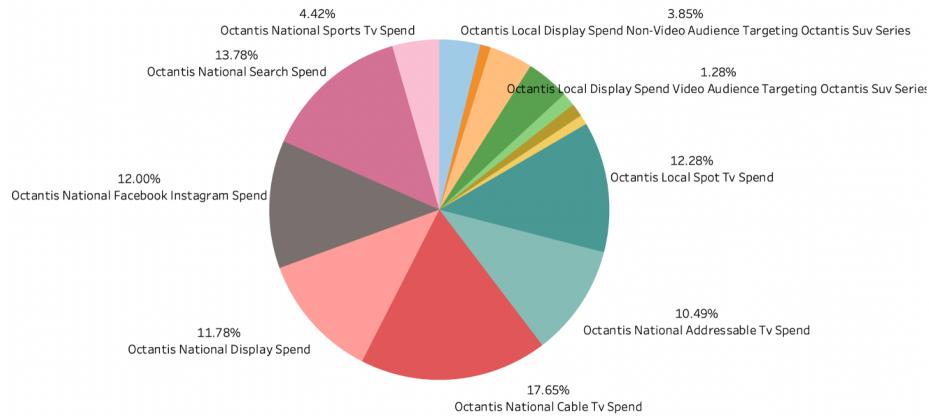
ROAS vs. City Name



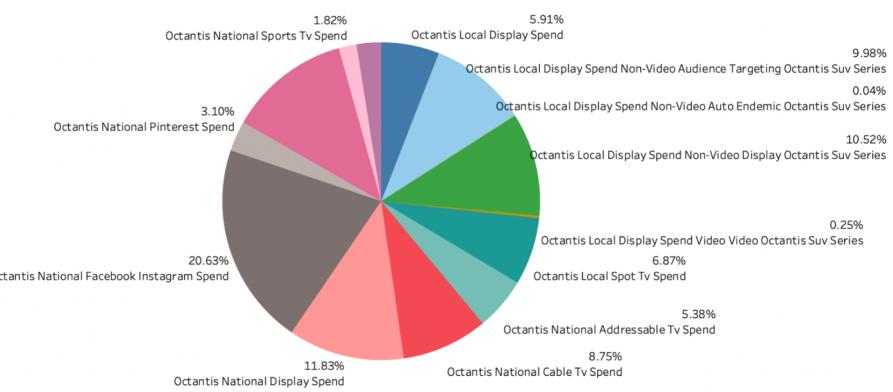
2019 Assume Product Price: \$74,332

2019 Assume Product Cost: \$42,369

# Exploratory Data Analysis - % Spend in Media Type



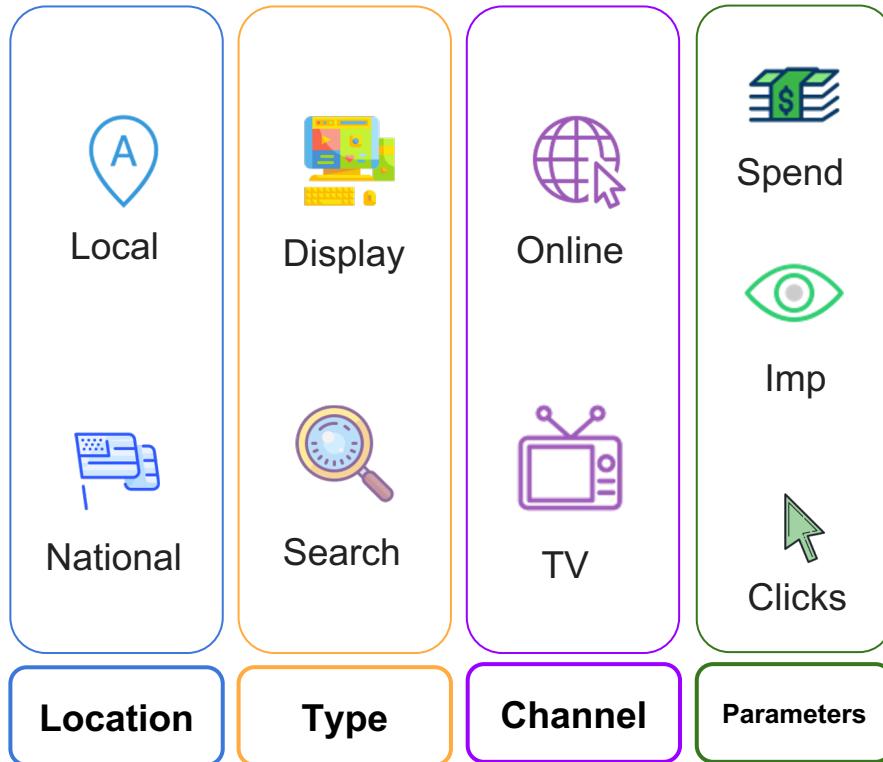
2018



2019

“What are the **top factors** affecting unit sales?”

# Top factors influencing unit sales – feature selection



Final 14 features

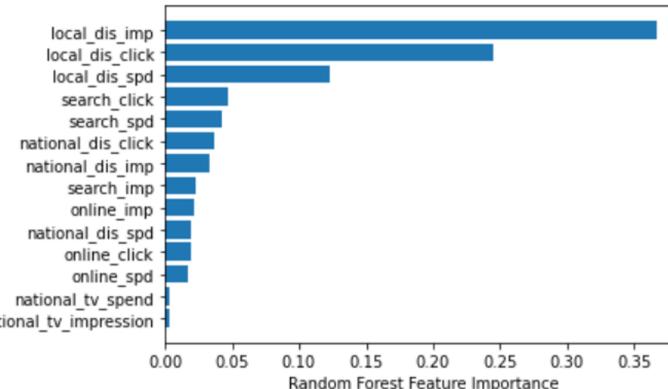
search_imp	search_spd
search_click	online_imp
online_spd	online_click
local_dis_imp	local_dis_spd
local_dis_click	national_dis_imp
