Welcome to my EDA Kernel

Description:

The dataset for this competition includes aggregate stopped vehicle information and intersection wait times. Your task is to predict congestion, based on an aggregate measure of stopping distance and waiting times, at intersections in 4 major US cities: Atlanta, Boston, Chicago & Philadelphia.

Italian Trulli

Objective:

It's a first contact with the data, so I want to explore it and understand how the data is.

Some important things that is standard to analyze:

- what are the data types of the features?
- We have missing values?
- How many unique values we have in each feature;
- The shape of full dataset.
- The entropy of each feature (that show us the level of disorder on this column, it's like a "messy metric")

After this first analyze we can think in other questions to explore:

- Which distribution we have in our columns?
- Which are the most common cities?
- Which are the distribution of the stops, time, distances?
- How long is our date range?
- What are the distribution of the regions?

And many more questions;

I'm near of grandmaster tier, so, if you find this kernel useful or interesting, please don't forget to upvote the kernel =)

Importing the Main Libraries to work with data

In [1]:
```python
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import scipy as sp
from scipy import stats
import matplotlib.pyplot as plt
import seaborn as sns

import plotly.graph_objs as go
import plotly.tools as tls
from plotly.offline import iplot, init_notebook_mode
#import cufflinks
#import cufflinks as cf
import plotly.figure_factory as ff

from sklearn.decomposition import PCA
from sklearn.cluster import KMeans
from sklearn.metrics import mean_squared_error
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.linear_model import LinearRegression

from functools import partial
from hyperopt import fmin, hp, tpe, Trials, space_eval, STATUS_OK, STATUS_RUNNING

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# Any results you write to the current directory are saved as output.
```

```
/kaggle/input/bigquery-geotab-intersection-congestion/train.csv
/kaggle/input/bigquery-geotab-intersection-congestion/sample_submission.csv
/kaggle/input/bigquery-geotab-intersection-congestion/test.csv
/kaggle/input/bigquery-geotab-intersection-congestion/submission_metric_map.json
/kaggle/input/bigquery-geotab-intersection-congestion/BigQuery-Dataset-Access.md
```

Importing datasets

In [2]:
```python
df_train = pd.read_csv('/kaggle/input/bigquery-geotab-intersection-congestion/train.csv')
df_test = pd.read_csv('/kaggle/input/bigquery-geotab-intersection-congestion/test.csv')
```

Util functions

In [3]:
```python
def resumetable(df):
    print(f"Dataset Shape: {df.shape}")
    summary = pd.DataFrame(df.dtypes,columns=['dtypes'])
    summary = summary.reset_index()
    summary['Name'] = summary['index']
    summary = summary[['Name','dtypes']]
    summary['Missing'] = df.isnull().sum().values
    summary['Uniques'] = df.nunique().values
    summary['First Value'] = df.loc[0].values
    summary['Second Value'] = df.loc[1].values
    summary['Third Value'] = df.loc[2].values

    for name in summary['Name'].value_counts().index:
        summary.loc[summary['Name'] == name, 'Entropy'] = round(stats.entropy(df[name].value_counts(nor
malize=True), base=2),2)

    return summary

def reduce_mem_usage(df, verbose=True):
    numerics = ['int16', 'int32', 'int64', 'float16', 'float32', 'float64']
    start_mem = df.memory_usage().sum() / 1024**2
    for col in df.columns:
        col_type = df[col].dtypes
        if col_type in numerics:
            c_min = df[col].min()
            c_max = df[col].max()
            if str(col_type)[:3] == 'int':
                if c_min > np.iinfo(np.int8).min and c_max < np.iinfo(np.int8).max:
                    df[col] = df[col].astype(np.int8)
                elif c_min > np.iinfo(np.int16).min and c_max < np.iinfo(np.int16).max:
                    df[col] = df[col].astype(np.int16)
                elif c_min > np.iinfo(np.int32).min and c_max < np.iinfo(np.int32).max:
                    df[col] = df[col].astype(np.int32)
                elif c_min > np.iinfo(np.int64).min and c_max < np.iinfo(np.int64).max:
                    df[col] = df[col].astype(np.int64)
            else:
                if c_min > np.finfo(np.float16).min and c_max < np.finfo(np.float16).max:
                    df[col] = df[col].astype(np.float16)
                elif c_min > np.finfo(np.float32).min and c_max < np.finfo(np.float32).max:
                    df[col] = df[col].astype(np.float32)
                else:
                    df[col] = df[col].astype(np.float64)
    end_mem = df.memory_usage().sum() / 1024**2
    if verbose: print('Mem. usage decreased to {:5.2f} Mb ({:.1f}% reduction)'.format(end_mem, 100 * (s
tart_mem - end_mem) / start_mem))
    return df
```

Summary of the data

In [4]:
```python
resumetable(df_train)
```

```
Dataset Shape: (857409, 28)
```

Out[4]:

	Name	dtypes	Missing	Uniques	First Value	Second Value	Third Value	Entropy
0	RowId	int64	0	857409	1920335	1920336	1920337	19.71
1	IntersectionId	int64	0	2539	0	0	0	10.63
2	Latitude	float64	0	4505	33.7917	33.7917	33.7917	11.41
3	Longitude	float64	0	4541	-84.43	-84.43	-84.43	11.43
4	EntryStreetName	object	8189	1707	Marietta Boulevard Northwest	Marietta Boulevard Northwest	Marietta Boulevard Northwest	8.97
5	ExitStreetName	object	5534	1693	Marietta Boulevard Northwest	Marietta Boulevard Northwest	Marietta Boulevard Northwest	8.95
6	EntryHeading	object	0	8	NW	SE	NW	2.85
7	ExitHeading	object	0	8	NW	SE	NW	2.85
8	Hour	int64	0	24	0	0	1	4.50
9	Weekend	int64	0	2	0	0	0	0.85
10	Month	int64	0	9	6	6	6	2.81
11	Path	object	0	15111	Marietta Boulevard Northwest_NW_Marietta Boule...	Marietta Boulevard Northwest_SE_Marietta Boule...	Marietta Boulevard Northwest_NW_Marietta Boule...	11.69
12	TotalTimeStopped_p20	int64	0	172	0	0	0	0.92
13	TotalTimeStopped_p40	int64	0	234	0	0	0	2.11
14	TotalTimeStopped_p50	int64	0	264	0	0	0	2.70
15	TotalTimeStopped_p60	int64	0	311	0	0	0	3.55
16	TotalTimeStopped_p80	int64	0	403	0	0	0	5.06
17	TimeFromFirstStop_p20	int64	0	239	0	0	0	0.98
18	TimeFromFirstStop_p40	int64	0	306	0	0	0	2.25
19	TimeFromFirstStop_p50	int64	0	329	0	0	0	2.87
20	TimeFromFirstStop_p60	int64	0	351	0	0	0	3.77
21	TimeFromFirstStop_p80	int64	0	355	0	0	0	5.35
22	DistanceToFirstStop_p20	float64	0	3479	0	0	0	1.35
23	DistanceToFirstStop_p40	float64	0	6257	0	0	0	3.23
24	DistanceToFirstStop_p50	float64	0	7483	0	0	0	4.16
25	DistanceToFirstStop_p60	float64	0	9495	0	0	0	5.55
26	DistanceToFirstStop_p80	float64	0	13267	0	0	0	8.10
27	City	object	0	4	Atlanta	Atlanta	Atlanta	1.85

Nice, this func give us a lot of cool and useful informations;

- We have only two features with missing values. Entry and Exit StreetName

City's

- I will start exploring the distribution of City's because it is a categorical with only a few categorys inside.

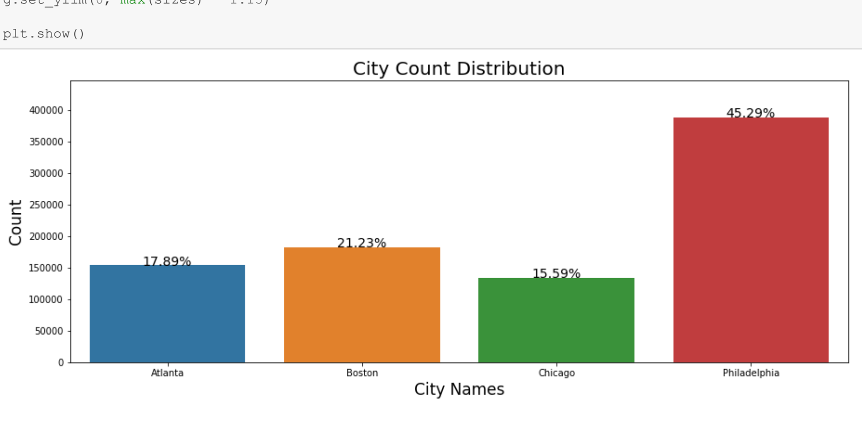
In [5]:
```python
resumetable(df_train)
```

```
Dataset Shape: (857409, 28)
```

Out[5]:

