1. Impact of Major Events on Traffic Flow

Authors

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2. Question and Hypothesis:

How does the release of a video game or a major event affect the traffic conditions surrounding the venue?

The aim of our project was to analyze the effect of events on nearby traffic conditions. We specifically focused on the effects of an event's time, location, and the number of attendees. Although the other factors could have contributed other important attributes such as attendee demographics, we were eager to analyze the impact of events on traffic with the data we had at our disposal. We hypothesized that the impact of events on traffic would be significant and that it would be exponentially larger.

Knowing the impact of events on traffic would be useful for communities where events are very frequent, large attendance, or Central Core are no longer sufficient to handle the traffic. Knowing the impact of events would also be useful for those who are planning to host a major event in a city that does not have enough traffic, large enough venues, or enough hotels and restaurants, who wishes to meet with public traffic?

Knowing the impact of events on traffic would be useful for those who are planning to host a business for an event with an already established venue that is in a location where the traffic is already heavy. Knowing the impact of events would also be useful for those who are planning to host a business for an event in a location where the traffic is already heavy. Knowing the impact of events would also be useful for those who are planning to host a business for an event in a location where there is not enough traffic, large enough venues, or enough hotels and restaurants, who wishes to meet with public traffic?

Of course, this is also beneficial for the city itself. Being aware of the impact that major events can bring to the city can lead to developing requirements that would be beneficial to the city. Knowing the impact of events on traffic would be useful for those who are planning to host a business for an event with an already established venue that is in a location where the traffic is already heavy. Knowing the impact of events would also be useful for those who are planning to host a business for an event in a location where there is not enough traffic, large enough venues, or enough hotels and restaurants, who wishes to meet with public traffic?

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3. Background & Literature

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4. Library Used

```
import pandas
import numpy as np
import matplotlib
import matplotlib.pyplot
import seaborn
from sklearn.ensemble import IsolationForest
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.metrics import roc_curve
from sklearn.metrics import roc_auc_score
from sklearn.metrics import precision_recall_curve
from sklearn.metrics import average_precision_score
from sklearn.metrics import f1_score
from sklearn.metrics import cohen_kappa_score
from sklearn.metrics import matthews_corrcoef
from sklearn.metrics import log_loss
from sklearn.metrics import brier_score_loss
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
from sklearn.metrics import explained_variance_score
from sklearn.metrics import max_error
from sklearn.metrics import median_absolute_error
from sklearn.metrics import mean_absolute_percentage_error
from sklearn.metrics import mean_squared_log_error
from sklearn.metrics import d2_absolute_error
from sklearn.metrics import d2_pinball_score
from sklearn.metrics import d2_tweedie_score
from sklearn.metrics import mean_tweedie_deviance
from sklearn.metrics import mean_pinball_loss
from sklearn.metrics import mean_poisson_deviance
from sklearn.metrics import mean_gamma_deviance
```

```
    return service_area


def area_service_area(service_area):
    """
    Helper Function.

    Calculates the area of a service area in meters.

    """

    return service_area['saPolygons']['features'][0]['attributes']['Shape_Area']


def num_vehicles(service_area):
    """
    Helper Function.

    Calculates the number of vehicles in a service area

    """

    study_area = arcgis.geometry.Geometry(
        service_area['saPolygons']['features'][0]['geometry'], spatialReference=sref_3857
    )
    vehicles = enrich(study_areas=[study_area], data_collections=['AutomobilesAutomotiveProducts'])
    num_vehicles = (vehicles.MP01002h_B + 2*vehicles.MP01003h_B + 3*vehicles.MP01004h_B)[0]

    return num_vehicles


def dist_to_highway(event):
    """
    Helper Function.

    Calculates the distance of an event to the highway.

    """

    distance_to_highway = distance(geometry1= event['SHAPE'],
                                   geometry2=highways_sdf['SHAPE'].loc[0],
                                   spatial_ref={'latestWkid': 3857, 'wkid': 102100},
                                   geodesic=True)['distance']

    return distance_to_highway


def generate_features(event):
    """
    Generates the following features for a particular event:

    1. The area of the 5 minute service area
    2. The number of veicles in a service area
    3. The distance of the event to the nearest highway

    Outputs a dataframe of three columns containing these values.

    """

    service_area = calc_service_area(event, baseline=True)
    area = area_service_area(service_area)
    vehicles = num_vehicles(service_area)
    distance = dist_to_highway(event)
    av_ratio = event["total_atte"] / vehicles

    features = pd.DataFrame({'service_area':[area], 'num_vehicles':[vehicles], 'av_ratio':[av_ratio], 'dist_to_highway'

    return features
```