national_dis_spd	national_dis_click
National_tv_impression	national_tv_spend

# Top factors influencing unit sales – model comparison

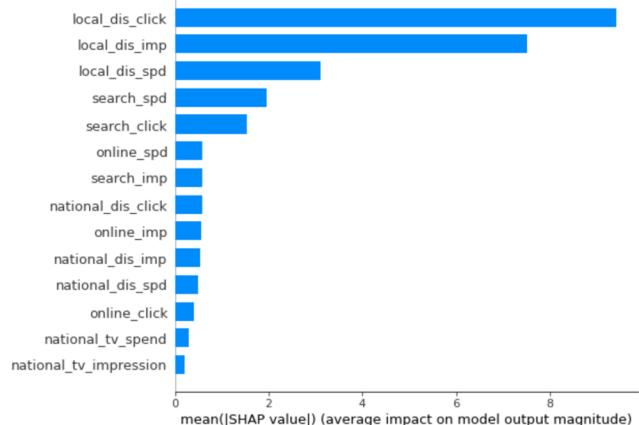
## Lasso Regression

iv	coef
local_dis_spd	3.249416e-03
search_click	8.845451e-04
national_dis_click	-1.070451e-04
local_dis_imp	8.546535e-05
online_click	7.596588e-05
national_dis_spd	2.751823e-05
online_spd	1.299349e-05
national_tv_spend	-1.001333e-05
search_imp	-4.223951e-06
search_spd	3.465426e-06
national_dis_imp	-1.109667e-07
national_tv_impression	-7.619900e-08
online_imp	-3.406382e-08
local_dis_click	-0.000000e+00