	Name	dtypes	Missing	Uniques	First Value	Second Value	Third Value	Entropy
0	RowId	int64	0	857409	1920335	1920336	1920337	19.71
1	IntersectionId	int64	0	2539	0	0	0	10.63
2	Latitude	float64	0	4505	33.7917	33.7917	33.7917	11.41
3	Longitude	float64	0	4541	-84.43	-84.43	-84.43	11.43
4	EntryStreetName	object	8189	1707	Marietta Boulevard Northwest	Marietta Boulevard Northwest	Marietta Boulevard Northwest	8.97
5	ExitStreetName	object	5534	1693	Marietta Boulevard Northwest	Marietta Boulevard Northwest	Marietta Boulevard Northwest	8.95
6	EntryHeading	object	0	8	NW	SE	NW	2.85
7	ExitHeading	object	0	8	NW	SE	NW	2.85
8	Hour	int64	0	24	0	0	1	4.50
9	Weekend	int64	0	2	0	0	0	0.85
10	Month	int64	0	9	6	6	6	2.81
11	Path	object	0	15111	Marietta Boulevard Northwest_NW_Marietta Boule...	Marietta Boulevard Northwest_SE_Marietta Boule...	Marietta Boulevard Northwest_NW_Marietta Boule...	11.69
12	TotalTimeStopped_p20	int64	0	172	0	0	0	0.92
13	TotalTimeStopped_p40	int64	0	234	0	0	0	2.11
14	TotalTimeStopped_p50	int64	0	264	0	0	0	2.70
15	TotalTimeStopped_p60	int64	0	311	0	0	0	3.55
16	TotalTimeStopped_p80	int64	0	403	0	0	0	5.06
17	TimeFromFirstStop_p20	int64	0	239	0	0	0	0.98
18	TimeFromFirstStop_p40	int64	0	306	0	0	0	2.25
19	TimeFromFirstStop_p50	int64	0	329	0	0	0	2.87
20	TimeFromFirstStop_p60	int64	0	351	0	0	0	3.77
21	TimeFromFirstStop_p80	int64	0	355	0	0	0	5.35
22	DistanceToFirstStop_p20	float64	0	3479	0	0	0	1.35
23	DistanceToFirstStop_p40	float64	0	6257	0	0	0	3.23
24	DistanceToFirstStop_p50	float64	0	7483	0	0	0	4.16
25	DistanceToFirstStop_p60	float64	0	9495	0	0	0	5.55
26	DistanceToFirstStop_p80	float64	0	13267	0	0	0	8.10
27	City	object	0	4	Atlanta	Atlanta	Atlanta	1.85

In [6]:
```python
total = len(df_train)
plt.figure(figsize=(15,19))

plt.subplot(311)
g = sns.countplot(x="City", data=df_train)
g.set_title("City Count Distribution", fontsize=20)
g.set_ylabel("Count",fontsize= 17)
g.set_xlabel("City Names", fontsize=17)
sizes=[]
for p in g.patches:
    height = p.get_height()
    sizes.append(height)
    g.text(p.get_x()+p.get_width()/2.,
            height + 3,
            '{:1.2f}%'.format(height/total*100),
            ha="center", fontsize=14)
g.set_ylim(0, max(sizes) * 1.15)

plt.show()
```



We can note that:

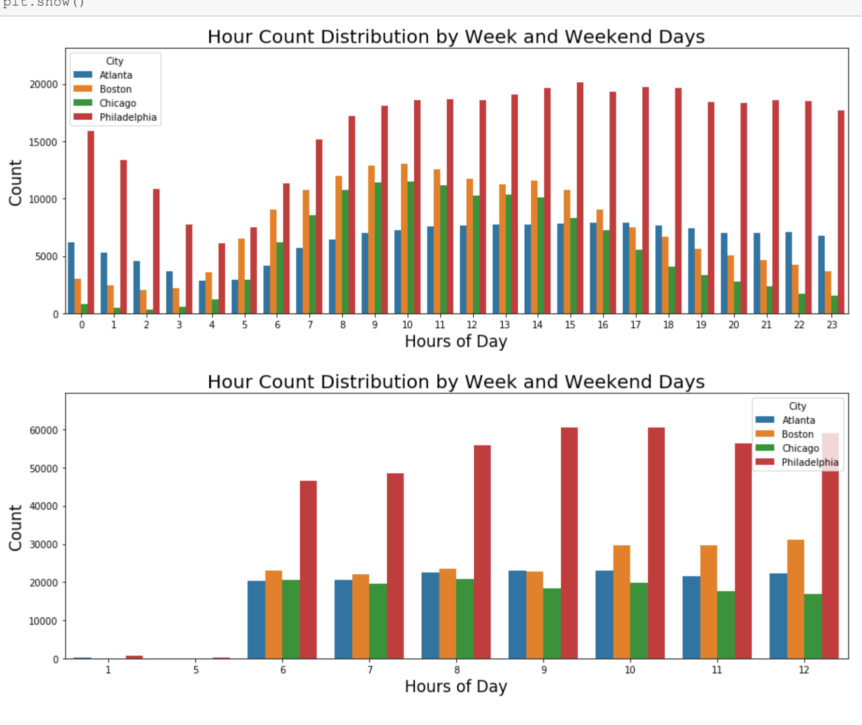
- The most common value is Philadelphia and it have 45.29% of the total entries.
- The other categories don't have a so discrepant difference between them. ? Let's

Date Features

- Hour Distribution
- Month Distribution

In [7]:
```python
tmp_hour = df_train.groupby(['City', 'Hour'])['RowId'].nunique().reset_index()
```

In [8]:
```python
plt.figure(figsize=(15,12))

plt.subplot(211)
g = sns.countplot(x="Hour", data=df_train, hue='City', dodge=True)
g.set_title("Hour Count Distribution by Week and Weekend Days", fontsize=20)
g.set_ylabel("Count",fontsize= 17)
g.set_xlabel("Hours of Day", fontsize=17)
sizes=[]
for p in g.patches:
    height = p.get_height()
    sizes.append(height)

g.set_ylim(0, max(sizes) * 1.15)

plt.subplot(212)
g1 = sns.countplot(x="Month", data=df_train, hue='City', dodge=True)
g1.set_title("Hour Count Distribution by Week and Weekend Days", fontsize=20)
g1.set_ylabel("Count",fontsize= 17)
g1.set_xlabel("Hours of Day", fontsize=17)
sizes=[]
for p in g1.patches:
    height = p.get_height()
    sizes.append(height)

g1.set_ylim(0, max(sizes) * 1.15)

plt.subplots_adjust(hspace = 0.3)

plt.show()
```



Cool.

In the hours chart:

- We can see that cities can have different hours patterns.
- Philadelphia is by far the most common in all hours. Only on 5 a.m that is almost lose to Boston in total entries.
- Atlanta is the city with less entries in all day, but after 17 p.m to 4a.m it's the second city with more rides

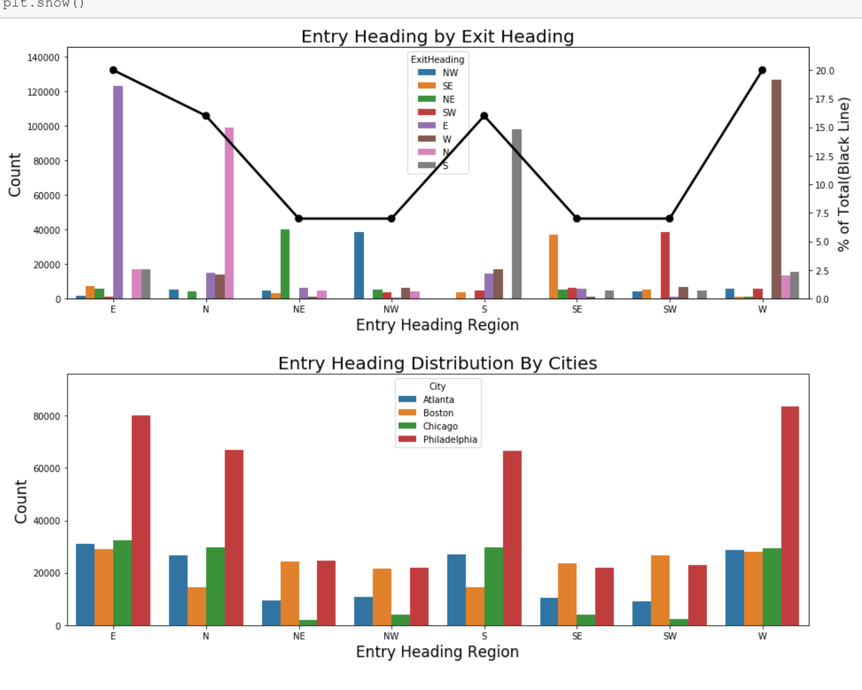
In the month chart:

- We can note that the data is about only 6 months (with few values in January and May)
- Also, the pattern of the Boston City improved througout the time and the others seem very unchanged.

Now, let's explore the Entry and Exit features.

EntryHeading and Exit Heading

In [9]:
```python
plt.figure(figsize=(15,12))

tmp = round(((df_train.groupby(['EntryHeading'])['RowId'].nunique() / total) * 100)).reset_index()

plt.subplot(211)
g = sns.countplot(x="EntryHeading",
                  data=df_train,
                  order=list(tmp['EntryHeading'].values),
                  hue='ExitHeading', dodge=True)
g.set_title("Entry Heading by Exit Heading", fontsize=20)
g.set_ylabel("Count",fontsize= 17)
g.set_xlabel("Entry Heading Region", fontsize=17)
gt = g.twinx()
gt = sns.pointplot(x='EntryHeading', y='RowId',
                   data=tmp, order=list(tmp['EntryHeading'].values),
                   color='black', legend=False)
gt.set_ylim(0, tmp['RowId'].max()*1.1)
gt.set_ylabel("% of Total(Black Line)", fontsize=16)
sizes=[]
for p in g.patches:
    height = p.get_height()
    sizes.append(height)

g.set_ylim(0, max(sizes) * 1.15)

plt.subplot(212)
g1 = sns.countplot(x="EntryHeading", order=list(tmp['EntryHeading'].values),
                   data=df_train, hue='City')
g1.set_title("Entry Heading Distribution By Cities", fontsize=20)
g1.set_ylabel("Count",fontsize= 17)
g1.set_xlabel("Entry Heading Region", fontsize=17)
sizes=[]
for p in g1.patches:
    height = p.get_height()
    sizes.append(height)

g1.set_ylim(0, max(sizes) * 1.15)

plt.subplots_adjust(hspace = 0.3)

plt.show()
```



Nice.
In Entry and Exit Heading chart:

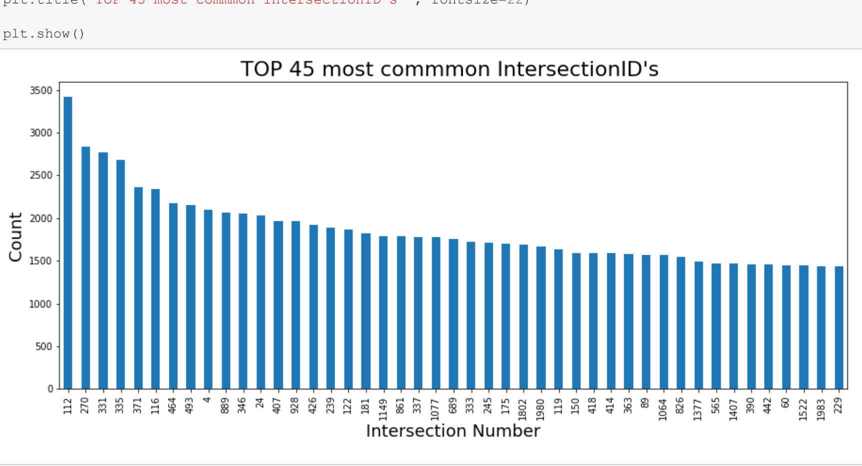
- We can note that in general the Entry and Exit Region is exactly the same.