In [23]:

```
# Testing on first event
#
# NOTE: It is likely that these numbers will differ slightly from the example calculated above.
#       The generalized procedure produces a baseline for the service area, which in turn affects
#       the enriched number of vehicles, whereas the example above calculates a service area for
#       a set date, day, and time that may not match the actual event.
generate_features(events_sdf.loc[0])
```

Out[23]:

	service_area	num_vehicles	av_ratio	dist_to_highway
0	9.570219e+06	16259	0.052894	3384.512326

In [24]:

```
# Run on all.
#
#! IMPORTANT: Please do not run this any more!  With all of these service area calculations
#  this burns through credits like a fire in a pile of flammable stuff.

run = False
if run:

    events_features = pd.DataFrame()

    for index, event in events_sdf.iterrows():

        events_features = events_features.append(generate_features(event), ignore_index=True)


    evsdf = events_sdf.merge(events_features, left_index=True, right_index=True)
    ev = evsdf.dropna().astype({'date':'str','start':'str','end_':'str'})

    # to_featurelayer fails because there are less than 1000 entries.
    # So, instead we just saved a csv.
    ev.spatial.to_featurelayer("Events Features", tags="features")
    evsdf.to_csv("events-features1.csv")
```

In [26]:

```
evsdf = pd.read_csv("events-features1.csv", index_col="Unnamed: 0")
evsdf.head(3)
```

Out[26]:

SHAPE	date	end_	id	latitude	longitude	start	title	total_atte	type	service_area	num_vehicles	av_ratio	dist_to_highway
{'x': 2312.189404054, 357633.435881...	2018-08-08	14:00:00	49813	32.715738	-117.161084	11:00:00	curbside bites food truck markets - downtown l...	330	farmers	4.516798e+06	15931	0.020714	684.266175
{'x': 2916.620843215, 358589.669007...	2018-08-08	13:00:00	50910	32.722965	-117.166514	09:00:00	little italys wednesday farmers market	1280	farmers	3.459450e+06	9725	0.131620	191.687997
{'x': 2720.918015596, 368787.072960...	2019-12-31	19:00:00	51870	32.799998	-117.254587	14:00:00	pacific beach tuesday farmers market	860	farmers	8.995374e+06	14633	0.058771	3384.512326

9. Summary & Results

Although we were unable to make real event traffic impact predictions, we were successful in creating a framework that can be used to make such predictions if historical service area data were to become available in the future. The framework is generally easy to interpret and can be modified if alternate features prove to be more effective. Gathering more data for this framework is also relatively easy as event location, attendance, type, and time is readily accessible online.

```
X = generate_features([events])

impacted_areas = area_service_area([
    calc_service_area([events], baseline=False)
])
y = (impacted_areas - X.service_areas) / X.service_areas

model.fit(X, y)
```

We have had the opportunity to research and work on a topic that has very rarely been explored. This framework can be used to guide future work and help different parties assess the impact of events on nearby traffic conditions.

10. Conclusion & Future Work

We were not quite able to completely answer our initial research question. As has already been mentioned, we were unable to gain access to historical traffic data and could therefore not calculate the traffic impact of an event. If we were to gain access to such data, we can assess the predictive power of the features we generated or explore other possible features that could help determine traffic impact.

Despite the drawbacks, we believe that we have created something useful that can be used for future development, not just in events, but other facets of society. For example, it could be used to assess the traffic impact of newly built infrastructure in a city such as business buildings or schools. In such cases, we can treat estimated daily human traffic as attendance and the hours of work or school as times. Really any area with a known location, daily attendance, and time can be treated as an event.

Ultimately, many small parameters/arguments can be changed in the code above in order to facilitate the study of different areas. For example: the service areas can be calculated using DirectionFromFacility instead of DirectionTo, and the datetime passed in would use the end time of the event instead of the start time. Likewise, the service area could be any distance, whether that is driving, walking, or biking. It really depends on the user and what they hope to accomplish. This is why there isn't necessarily a specific individual that this is targeted for.