## Random Forest

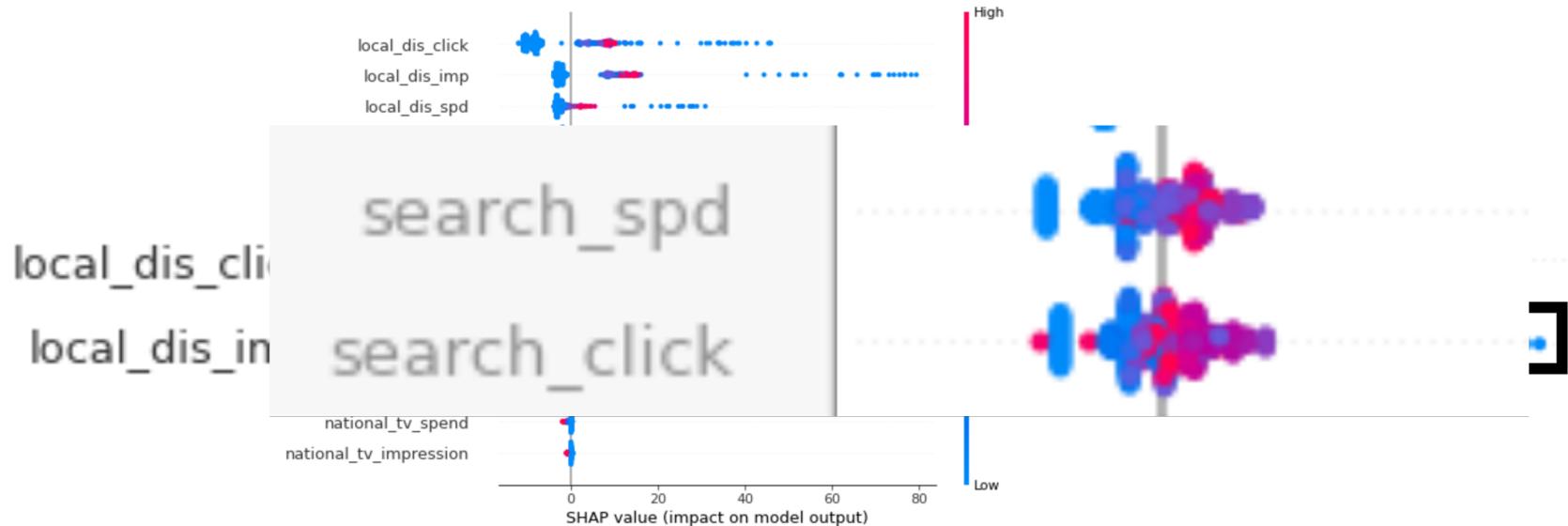


## SHAP



- SHAP and RF agree that **local display** are the most important features
- Followed by **search advertisements**
- National level campaigns are less effective than local level campaigns
- Channel-wise, online performs better than TV, but it still has room for improvement

# Top factors influencing unit sales – insight derived...



- The relationship between local display and unit sales is not linear, indicating certain display strategies are extremely effective.
- Search is positively correlated with unit sales—raise brand awareness to push search's impact.

“How can we **optimize** the media levers even more to generate more sales while maintaining a high ROI in the upcoming 2020 year?”

# Modeling - Data

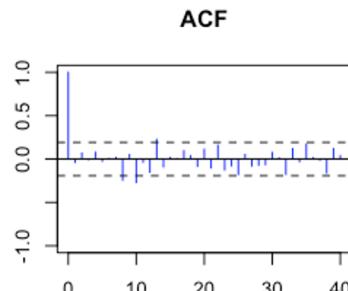
Geography	Period	OCTANTIS.RETAIL.SALE.UNITS	OCTANTIS.LOCAL.DISPLAY.SPEND	OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUDIENCE.TARGETING_OCTANTIS.SUV.SERIES	OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUDIENCE.TARGETING_OCTANTIS.SUV.SERIES
1	ALL OTHER 1/1/18	213	NA	NA	NA
2	ALL OTHER 1/8/18	111	NA	NA	NA
3	ALL OTHER 1/15/18	144	NA	NA	NA
4	ALL OTHER 1/22/18	192	NA	NA	NA
5	ALL OTHER 1/29/18	327	NA	NA	NA
6	ALL OTHER 2/5/18	186	NA	NA	NA
7	ALL OTHER 2/12/18	165	NA	NA	NA
8	ALL OTHER 2/19/18	234	NA	NA	NA
9	ALL OTHER 2/26/18	252	NA	NA	NA
10	ALL OTHER 3/5/18	135	NA		101.12169 NA
11	ALL OTHER 3/12/18	216	NA		838.69737 NA
12	ALL OTHER 3/19/18	195	NA		1344.73119 NA
13	ALL OTHER 3/26/18	339	NA		775.15575 NA
14	ALL OTHER 4/2/18	213	NA		NA
15	ALL OTHER 4/9/18	135	NA		142.091985
16	ALL OTHER 4/16/18	180	NA		990.593895
17	ALL OTHER 4/23/18	312	NA		1779.7656
18	ALL OTHER 4/30/18	252	NA		770.73357
19	ALL OTHER 5/7/18	222	NA		665.296215
20	ALL OTHER 5/14/18	264	NA		610.19025
21	ALL OTHER 5/21/18	327	NA		559.680705
22	ALL OTHER 5/28/18	429	NA		547.44132
23	ALL OTHER 6/4/18	294	NA		795.25192 NA