In Entry by Cities chart:

- We can note the difference patterns on the cities. It's a very interesting and could give us many interesting insights.

IntersectionID

In [10]:
```python
plt.figure(figsize=(15,6))
df_train.IntersectionId.value_counts()[:45].plot(kind='bar')
plt.xlabel("Intersection Number", fontsize=18)
plt.ylabel("Count", fontsize=18)
plt.title("TOP 45 most commmon IntersectionID's ", fontsize=22)

plt.show()
```



In [11]:
```python
df_train.groupby(['IntersectionId', 'EntryHeading', 'ExitHeading'])['RowId'].count().reset_index().head
()
```

Out[11]:

	IntersectionId	EntryHeading	ExitHeading	RowId
0	0	E	E	150
1	0	E	N	24
2	0	N	E	31
3	0	N	N	59
4	0	N	W	22

Exploring numerical features

If you readed the competition description, you know that these are the target features;

The targets are:

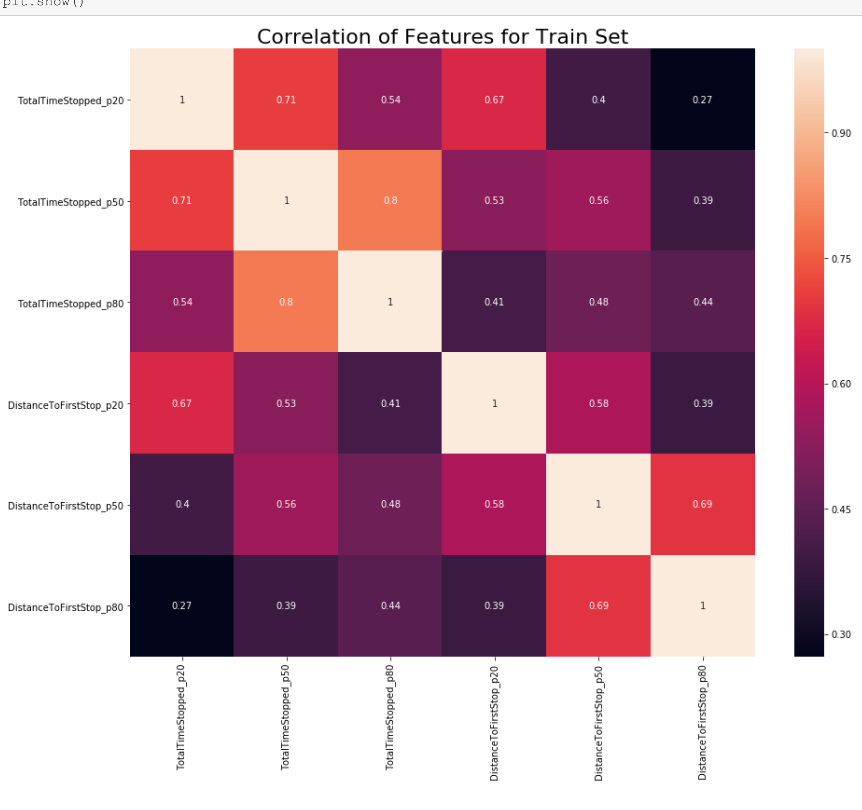
- TotalTimeStopped_p20
- TotalTimeStopped_p50
- TotalTimeStopped_p80
- DistanceToFirstStop_p20
- DistanceToFirstStop_p50
- DistanceToFirstStop_p80

And the as the TimeFromFirstStop is an optional data, I will use it to see the correlations.

In [12]:
```python
t_stopped = ['TotalTimeStopped_p20',
             'TotalTimeStopped_p50',
             'TotalTimeStopped_p80']
t_first_stopped = ['TimeFromFirstStop_p20',
                   'TimeFromFirstStop_p50',
                   'TimeFromFirstStop_p80']
d_first_stopped = ['DistanceToFirstStop_p20',
                   'DistanceToFirstStop_p50',
                   'DistanceToFirstStop_p80']
```

Heatmap Target Features

In [13]:
```python
plt.figure(figsize=(15,12))
plt.title('Correlation of Features for Train Set', fontsize=22)
sns.heatmap(df_train[t_stopped +
                     #t_first_stopped +
                     d_first_stopped].astype(float).corr(),
            vmax=1.0,  annot=True)
plt.show()
```



Cool!
We can see that the best correlation between the metrics are:

- Distance to First Stop p20 and Total Time Stopped p20 have a high correlation.

Scaling the target

- Geting the min_max transformation to get clusterization and PCA features

In [14]:
```python
from sklearn.preprocessing import minmax_scale

target_cols = t_stopped + d_first_stopped
```

In [15]:
```python
for col in target_cols:
    df_train[col+str("_minmax")] = (minmax_scale(df_train[col], feature_range=(0,1)))

min_max_cols = ['TotalTimeStopped_p20_minmax', 'TotalTimeStopped_p50_minmax',
                'TotalTimeStopped_p80_minmax', 'DistanceToFirstStop_p20_minmax',
                'DistanceToFirstStop_p50_minmax', 'DistanceToFirstStop_p80_minmax']
```

PCA

- To better see the distribution of our metrics, lets apply PCA to reduce the dimensionality of the data

In [16]:
```python
pca = PCA(n_components=3, random_state=5)

principalComponents = pca.fit_transform(df_train[min_max_cols])

principalDf = pd.DataFrame(principalComponents)

# df.drop(cols, axis=1, inplace=True)
prefix='Target_PCA'
principalDf.rename(columns=lambda x: str(prefix)+str(x), inplace=True)

df_train = pd.concat([df_train, principalDf], axis=1)
```

Nice, now we have the PCA features... Let's see the ratio of explanation of the first two Principal Components

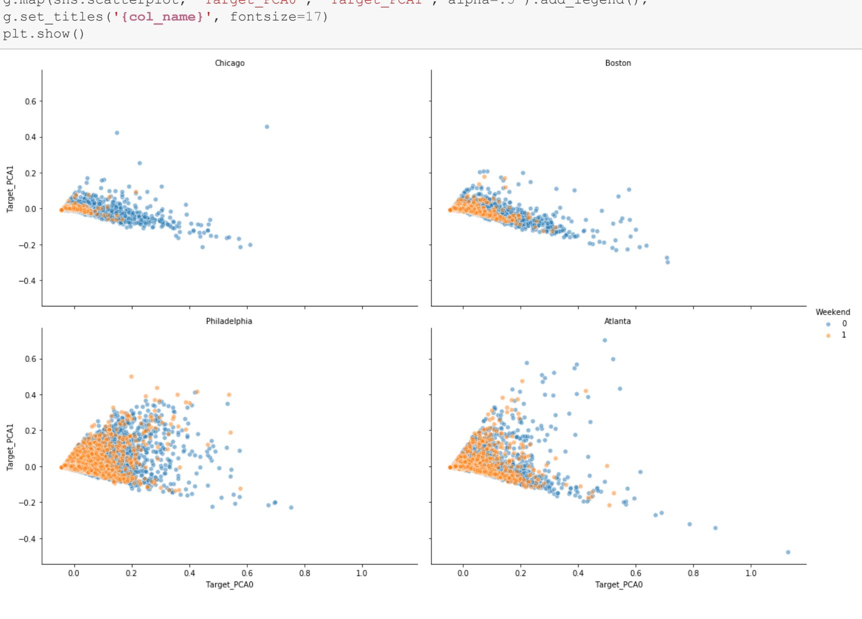
In [17]:
```python
pca.explained_variance_ratio_[:2].sum()
```

Out[17]:
```
0.8393328815798986
```

With the 2 first components we have almost 84% of the data explained. It's a very way to easiest visualize the differences between the patterns.

Scatter plot of cities by the PCA

In [18]:
```python
g = sns.FacetGrid(df_train.sample(50000), col="City",
                  col_wrap=2, height=5, aspect=1.5, hue='Weekend')

g.map(sns.scatterplot, "Target_PCA0", "Target_PCA1", alpha=.5 ).add_legend();
g.set_titles('{col_name}', fontsize=17)
plt.show()
```

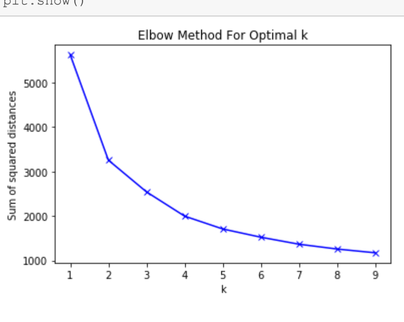


Cool. We can see differet patterns by the Cities and their weekend patterns.

KMeans Clusterization

- First, I will apply the elbow method to find the correct number of cluster we have in our data
- After it, we will implement the kmeans with the best quantity

In [19]:
```python
#sum of squared distances
ssd = []

K = range(1,10)
for k in K:
    km = KMeans(n_clusters=k, random_state=4)
    km = km.fit(df_train[min_max_cols])
    ssd.append(km.inertia_)

plt.plot(K, ssd, 'bx-')
plt.xlabel('k')
plt.ylabel('Sum of squared distances')
plt.title('Elbow Method For Optimal k')

plt.show()
```



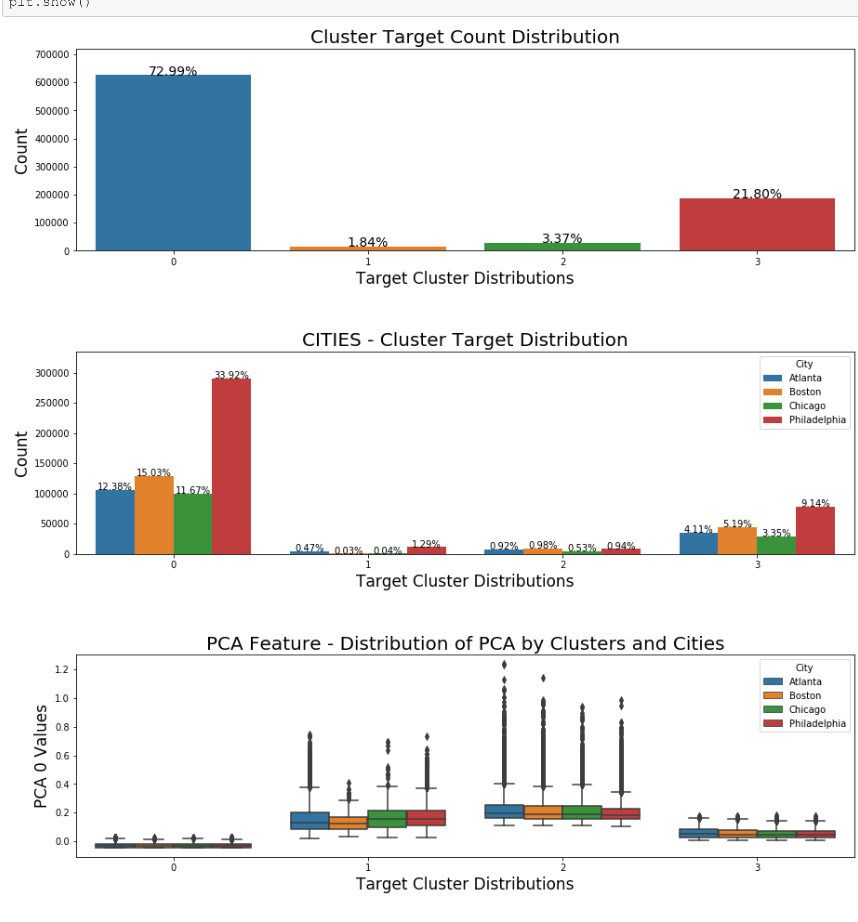
Nice.
Based on Elbow Method the best number of cluster is 4. So, let's apply the K means on data.

In [20]:
```python
km = KMeans(n_clusters=4, random_state=4)
km = km.fit(df_train[min_max_cols])
df_train['clusters_T'] = km.predict(df_train[min_max_cols])
```

Ploting Clusters

- Understanding the cluster distribution
- Exploring by Cities

```
In [21]: tmp = pd.crosstab(df_train['City'], df_train['clusters_T'],
                           normalize='columns').unstack('City').reset_index().rename(columns={0:"perc"})

         total = len(df_train)
         plt.figure(figsize=(15,16))

         plt.subplot(311)
         g = sns.countplot(x="clusters_T", data=df_train)
         g.set_title("Cluster Target Count Distribution", fontsize=20)
         g.set_ylabel("Count",fontsize= 17)
         g.set_xlabel("Target Cluster Distributions", fontsize=17)
         sizes=[]
         for p in g.patches:
             height = p.get_height()
             sizes.append(height)
             g.text(p.get_x()+p.get_width()/2.,
                     height + 3,
                     '{:1.2f}%'.format(height/total*100),
                     ha="center", fontsize=14)
         g.set_ylim(0, max(sizes) * 1.15)

         plt.subplot(312)
         g1 = sns.countplot(x="clusters_T", data=df_train, hue='City')
         g1.set_title("CITIES - Cluster Target Distribution", fontsize=20)
         g1.set_ylabel("Count",fontsize= 17)
         g1.set_xlabel("Target Cluster Distributions", fontsize=17)
         sizes=[]
         for p in g1.patches:
             height = p.get_height()
             sizes.append(height)
             g1.text(p.get_x()+p.get_width()/2.,
                     height + 3,
                     '{:1.2f}%'.format(height/total*100),
                     ha="center", fontsize=10)
         g1.set_ylim(0, max(sizes) * 1.15)

         plt.subplot(313)
         g1 = sns.boxplot(x="clusters_T", y='Target_PCA0',
                          data=df_train, hue='City')
         g1.set_title("PCA Feature - Distribution of PCA by Clusters and Cities",
                      fontsize=20)
         g1.set_ylabel("PCA 0 Values",fontsize= 17)
         g1.set_xlabel("Target Cluster Distributions", fontsize=17)

         plt.subplots_adjust(hspace = 0.5)

         plt.show()
```



Nice.

In the first chart:

- We can note that the most common cluster is the 1 that have 73% of all data.

Second chart:

- Philadelphia is the most common in the first 3 clusters.
- Boston is the second most common in 0,1 and the most common on Cluster 3;
- In the second cluster, Atlanta is the second most common city.

Third Chart:

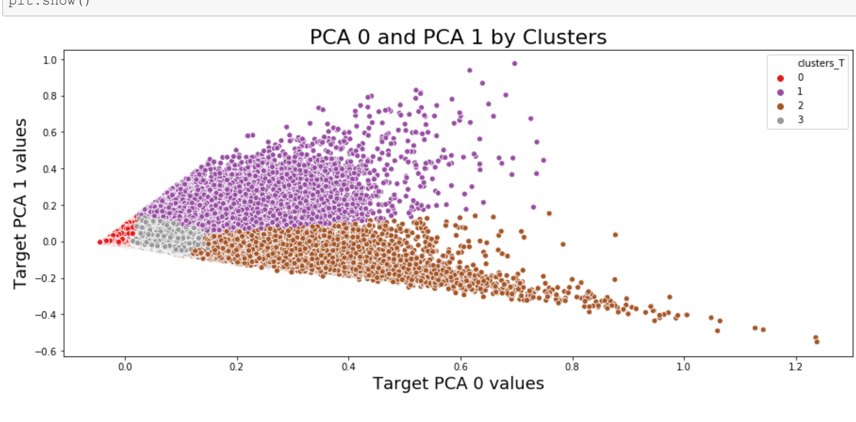
- Is clear to understand how the algorithmn divided the data in PCA values

NOTE: EVERY TIME I RUN IT, THE VALUES CHANGES, SO SORRY BY THE WRONG

PCA values by CLUSTERS

- Let's see in another way how the algorithmn have decided by the clusterization

```
In [22]: plt.figure(figsize=(15,6))

         sns.scatterplot(x='Target_PCA0', y='Target_PCA1',
                         hue='clusters_T', data=df_train,
                         palette='Set1')
         plt.title("PCA 0 and PCA 1 by Clusters", fontsize=22)
         plt.ylabel("Target PCA 1 values", fontsize=18)
         plt.xlabel("Target PCA 0 values", fontsize=18)

         plt.show()
```



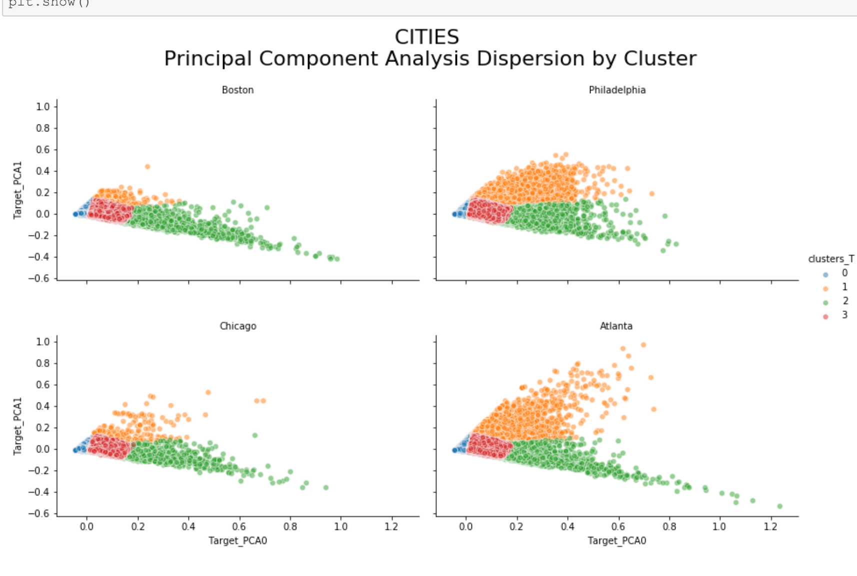
Cool. It gives us a good understand of the boundaries of Clusters.
I suspect that the cluster 2 is about traffic;

Let's plot it by each city and try to find any pattern in the PCA dispersion.