Multivariate Time Series  
(SARIMAX/ARIMAX)

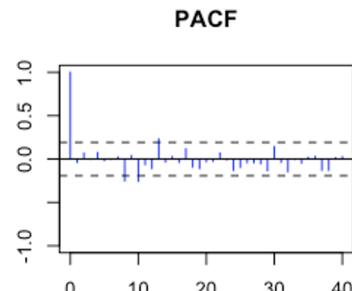
Lasso regression

Linear Programming

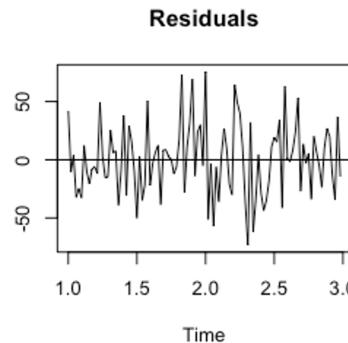
# Modeling - Multivariate Time Series (ARIMAX) - Boston



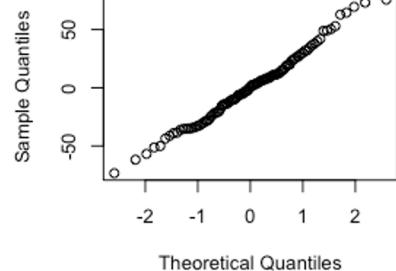
Lag



Lag

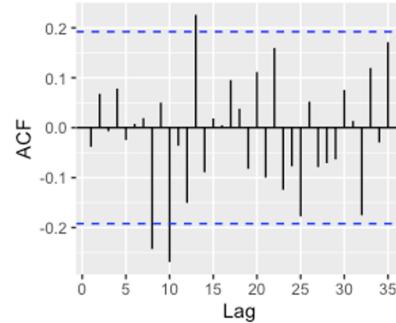
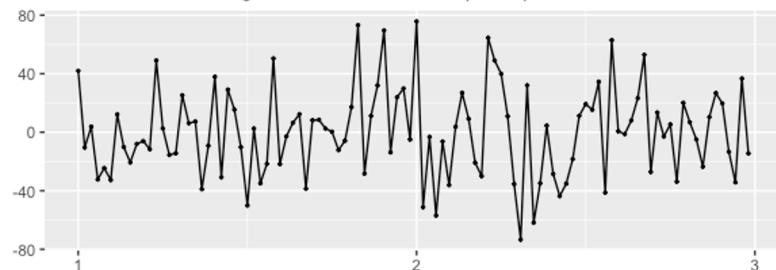


Time

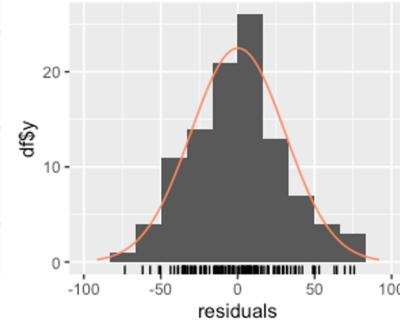


Theoretical Quantiles

Residuals from Regression with ARIMA(4,0,0) errors

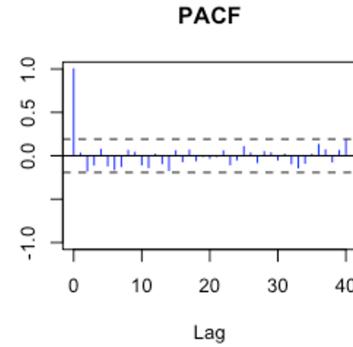
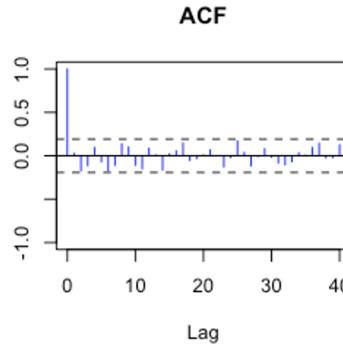