PCA Dispersion by clusters and by Each City

- To better understand the patterns, let's plot by Cities

```
In [23]: g = sns.FacetGrid(df_train.sample(500000), col="City",
                           col_wrap=2, height=4, aspect=1.5,
                           hue='clusters_T')

         g.map(sns.scatterplot, "Target_PCA0", "Target_PCA1",
               alpha=.5).add_legend();
         g.set_titles('{col_name}', fontsize=50)

         plt.suptitle("CITIES \nPrincipal Component Analysis Dispersion by Cluster", fontsize=22)

         plt.subplots_adjust(hspace = 0.3, top=.85)

         plt.show()
```



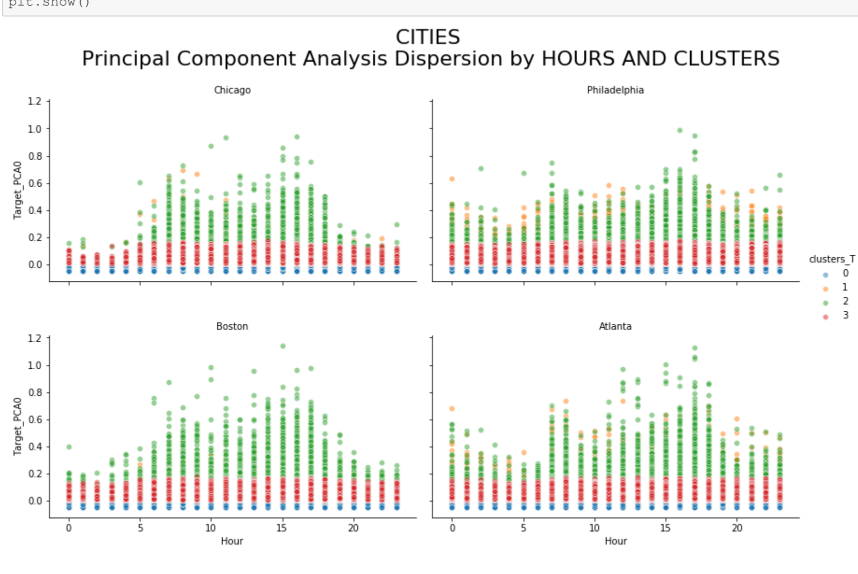
Cool! We can see that Atlanta and Philadelphia have similar pattern of the Cluster 2;
The other cluster seens very similar

Clusters by the Hours

I was wondering and I had an insight that I will try to implement here.

- I think that make a lot of sense explore the hours by the clusters
- Let's see the distribution of PCA0 and the Clusters by the Hours

```
In [24]: g = sns.FacetGrid(df_train.sample(500000), col="City",
                           col_wrap=2, height=4, aspect=1.5,
                           hue='clusters_T')

         g.map(sns.scatterplot, "Hour", "Target_PCA0",
               alpha=.5).add_legend();
         g.set_titles('{col_name}', fontsize=50)

         plt.suptitle("CITIES \nPrincipal Component Analysis Dispersion by HOURS AND CLUSTERS", fontsize=22)

         plt.subplots_adjust(hspace = 0.3, top=.85)

         plt.show()
```



Cool! We can have a best intuition about the data and how it posible clustered the data.

```
In [25]: round(pd.crosstab([df_train['clusters_T'], df_train['Weekend']], df_train['City'],
                     normalize='index' ) * 100,0)
```

Out[25]:

clusters_T	Weekend	Atlanta	Boston	Chicago	Philadelphia
0	0	15.0	22.0	22.0	41.0
	1	22.0	16.0	3.0	59.0
1	0	24.0	2.0	3.0	71.0
	1	30.0	1.0	0.0	69.0
2	0	24.0	32.0	18.0	26.0
	1	43.0	15.0	2.0	41.0
3	0	17.0	26.0	19.0	38.0
	1	27.0	14.0	2.0	56.0

Modeling

- As I was getting problems with my model, I decided to implement the solution of the public kernels
- I will import the datasets again

Many parts of this implementation I got on @dcaichara Kernel.
You can see the kernel here: https://www.kaggle.com/dcaichara/feature-engineering-and-lightgbm

```
In [26]: df_train = pd.read_csv('/kaggle/input/bigquery-geotab-intersection-congestion/train.csv')
         df_test = pd.read_csv('/kaggle/input/bigquery-geotab-intersection-congestion/test.csv')
```

Hour Feature

- Let's encode the Hour Features

```
In [27]: def date_cyc_enc(df, col, max_vals):
             df[col + '_sin'] = np.sin(2 * np.pi * df[col]/max_vals)
             df[col + '_cos'] = np.cos(2 * np.pi * df[col]/max_vals)
             return df

         df_train = date_cyc_enc(df_train, 'Hour', 24)
         df_test = date_cyc_enc(df_test, 'Hour', 24)
```

Flag - is day?

Testing some features about the data

```
In [28]: df_train['is_day'] = df_train['Hour'].apply(lambda x: 1 if 7 < x < 18 else 0)
         df_test['is_day'] = df_test['Hour'].apply(lambda x: 1 if 7 < x < 18 else 0)

         df_train['is_morning'] = df_train['Hour'].apply(lambda x: 1 if 6 < x < 10 else 0)
         df_test['is_morning'] = df_test['Hour'].apply(lambda x: 1 if 6 < x < 10 else 0)

         df_train['is_night'] = df_train['Hour'].apply(lambda x: 1 if 17 < x < 20 else 0)
         df_test['is_night'] = df_test['Hour'].apply(lambda x: 1 if 17 < x < 20 else 0)

         df_train['is_day_weekend'] = np.where((df_train['is_day'] == 1) & (df_train['Weekend'] == 1), 1,0)
         df_test['is_day_weekend'] = np.where((df_test['is_day'] == 1) & (df_train['Weekend'] == 1), 1,0)

         df_train['is_mor_weekend'] = np.where((df_train['is_morning'] == 1) & (df_train['Weekend'] == 1), 1,0)
         df_test['is_mor_weekend'] = np.where((df_test['is_morning'] == 1) & (df_train['Weekend'] == 1), 1,0)

         df_train['is_nig_weekend'] = np.where((df_train['is_night'] == 1) & (df_train['Weekend'] == 1), 1,0)
         df_test['is_nig_weekend'] = np.where((df_test['is_night'] == 1) & (df_train['Weekend'] == 1), 1,0)
```

```
In [ ]:
```

Intersec - Concatenating IntersectionId and City

```
In [29]: df_train["Intersec"] = df_train["IntersectionId"].astype(str) + df_train["City"]
         df_test["Intersec"] = df_test["IntersectionId"].astype(str) + df_test["City"]

         print(df_train["Intersec"].sample(6).values)

['7Boston' '598Philadelphia' '1525Philadelphia' '1823Chicago'
 '1786Philadelphia' '175Atlanta']
```

Label Encoder of Intersecion + City

```
In [30]: le = LabelEncoder()

         le.fit(pd.concat([df_train["Intersec"],df_test["Intersec"]]).drop_duplicates().values)
         df_train["Intersec"] = le.transform(df_train["Intersec"])
         df_test["Intersec"] = le.transform(df_test["Intersec"])
```

Street Feature

- Extracting informations from street features

```
In [31]: road_encoding = {
             'Road': 1,
             'Street': 2,
             'Avenue': 2,
             'Drive': 3,
             'Broad': 3,
             'Boulevard': 4
         }
```

```
In [32]: def encode(x):
             if pd.isna(x):
                 return 0
             for road in road_encoding.keys():
                 if road in x:
                     return road_encoding[road]
             return 0
```

Creating the new feature

```
In [33]: df_train['EntryType'] = df_train['EntryStreetName'].apply(encode)
         df_train['ExitType'] = df_train['ExitStreetName'].apply(encode)
         df_test['EntryType'] = df_test['EntryStreetName'].apply(encode)
         df_test['ExitType'] = df_test['ExitStreetName'].apply(encode)
```

Encoding the Regions

```
In [34]: directions = {
             'N': 0,
             'NE': 1/4,
             'E': 1/2,
             'SE': 3/4,
             'S': 1,
             'SW': 5/4,
             'W': 3/2,
             'NW': 7/4
         }
```

Applying the transformation in Entry and Exit Heading Columns

```
In [35]: df_train['EntryHeading'] = df_train['EntryHeading'].map(directions)
         df_train['ExitHeading'] = df_train['ExitHeading'].map(directions)

         df_test['EntryHeading'] = df_test['EntryHeading'].map(directions)
         df_test['ExitHeading'] = df_test['ExitHeading'].map(directions)
```

Difference between the regions

```
In [36]: df_train['diffHeading'] = df_train['EntryHeading']-df_train['ExitHeading']
         df_test['diffHeading'] = df_test['EntryHeading']-df_test['ExitHeading']
```

Getting the binary if the entry and exit was in the same street

```
In [37]: df_train["same_str"] = (df_train["EntryStreetName"] ==  df_train["ExitStreetName"]).astype(int)
         df_test["same_str"] = (df_test["EntryStreetName"] ==  df_test["ExitStreetName"]).astype(int)
```

Concatenating City and Month

```
In [38]: # Concatenating the city and month into one variable
         df_train['city_month'] = df_train["City"] + df_train["Month"].astype(str)
         df_test['city_month'] = df_test["City"] + df_test["Month"].astype(str)
```

Month rainfall ratio by city and seasons

```
In [39]: monthly_rainfall = {'Atlanta1': 5.02, 'Atlanta5': 3.95, 'Atlanta6': 3.63, 'Atlanta7': 5.12,
                             'Atlanta8': 3.67, 'Atlanta9': 4.09,'Atlanta10': 3.11, 'Atlanta11': 4.10,
                             'Atlanta12': 3.82, 'Boston1': 3.92, 'Boston5': 3.24, 'Boston6': 3.22,
                             'Boston7': 3.06, 'Boston8': 3.37, 'Boston9': 3.47, 'Boston10': 3.79,
                             'Boston11': 3.98, 'Boston12': 3.73, 'Chicago1': 1.75, 'Chicago5': 3.38,
                             'Chicago6': 3.63, 'Chicago7': 3.51, 'Chicago8': 4.62, 'Chicago9': 3.27,
                             'Chicago10': 2.71,  'Chicago11': 3.01, 'Chicago12': 2.43,
                             'Philadelphia1': 3.52, 'Philadelphia5': 3.88, 'Philadelphia6': 3.29,
                             'Philadelphia7': 4.39, 'Philadelphia8': 3.82, 'Philadelphia9':3.88 ,
                             'Philadelphia10': 2.75, 'Philadelphia11': 3.16, 'Philadelphia12': 3.31}

         # Creating a new column by mapping the city_month variable to it's corresponding average monthly rainfa
         ll
         df_train["average_rainfall"] = df_train['city_month'].map(monthly_rainfall)
         df_test["average_rainfall"] = df_test['city_month'].map(monthly_rainfall)
```

Getting Dummies

```
In [40]: print(f'Shape before dummy transformation: {df_train.shape}')
         df_train = pd.get_dummies(df_train, columns=['City' ],\
                                   prefix=['City'], drop_first=False)

         print(f'Shape after dummy transformation: {df_train.shape}')

         df_test = pd.get_dummies(df_test, columns=['City' ],\
                                   prefix=['City'], drop_first=False)

Shape before dummy transformation: (857409, 43)
Shape after dummy transformation: (857409, 46)
```

MinMax Scaling the lat and long

```
In [41]: from sklearn.preprocessing import StandardScaler
         scaler = StandardScaler()
         for col in ['Latitude','Longitude']:
             scaler.fit(df_train[col].values.reshape(-1, 1))
             df_train[col] = scaler.transform(df_train[col].values.reshape(-1, 1))
             df_test[col] = scaler.transform(df_test[col].values.reshape(-1, 1))
```

Dropping not used features

```
In [42]: df_train.drop(['RowId', 'Path','EntryStreetName','ExitStreetName'
                       ],axis=1, inplace=True)
         df_test.drop(['RowId', 'Path',
                       'EntryStreetName','ExitStreetName'],axis=1, inplace=True)
```

```
In [43]: interesting_feat = ['IntersectionId', 'Latitude', 'Longitude', 'EntryHeading',
                             'ExitHeading', 'Hour', 'Weekend', 'Month',
                             'is_morning', 'is_night', 'is_day_weekend', 'is_mor_weekend',
                             'is_nig_weekend', #  'Hour_sin',
                             'Hour', 'same_str', 'Intersec', 'EntryType',
                             'ExitType', 'diffHeading', 'average_rainfall', 'is_day',
                             'City_Boston', 'City_Chicago', 'City_Philadelphia',
                             'City_Atlanta']

         total_time = ['TotalTimeStopped_p20',
                       'TotalTimeStopped_p50',
                       'TotalTimeStopped_p80']

         target_stopped = ['DistanceToFirstStop_p20',
                           'DistanceToFirstStop_p50',
                           'DistanceToFirstStop_p80']
```

Setting X and y

```
In [44]: X = df_train[interesting_feat]
         y = df_train[total_time + target_stopped]

         X_test = df_test[interesting_feat]
```

```
In [45]: print(f'Shape of X: {X.shape}')
         print(f'Shape of X_test: {X_test.shape}')

Shape of X: (857409, 25)
Shape of X_test: (1920335, 25)
```

Reduce memory usage

X = reduce_mem_usage(X) X_test = reduce_mem_usage(X_test)

Spliting data into train and validation

```
In [46]: X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.10,
                                                           random_state=42)
```

Hyperopt Space

- Here we will set all range of our hyperparameters

```
In [47]: # Define searched space
         hyper_space = {'objective': 'regression',
                        'metric':'rmse',
                        'boosting':'gbdt', 'gpu_device_id': 0,
                        #'n_estimators': hp.choice('n_estimators', [25, 40, 50, 75, 100, 250, 500]),
                        'max_depth':  hp.choice('max_depth', list(range(6, 18, 2))),
                        'num_leaves': hp.choice('num_leaves', list(range(20, 180, 20))),
                        'subsample': hp.choice('subsample', [.7, .8, .9, 1]),
                        'colsample_bytree': hp.uniform('colsample_bytree', 0.7, 1),
                        'learning_rate': hp.uniform('learning_rate', 0.03, 0.12),
                        #'reg_alpha': hp.choice('reg_alpha', [.1, .2, .3, .4, .5, .6]),
                        #'reg_lambda':  hp.choice('reg_lambda', [.1, .2, .3, .4, .5, .6]),
                        'min_child_samples': hp.choice('min_child_samples', [20, 45, 70, 100])}
```

Building Hyperopt Function to be optimized

```
In [48]: cat_feat = ['IntersectionId','Hour', 'Weekend','Month',
                     'is_day', 'is_morning', 'is_night',
                     'same_str', 'Intersec', 'City_Atlanta', 'City_Boston',
                     'City_Chicago', 'City_Philadelphia', 'EntryType', 'ExitType']
```

```
In [49]: from sklearn.model_selection import KFold
         import lightgbm as lgb

         def evaluate_metric(params):

             all_preds_test ={0:[],1:[],2:[],3:[],4:[],5:[]}

             print(f'Params: {params}')
             FOLDS = 4

             count=1

             for i in range(len(all_preds_test)):

                 score_mean = 0

                 kf = KFold(n_splits=FOLDS, shuffle=False,
                            random_state=42)


                 for tr_idx, val_idx in kf.split(X, y):

                     X_tr, X_vl = X.iloc[tr_idx, :], X.iloc[val_idx, :]
                     y_tr, y_vl = y.iloc[tr_idx], y.iloc[val_idx]

                     lgtrain = lgb.Dataset(X_tr, label=y_tr.iloc[:,i])
                     lgval = lgb.Dataset(X_vl, label=y_vl.iloc[:,i])

                     lgbm_reg = lgb.train(params, lgtrain, 2000, valid_sets = [lgval],
                                          categorical_feature=cat_feat,
                                          verbose_eval=0,
                                          early_stopping_rounds = 300)

                 pred_lgb = lgbm_reg.predict(X_val, num_iteration=lgbm_reg.best_iteration)
                 all_preds_test[i] = pred_lgb
                 score_uni = np.sqrt(mean_squared_error(pred_lgb, y_val.iloc[:,i]))
                 print(f'Score Validation : {score_uni}')


             pred = pd.DataFrame(all_preds_test).stack()
             pred = pd.DataFrame(pred)

             y_val_sc = pd.DataFrame(y_val).stack()
             y_val_sc = pd.DataFrame(y_val_sc)

             count = count +1

             score = np.sqrt(mean_squared_error(pred[0].values, y_val_sc[0].values ))
             #score = metric(df_val, pred)

             print(f'Full Score Run: {score}')

             return {
                 'loss': score,
                 'status': STATUS_OK
             }
```