Lag

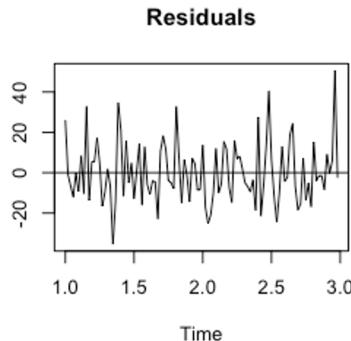
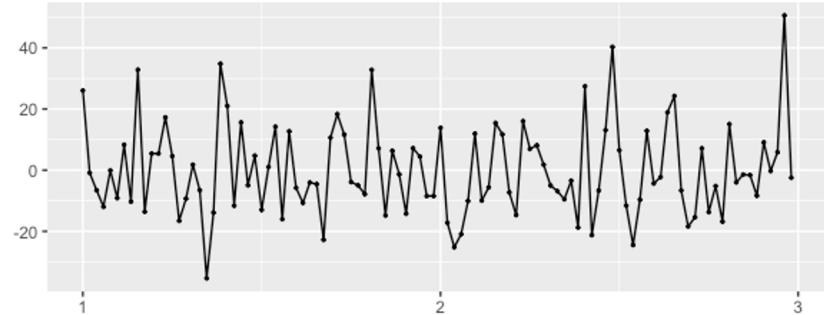


**AIC = 1054.669**

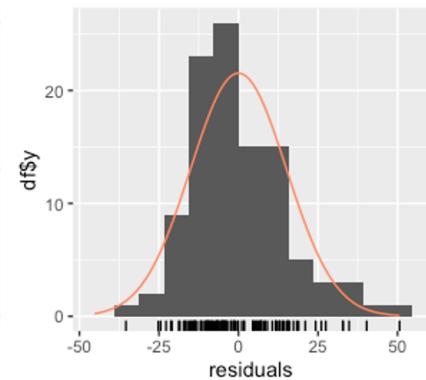
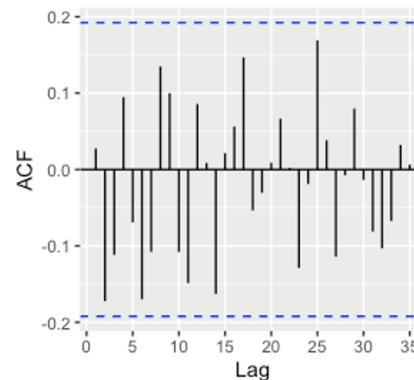
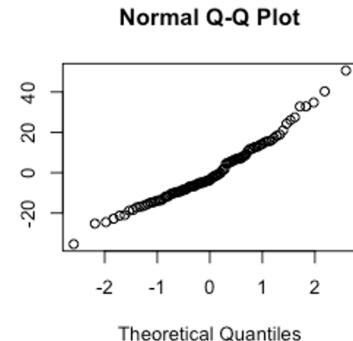
# Modeling - Multivariate Time Series - Chicago



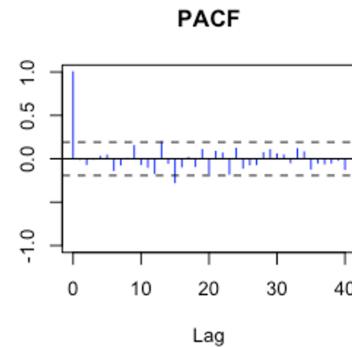
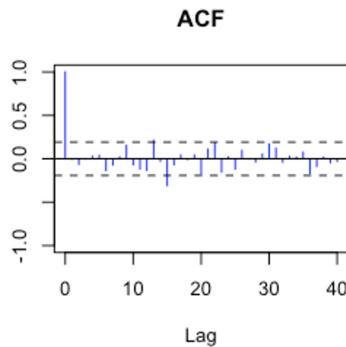
Residuals from Regression with ARIMA(0,0,0) errors



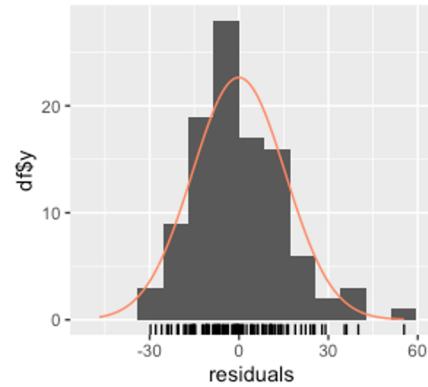
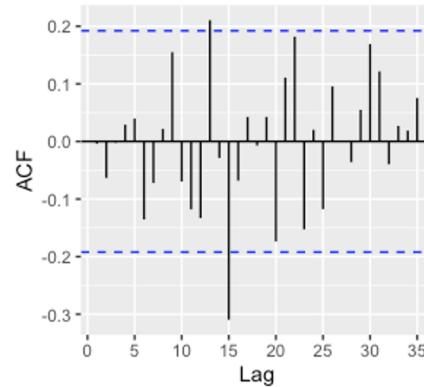
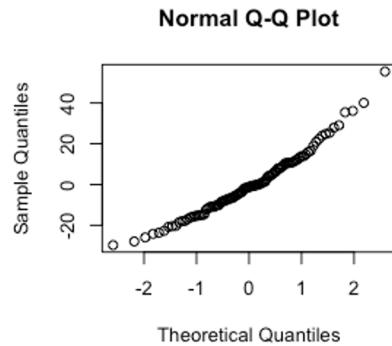
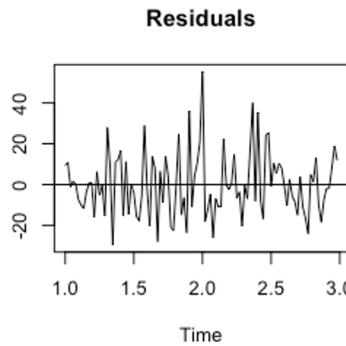
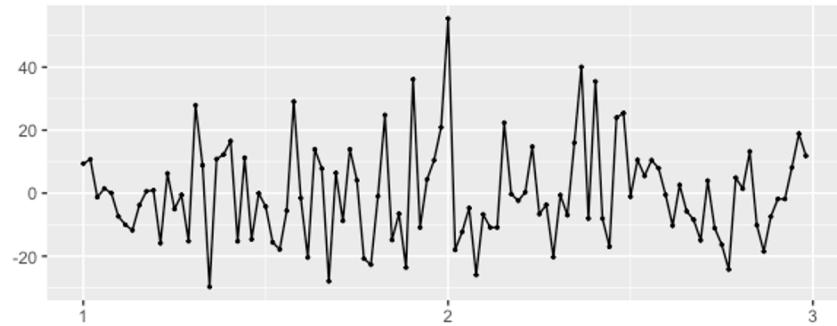
Sample Quantiles