Running the hyperopt Function

In [50]:

```python
# Seting the number of Evals
MAX_EVALS= 15

# Fit Tree Parzen Estimator
best_vals = fmin(evaluate_metric,
                 space=hyper_space,
                 verbose=-1,
                 algo=tpe.suggest,
                 max_evals=MAX_EVALS)

# Print best parameters
best_params = space_eval(hyper_space, best_vals)
```

```
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.9247659742717267, 'gpu_device_id': 0, 'learning_ra
te': 0.04556082404133874, 'max_depth': 12, 'metric': 'rmse', 'min_child_samples': 45, 'num_leaves': 1
40, 'objective': 'regression', 'subsample': 0.8}
  0%|          | 0/15 [00:00<?, ?it/s, best loss: ?]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.401957611384795
  0%|          | 0/15 [02:16<?, ?it/s, best loss: ?]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.646284277555
  0%|          | 0/15 [04:39<?, ?it/s, best loss: ?]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 21.687640851080165
  0%|          | 0/15 [07:08<?, ?it/s, best loss: ?]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 25.91830442123546
  0%|          | 0/15 [09:18<?, ?it/s, best loss: ?]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 65.14003527847642
  0%|          | 0/15 [11:30<?, ?it/s, best loss: ?]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 152.45809571139537
Full Score Run: 69.31777186872799
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.7775015002305097, 'gpu_device_id': 0, 'learning_ra
te': 0.06827339072231259, 'max_depth': 16, 'metric': 'rmse', 'min_child_samples': 100, 'num_leaves':
80, 'objective': 'regression', 'subsample': 0.9}
  7%|█         | 1/15 [13:40<3:11:24, 820.30s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.564807428395332
  7%|█         | 1/15 [15:29<3:11:24, 820.30s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.97189927853345
  7%|█         | 1/15 [17:30<3:11:24, 820.30s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.007111496703793
  7%|█         | 1/15 [19:36<3:11:24, 820.30s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 25.753810892649778
  7%|█         | 1/15 [21:13<3:11:24, 820.30s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 70.05141898376752
  7%|█         | 1/15 [22:59<3:11:24, 820.30s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 151.63390301314774
Full Score Run: 69.83191777884367
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.7836858397777255, 'gpu_device_id': 0, 'learning_ra
te': 0.04924088219153466, 'max_depth': 14, 'metric': 'rmse', 'min_child_samples': 100, 'num_leaves':
60, 'objective': 'regression', 'subsample': 0.7}
 13%|█         | 2/15 [24:48<2:47:49, 774.58s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.462503416314482
 13%|█         | 2/15 [26:31<2:47:49, 774.58s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 13.06194660264434
 13%|█         | 2/15 [28:28<2:47:49, 774.58s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.539547831305235
 13%|█         | 2/15 [30:35<2:47:49, 774.58s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.231844964043013
 13%|█         | 2/15 [32:11<2:47:49, 774.58s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 66.36324985745941
 13%|█         | 2/15 [33:57<2:47:49, 774.58s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 152.68254451642343
Full Score Run: 69.6713231750418
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.7991689396868674, 'gpu_device_id': 0, 'learning_ra
te': 0.08698293851042099, 'max_depth': 6, 'metric': 'rmse', 'min_child_samples': 45, 'num_leaves': 2
0, 'objective': 'regression', 'subsample': 0.7}
 20%|██        | 3/15 [35:41<2:27:37, 738.13s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.573350102688967
 20%|██        | 3/15 [36:45<2:27:37, 738.13s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 13.188261316127202
 20%|██        | 3/15 [37:53<2:27:37, 738.13s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 23.06028867056899
 20%|██        | 3/15 [39:04<2:27:37, 738.13s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.25051892955891
 20%|██        | 3/15 [40:04<2:27:37, 738.13s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 66.71579800854323
 20%|██        | 3/15 [41:08<2:27:37, 738.13s/it, best loss: 69.31777186872799]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 150.5636093747943
Full Score Run: 68.99082547416296
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.7883598664947729, 'gpu_device_id': 0, 'learning_ra
te': 0.03641115489528002, 'max_depth': 8, 'metric': 'rmse', 'min_child_samples': 20, 'num_leaves': 2
0, 'objective': 'regression', 'subsample': 1}
 27%|██▋       | 4/15 [42:07<1:55:57, 632.50s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.6147684795792525
 27%|██▋       | 4/15 [43:27<1:55:57, 632.50s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 13.242536962518429
 27%|██▋       | 4/15 [44:55<1:55:57, 632.50s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.983498065765318
 27%|██▋       | 4/15 [46:28<1:55:57, 632.50s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.190594104351508
 27%|██▋       | 4/15 [47:42<1:55:57, 632.50s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 66.00834153034903
 27%|██▋       | 4/15 [48:58<1:55:57, 632.50s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 153.0463379572026
Full Score Run: 69.77773171986595
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.9657408510837153, 'gpu_device_id': 0, 'learning_ra
te': 0.0741720205732466, 'max_depth': 14, 'metric': 'rmse', 'min_child_samples': 45, 'num_leaves': 4
0, 'objective': 'regression', 'subsample': 1}
 33%|███▎      | 5/15 [50:08<1:37:50, 587.02s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.512633405994382
 33%|███▎      | 5/15 [51:34<1:37:50, 587.02s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 13.025671568133117
 33%|███▎      | 5/15 [53:13<1:37:50, 587.02s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.59648668436431
 33%|███▎      | 5/15 [55:00<1:37:50, 587.02s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.35507654683557
 33%|███▎      | 5/15 [56:20<1:37:50, 587.02s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 68.74495198368747
 33%|███▎      | 5/15 [57:49<1:37:50, 587.02s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 151.94084370065286
Full Score Run: 69.79632534698572
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.9550275887884132, 'gpu_device_id': 0, 'learning_ra
te': 0.11416181578363499, 'max_depth': 8, 'metric': 'rmse', 'min_child_samples': 45, 'num_leaves': 14
0, 'objective': 'regression', 'subsample': 1}
 40%|████      | 6/15 [59:19<1:26:27, 576.33s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.380312909529207
 40%|████      | 6/15 [1:01:09<1:26:27, 576.33s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.736989592964107
 40%|████      | 6/15 [1:02:56<1:26:27, 576.33s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.191251812565092
 40%|████      | 6/15 [1:04:44<1:26:27, 576.33s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 25.051527232957934
 40%|████      | 6/15 [1:06:32<1:26:27, 576.33s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 67.49888900294731
 40%|████      | 6/15 [1:08:15<1:26:27, 576.33s/it, best loss: 68.99082547416296]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 149.7298364096299
Full Score Run: 68.67567970579036
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.7226770931240585, 'gpu_device_id': 0, 'learning_ra
te': 0.11531908130585261, 'max_depth': 6, 'metric': 'rmse', 'min_child_samples': 70, 'num_leaves': 8
0, 'objective': 'regression', 'subsample': 1}
 47%|████▋     | 7/15 [1:09:56<1:19:16, 594.52s/it, best loss: 68.67567970579036]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.35392223669651
 47%|████▋     | 7/15 [1:11:26<1:19:16, 594.52s/it, best loss: 68.67567970579036]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.832305497461235
 47%|████▋     | 7/15 [1:12:49<1:19:16, 594.52s/it, best loss: 68.67567970579036]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.7591119508893
 47%|████▋     | 7/15 [1:14:12<1:19:16, 594.52s/it, best loss: 68.67567970579036]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.14197059737934
 47%|████▋     | 7/15 [1:15:31<1:19:16, 594.52s/it, best loss: 68.67567970579036]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 69.87175673065335
 47%|████▋     | 7/15 [1:16:47<1:19:16, 594.52s/it, best loss: 68.67567970579036]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 150.4268167717459
Full Score Run: 69.42227042813846
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.7884096877612788, 'gpu_device_id': 0, 'learning_ra
te': 0.1172389910071352, 'max_depth': 10, 'metric': 'rmse', 'min_child_samples': 20, 'num_leaves': 12
0, 'objective': 'regression', 'subsample': 0.9}
 53%|█████▎    | 8/15 [1:18:02<1:05:32, 561.82s/it, best loss: 68.67567970579036]

/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:
```

```
categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.502207056901731
 53%|█████     | 8/15 [1:19:36<1:05:32, 561.82s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.68627108348998
 53%|█████     | 8/15 [1:21:16<1:05:32, 561.82s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 21.871294511925193
 53%|█████     | 8/15 [1:22:59<1:05:32, 561.82s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.305445617172072
 53%|█████     | 8/15 [1:24:25<1:05:32, 561.82s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 70.80688117761943
 53%|█████     | 8/15 [1:25:55<1:05:32, 561.82s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 148.99790285981052
Full Score Run: 69.0260091584844
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.9360683895657687, 'gpu_device_id': 0, 'learning_ra
te': 0.09642143740152433, 'max_depth': 6, 'metric': 'rmse', 'min_child_samples': 70, 'num_leaves': 14
0, 'objective': 'regression', 'subsample': 1}
 60%|██████    | 9/15 [1:27:28<56:18, 563.05s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.494440365285622
 60%|██████    | 9/15 [1:28:59<56:18, 563.05s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.839771650346195
 60%|██████    | 9/15 [1:30:30<56:18, 563.05s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.663962154187608
 60%|██████    | 9/15 [1:31:56<56:18, 563.05s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 25.818792253027116
 60%|██████    | 9/15 [1:33:17<56:18, 563.05s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 67.70730123212613
 60%|██████    | 9/15 [1:34:33<56:18, 563.05s/it, best loss: 68.67567970579036]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 148.9149223935132
Full Score Run: 68.49237847773847
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.809353215911912, 'gpu_device_id': 0, 'learning_rat
e': 0.06341552039636664, 'max_depth': 14, 'metric': 'rmse', 'min_child_samples': 70, 'num_leaves': 8
0, 'objective': 'regression', 'subsample': 0.9}
 67%|██████▋   | 10/15 [1:35:48<45:22, 544.41s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.542786497224878
 67%|██████▋   | 10/15 [1:37:34<45:22, 544.41s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 13.028440503696038
 67%|██████▋   | 10/15 [1:39:33<45:22, 544.41s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 22.203522912888538
 67%|██████▋   | 10/15 [1:41:42<45:22, 544.41s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 25.805119194578676
 67%|██████▋   | 10/15 [1:43:19<45:22, 544.41s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 68.75808054926084
 67%|██████▋   | 10/15 [1:45:05<45:22, 544.41s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 151.8479110638374
Full Score Run: 69.71000724282216
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.7528297215102727, 'gpu_device_id': 0, 'learning_ra
te': 0.06495286330765361, 'max_depth': 16, 'metric': 'rmse', 'min_child_samples': 45, 'num_leaves': 1
40, 'objective': 'regression', 'subsample': 1}
 73%|███████▎  | 11/15 [1:46:55<38:43, 580.95s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.655447577514592
 73%|███████▎  | 11/15 [1:48:56<38:43, 580.95s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.759245728024199
 73%|███████▎  | 11/15 [1:51:12<38:43, 580.95s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 21.51820691866953
 73%|███████▎  | 11/15 [1:53:34<38:43, 580.95s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.869061397635846
 73%|███████▎  | 11/15 [1:55:23<38:43, 580.95s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 69.76284334866493
 73%|███████▎  | 11/15 [1:57:27<38:43, 580.95s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 151.38725034503628
Full Score Run: 69.73405062869311
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.9326430212082156, 'gpu_device_id': 0, 'learning_ra
te': 0.10727424763556975, 'max_depth': 14, 'metric': 'rmse', 'min_child_samples': 20, 'num_leaves': 1
60, 'objective': 'regression', 'subsample': 0.8}
 80%|████████  | 12/15 [1:59:30<31:40, 633.38s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.49545355966543
 80%|████████  | 12/15 [2:01:15<31:40, 633.38s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.480156024955374
 80%|████████  | 12/15 [2:03:21<31:40, 633.38s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 21.922161811030993
 80%|████████  | 12/15 [2:05:34<31:40, 633.38s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 25.988028356797855
 80%|████████  | 12/15 [2:07:19<31:40, 633.38s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 70.79218220743714
 80%|████████  | 12/15 [2:09:15<31:40, 633.38s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 149.01623580365393
Full Score Run: 69.0063712064291
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.88558283270693, 'gpu_device_id': 0, 'learning_rat
e': 0.11175298664667993, 'max_depth': 10, 'metric': 'rmse', 'min_child_samples': 20, 'num_leaves': 8
0, 'objective': 'regression', 'subsample': 1}
 87%|████████▋ | 13/15 [2:11:13<21:48, 654.13s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.422412865598778
 87%|████████▋ | 13/15 [2:12:38<21:48, 654.13s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.917922214210137
 87%|████████▋ | 13/15 [2:14:14<21:48, 654.13s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 21.810877250907712
 87%|████████▋ | 13/15 [2:15:57<21:48, 654.13s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 25.871191058618674
 87%|████████▋ | 13/15 [2:17:19<21:48, 654.13s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 70.95068395690335
 87%|████████▋ | 13/15 [2:18:46<21:48, 654.13s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 149.576393294255
Full Score Run: 69.23420394990752
Params: {'boosting': 'gbdt', 'colsample_bytree': 0.8867539376941114, 'gpu_device_id': 0, 'learning_ra
te': 0.09640316874797038, 'max_depth': 16, 'metric': 'rmse', 'min_child_samples': 45, 'num_leaves': 1
20, 'objective': 'regression', 'subsample': 0.7}
 93%|█████████▎| 14/15 [2:20:16<10:20, 620.72s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 6.555119028334827
 93%|█████████▎| 14/15 [2:22:00<10:20, 620.72s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 12.982345801286776
 93%|█████████▎| 14/15 [2:24:02<10:20, 620.72s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 21.93478375055509
 93%|█████████▎| 14/15 [2:26:12<10:20, 620.72s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 26.27049030965609
 93%|█████████▎| 14/15 [2:27:52<10:20, 620.72s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 69.83099607592712
 93%|█████████▎| 14/15 [2:29:44<10:20, 620.72s/it, best loss: 68.49237847773847]
/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:1209: UserWarning:

categorical_feature in Dataset is overridden.
New categorical_feature is ['City_Atlanta', 'City_Boston', 'City_Chicago', 'City_Philadelphia', 'Entr
yType', 'ExitType', 'Hour', 'Intersec', 'IntersectionId', 'Month', 'Weekend', 'is_day', 'is_morning',
'is_night', 'same_str']


/opt/conda/lib/python3.6/site-packages/lightgbm/basic.py:762: UserWarning:

categorical_feature in param dict is overridden.

Score Validation : 149.9013044308472
Full Score Run: 69.19724629672636
100%|██████████| 15/15 [2:31:38<00:00, 606.57s/it, best loss: 68.49237847773847]
```