# Modeling - Multivariate Time Series - Atlanta



Residuals from Regression with ARIMA(0,0,4) errors

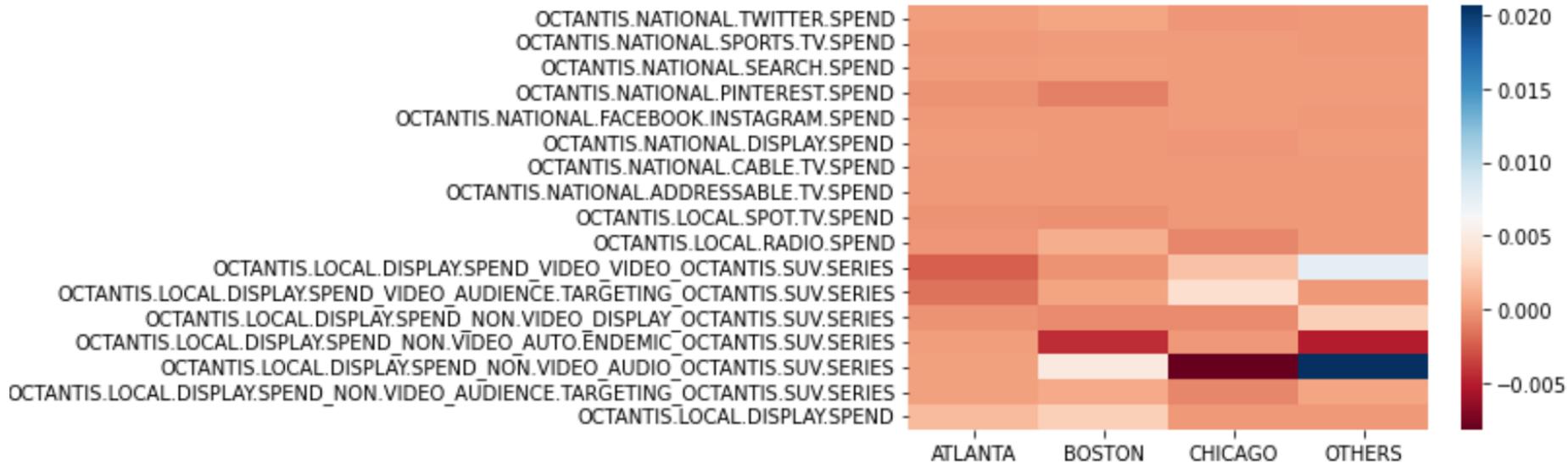


# Modeling - ALL Others

## Lasso Regression

		iv	coef	abs coef
2	OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUDIO_O...	0.020634	0.020634	
6	OCTANTIS.LOCAL.DISPLAY.SPEND_VIDEO_VIDEO_OCTAN...	0.007644	0.007644	
3	OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUTO.EN...	-0.005100	0.005100	
4	OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_DISPLAY...	0.002830	0.002830	
1	OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUDIENC...	0.000591	0.000591	
13	OCTANTIS.NATIONAL.PINTEREST.SPEND	0.000116	0.000116	
11	OCTANTIS.NATIONAL.DISPLAY.SPEND	0.000056	0.000056	
14	OCTANTIS.NATIONAL.SEARCH.SPEND	0.000043	0.000043	
12	OCTANTIS.NATIONAL.FACEBOOK.INSTAGRAM.SPEND	0.000032	0.000032	
15	OCTANTIS.NATIONAL.SPORTS.TV.SPEND	-0.000024	0.000024	
16	OCTANTIS.NATIONAL.TWITTER.SPEND	0.000020	0.000020	
9	OCTANTIS.NATIONAL.ADDRESSABLE.TV.SPEND	0.000010	0.000010	
10	OCTANTIS.NATIONAL.CABLE.TV.SPEND	-0.000007	0.000007	
8	OCTANTIS.LOCAL.SPOT.TV.SPEND	-0.000005	0.000005	
7	OCTANTIS.LOCAL.RADIO.SPEND	0.000000	0.000000	
5	OCTANTIS.LOCAL.DISPLAY.SPEND_VIDEO_AUDIENCE.TA...	0.000000	0.000000	
0	OCTANTIS.LOCAL.DISPLAY.SPEND	0.000000	0.000000	

# Modeling - Coefficients



# Optimization - Budget Allocation

Max  $\sum_{ij} \beta_{ij} X_{ij}$  where  $i$  is media type,  $j$  is location

$$s.t. \quad \sum_{ij} X_{ij} \leq B$$

$$5.03\% * B \leq \sum_i X_{i1} \leq 5.48\% * B \quad (\text{Atlanta})$$

$$5.46\% * B \leq \sum_i X_{i2} \leq 5.91\% * B \quad (\text{Boston})$$

$$5.09\% * B \leq \sum_i X_{i3} \leq 5.43\% * B \quad (\text{Chicago})$$

$$\sum_j X_{1j} \leq 6\% * B \quad (\text{Media Type: Octantis Local Display Spend})$$

$$7\% * B \leq \sum_j X_{2j} \leq 12\% * B \quad (\text{Media Type: Octantis Local Spot Tv Spend})$$

.....

$$X_{ij} \geq 0$$

where  $B$  is total budget

**Total Spend of 2019:**  
~\$21.5M

- 68 variables
- 42 constraints

**Linear Programming solver**

**Feasible solution**

**Optimal objective:**

**110, 329 units**

# Forecasting

	ATLANTA	BOSTON	CHICAGO	OTHERS
OCTANTIS.NATIONAL.TWITTER.SPEND	\$1,178,737.50	\$-	\$-	\$-
OCTANTIS.NATIONAL.SPORTS.TV.SPEND	\$-	\$-	\$-	\$827,576.19
OCTANTIS.NATIONAL.SEARCH.SPEND	\$-	\$-	\$-	\$-
OCTANTIS.NATIONAL.PINTEREST.SPEND	\$-	\$-	\$-	\$721,106.19
OCTANTIS.NATIONAL.FACEBOOK.INSTAGRAM.SPEND	\$-	\$-	\$-	\$872,747.29
OCTANTIS.NATIONAL.DISPLAY.SPEND	\$-	\$-	\$-	\$-
OCTANTIS.NATIONAL.CABLE.TV.SPEND	\$-	\$-	\$-	\$54,009.16
OCTANTIS.NATIONAL.ADDRESSABLE.TV.SPEND	\$-	\$-	\$-	\$-
OCTANTIS.LOCAL.SPOT.TV.SPEND	\$-	\$-	\$-	\$1,477,566.56
OCTANTIS.LOCAL.RADIO.SPEND	\$-		\$736,306.37	\$421,118.93
OCTANTIS.LOCAL.DISPLAY.SPEND_VIDEO_VIDEO_OCTANTIS.SUV.SERIES	\$-	\$-	\$-	\$3,793,853.02
OCTANTIS.LOCAL.DISPLAY.SPEND_VIDEO_AUDIENCE.TARGETING_OCTANTIS.SUV.SERIES	\$-	\$-	\$1,168,095.00	\$1,364,760.64
OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_DISPLAY_OCTANTIS.SUV.SERIES	\$-	\$-	\$-	\$4,436,161.82
OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUTO-ENDEMIC_OCTANTIS.SUV.SERIES	\$-	\$-	\$-	\$-
OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUDIO_OCTANTIS.SUV.SERIES	\$-	\$-	\$-	\$2,963,216.15
OCTANTIS.LOCAL.DISPLAY.SPEND_NON.VIDEO_AUDIENCE.TARGETING_OCTANTIS.SUV.SERIES	\$-	\$-	\$-	\$949,391.04
OCTANTIS.LOCAL.DISPLAY.SPEND	\$-		\$535,354.13	\$-

Hypothetically, 110, 329 units (*69% increase*) from 2019

# Conclusion - Octantis T800

**Top Factors:** Local Display Impression\Clicks\Spending, Search Click

## Budget Allocation:

- *Twitter Spend - Atlanta*
- *Local Radio/Display Spend - Boston*
- *Local Display w/ Targeted Audience - Chicago*
- *Local Display - Others*

**Forecasting:** 110k Unit Sale → \$8B Total Annual Rev in 2020

# Implementation - Marketing Campaigns

1. Increase Flagship store locations (increase *local\_display* channel)
  - a. Matching with luxury branding promotion
  - b. Allow customers to experience the comfort in real life
2. Invest on new market channels to target high-net-worth individuals (HNWIs)
  - a. Tiktok/YouTube/Instagram - KOLs/Influencers (take on a ride in Rodeo Drive for example)
  - b. Collaborate with celebrities (e.g. Hollywood Film Industry - *Fast and the Furious*)
3. Conduct Search Engine Optimization (optimize *search\_click*)

**New Measuring Metrics :** the sales made by new flagships/channels & search clicks

# Limitations & Next steps

## *Limitations:*

1. Further improve the model accuracy (by imputing missing values)
2. Only looked at T800's product data

## *Next steps:*

1. Understanding the competitor's interaction with our product
2. Compare Markov chain Monte Carlo vs ARIMA
3. Decision Analysis (more constraints)
4. Qualitative approach (online surveys)
5. Implement our optimization model into client's system (newest data for more up to date analysis)

# Thanks!

## Q & A