In [51]:
```
best_params
```

Out[51]:
```
{'boosting': 'gbdt',
 'colsample_bytree': 0.9360683895657687,
 'gpu_device_id': 0,
 'learning_rate': 0.09642143740152433,
 'max_depth': 6,
 'metric': 'rmse',
 'min_child_samples': 70,
 'num_leaves': 140,
 'objective': 'regression',
 'subsample': 1}
```

In [ ]:

In [52]:
```
all_preds ={0:[],1:[],2:[],3:[],4:[],5:[]}
```

In [53]:

```python
%%time
import lightgbm as lgb

for i in range(len(all_preds)):
    print(f'## {i+1} Run')
    X_tr,X_val,y_tr,y_val=train_test_split(X, y.iloc[:,i],
                                            test_size=0.10, random_state=31)

    xg_train = lgb.Dataset(X_tr, label = y_tr)
    xg_valid = lgb.Dataset(X_val, label = y_val )

    lgbm_reg = lgb.train(best_params, xg_train, 10000,
                      valid_sets = [xg_valid],
                      verbose_eval=500,
                      early_stopping_rounds = 250)

    all_preds[i] = lgbm_reg.predict(X_test, num_iteration=lgbm_reg.best_iteration)

    print(f"{i+1} running done." )
```

```
## 1 Run
Training until validation scores don't improve for 250 rounds.
[500]	valid_0's rmse: 5.9966
[1000]	valid_0's rmse: 5.81271
[1500]	valid_0's rmse: 5.71554
[2000]	valid_0's rmse: 5.66125
[2500]	valid_0's rmse: 5.62021
[3000]	valid_0's rmse: 5.59185
[3500]	valid_0's rmse: 5.5684
[4000]	valid_0's rmse: 5.55066
[4500]	valid_0's rmse: 5.5384
[5000]	valid_0's rmse: 5.52517
[5500]	valid_0's rmse: 5.51543
[6000]	valid_0's rmse: 5.50762
[6500]	valid_0's rmse: 5.50118
[7000]	valid_0's rmse: 5.49581
[7500]	valid_0's rmse: 5.49113
[8000]	valid_0's rmse: 5.48716
[8500]	valid_0's rmse: 5.48506
[9000]	valid_0's rmse: 5.48223
[9500]	valid_0's rmse: 5.47914
[10000]	valid_0's rmse: 5.47726
Did not meet early stopping. Best iteration is:
[9978]	valid_0's rmse: 5.47704
1 running done.
## 2 Run
Training until validation scores don't improve for 250 rounds.
[500]	valid_0's rmse: 11.7668
[1000]	valid_0's rmse: 11.0558
[1500]	valid_0's rmse: 10.6517
[2000]	valid_0's rmse: 10.4188
[2500]	valid_0's rmse: 10.2593
[3000]	valid_0's rmse: 10.1452
[3500]	valid_0's rmse: 10.0519
[4000]	valid_0's rmse: 9.97555
[4500]	valid_0's rmse: 9.91836
[5000]	valid_0's rmse: 9.86278
[5500]	valid_0's rmse: 9.81646
[6000]	valid_0's rmse: 9.77614
[6500]	valid_0's rmse: 9.74299
[7000]	valid_0's rmse: 9.71049
[7500]	valid_0's rmse: 9.68545
[8000]	valid_0's rmse: 9.658
[8500]	valid_0's rmse: 9.6407
[9000]	valid_0's rmse: 9.62057
[9500]	valid_0's rmse: 9.60493
[10000]	valid_0's rmse: 9.59146
Did not meet early stopping. Best iteration is:
[10000]	valid_0's rmse: 9.59146
2 running done.
## 3 Run
Training until validation scores don't improve for 250 rounds.
[500]	valid_0's rmse: 20.4292
[1000]	valid_0's rmse: 19.0196
[1500]	valid_0's rmse: 18.2787
[2000]	valid_0's rmse: 17.8637
[2500]	valid_0's rmse: 17.5385
[3000]	valid_0's rmse: 17.305
[3500]	valid_0's rmse: 17.1265
[4000]	valid_0's rmse: 16.9832
[4500]	valid_0's rmse: 16.859
[5000]	valid_0's rmse: 16.757
[5500]	valid_0's rmse: 16.6741
[6000]	valid_0's rmse: 16.5996
[6500]	valid_0's rmse: 16.5396
[7000]	valid_0's rmse: 16.477
[7500]	valid_0's rmse: 16.4278
[8000]	valid_0's rmse: 16.3848
[8500]	valid_0's rmse: 16.3496
[9000]	valid_0's rmse: 16.3175
[9500]	valid_0's rmse: 16.2871
[10000]	valid_0's rmse: 16.2591
Did not meet early stopping. Best iteration is:
[10000]	valid_0's rmse: 16.2591
3 running done.
## 4 Run
Training until validation scores don't improve for 250 rounds.
[500]	valid_0's rmse: 23.0849
[1000]	valid_0's rmse: 22.5089
[1500]	valid_0's rmse: 22.253
[2000]	valid_0's rmse: 22.0976
[2500]	valid_0's rmse: 21.9956
[3000]	valid_0's rmse: 21.924
[3500]	valid_0's rmse: 21.8876
[4000]	valid_0's rmse: 21.842
[4500]	valid_0's rmse: 21.82
[5000]	valid_0's rmse: 21.8023
[5500]	valid_0's rmse: 21.79
[6000]	valid_0's rmse: 21.7766
[6500]	valid_0's rmse: 21.7734
Early stopping, best iteration is:
[6671]	valid_0's rmse: 21.7674
4 running done.
## 5 Run
Training until validation scores don't improve for 250 rounds.
[500]	valid_0's rmse: 53.3206
[1000]	valid_0's rmse: 50.5741
[1500]	valid_0's rmse: 49.3754
[2000]	valid_0's rmse: 48.5289
[2500]	valid_0's rmse: 48.1257
[3000]	valid_0's rmse: 47.7898
[3500]	valid_0's rmse: 47.5662
[4000]	valid_0's rmse: 47.3932
[4500]	valid_0's rmse: 47.2312
[5000]	valid_0's rmse: 47.1279
[5500]	valid_0's rmse: 47.0027
[6000]	valid_0's rmse: 46.9357
[6500]	valid_0's rmse: 46.887
[7000]	valid_0's rmse: 46.8448
[7500]	valid_0's rmse: 46.8243
[8000]	valid_0's rmse: 46.7942
[8500]	valid_0's rmse: 46.7559
Early stopping, best iteration is:
[8570]	valid_0's rmse: 46.7514
5 running done.
## 6 Run
Training until validation scores don't improve for 250 rounds.
[500]	valid_0's rmse: 97.7012
[1000]	valid_0's rmse: 90.1463
[1500]	valid_0's rmse: 87.1521
[2000]	valid_0's rmse: 85.2443
[2500]	valid_0's rmse: 84.1762
[3000]	valid_0's rmse: 83.3879
[3500]	valid_0's rmse: 82.9284
[4000]	valid_0's rmse: 82.5356
[4500]	valid_0's rmse: 82.2854
[5000]	valid_0's rmse: 82.0698
[5500]	valid_0's rmse: 81.8858
[6000]	valid_0's rmse: 81.745
[6500]	valid_0's rmse: 81.6304
[7000]	valid_0's rmse: 81.533
[7500]	valid_0's rmse: 81.4556
[8000]	valid_0's rmse: 81.4098
[8500]	valid_0's rmse: 81.3495
[9000]	valid_0's rmse: 81.3104
[9500]	valid_0's rmse: 81.2524
[10000]	valid_0's rmse: 81.2331
Did not meet early stopping. Best iteration is:
[9891]	valid_0's rmse: 81.2295
6 running done.
CPU times: user 6h 28min 53s, sys: 2min 15s, total: 6h 31min 8s
Wall time: 3h 22min 42s
```

Importing submission file

- stacking all results in the same file

In [54]:

```python
sub  = pd.read_csv("../input/bigquery-geotab-intersection-congestion/sample_submission.csv")
```

In [55]:

```python
dt = pd.DataFrame(all_preds).stack()
dt = pd.DataFrame(dt)
sub['Target'] = dt[0].values
```

In [56]:

```python
sub.head()
```

Out[56]:

	TargetId	Target
0	0_0	0.492081
1	0_1	4.877809
2	0_2	11.635321
3	0_3	-5.298652
4	0_4	35.841453

In [57]:

```python
sub.to_csv("lgbm_pred_hyperopt_test.csv", index = False)
```

Most part of the first modeling try I got from @danofer
Plase, visit the kernel with all work here: https://www.kaggle.com/danofer/baseline-feature-engineering-geotab-69-5-lb
The Catboost model I got from @rohitpatil kernel, Link: https://www.kaggle.com/rohitpatil/geotab-catboost
Some ideas of modelling I saw on: https://www.kaggle.com/dcaichara/feature-engineering-and-lightgbm

NOTE: This Kernel is not finished.

Please stay tuned and votes up the kernel, please!