Deco_policing

March 19, 2021

```
[16]: import altair as alt
      import pandas as pd
      %matplotlib inline
      import matplotlib.pyplot as plt
      import seaborn as sb
      import datetime

      import geopandas as gpd
      import geoplot
      import geoplot.crs as gcrs

      from pyproj import CRS
      import contextily, geoplot

      # https://github.com/darribas/contextily
      import contextily

      import matplotlib.colors as colors
```

```
[17]: denco_poli_df = pd.read_csv("denver-1.nov.csv", parse_dates=[['date', 'time']])
      denco_poli_df.head()
```

```
[17]:           date_time  raw_row_number                        location  \
      0 2012-11-13 00:02:22               1           8500 W CRESTLINE AVE
      1 2012-11-29 00:25:01              16           8500 W CRESTLINE AVE
      2 2012-11-23 22:58:10              72              4830 S HOLLAND WAY
      3 2012-11-27 17:48:33             121               4885 S QUEBEC ST
      4 2012-11-14 23:46:58             138  W LAYTON AVE / S WADSWORTH BLVD

               lat         lng district precinct        type  \
      0  39.618329 -105.092691        4      423   vehicular
      1  39.618329 -105.092691        4      423   vehicular
      2  39.630666 -105.102551        4      423   vehicular
      3  39.626174 -104.904062        3      324  pedestrian
      4  39.630150 -105.081693        4      423   vehicular

                     disposition  arrest_made  citation_issued  warning_issued  \
```

```
0  K - Street Check Completed          False          False          False
1              Party Advised           False          False          False
2  K - Street Check Completed          False          False          False
3                In Service            False          False          False
4              Party Advised           False          False          False

   outcome
0     NaN
1     NaN
2     NaN
3     NaN
4     NaN
```

[18]:
```python
# check unique data type under column type
denco_poli_df["type"].unique()
```

[18]:
```
array(['vehicular', 'pedestrian'], dtype=object)
```

[19]:
```python
# check unique data type under column outcome
denco_poli_df["outcome"].unique()
```

[19]:
```
array([nan, 'warning', 'citation', 'arrest'], dtype=object)
```

[21]:
```python
#denco_poli_df.set_index(['date', 'time'], drop=False)
#denco_poli_df['date'] = pd.to_datetime(denco_poli_df["date"])
#denco_poli_df = denco_poli_df.sort_values(by='date')
type(denco_poli_df["date_time"])
denco_poli_df["date_time"] = pd.to_datetime(denco_poli_df["date_time"])
denco_poli_df = denco_poli_df.set_index("date_time")
denco_poli_df = denco_poli_df.sort_index()
denco_poli_df.head()
```

[21]:
```
                      raw_row_number                      location        lat  \
date_time
2012-11-01 00:00:33          174594   E ALAMEDA AVE / S BROADWAY ST  39.711158
2012-11-01 00:00:48          289271             1500 N WASHINGTON ST  39.740017
2012-11-01 00:03:27          239537        W 8TH AVE / N KALAMATH ST  39.728925
2012-11-01 00:04:21          316963      N MONACO ST / E COLFAX AVE  39.740154
2012-11-01 00:09:44          645990        E 51ST AVE / N PEORIA ST  39.789278

                            lng district precinct        type  \
date_time
2012-11-01 00:00:33 -104.987575        3      311   vehicular
2012-11-01 00:00:48 -104.978743        6      621  pedestrian
2012-11-01 00:03:27 -105.000176        1      123   vehicular
2012-11-01 00:04:21 -104.912430        2      223   vehicular
2012-11-01 00:09:44 -104.847087        5      521   vehicular
```

```
                          disposition  arrest_made  citation_issued  \
date_time
2012-11-01 00:00:33  T - Citation Issued        False             True
2012-11-01 00:00:48           In Service        False            False
2012-11-01 00:03:27        Warning Issued        False            False
2012-11-01 00:04:21          Arrest Made         True            False
2012-11-01 00:09:44          Arrest Made         True            False


                     warning_issued   outcome
date_time
2012-11-01 00:00:33           False  citation
2012-11-01 00:00:48           False       NaN
2012-11-01 00:03:27            True   warning
2012-11-01 00:04:21           False    arrest
2012-11-01 00:09:44           False    arrest
```

```python
denco_poli_gdf = gpd.GeoDataFrame(
    denco_poli_df, geometry=gpd.points_from_xy(denco_poli_df.lng, denco_poli_df.
  lat))
```

```python
denco_poli_gdf.head()
```

```
                       raw_row_number                     location        lat  \
date_time
2012-11-01 00:00:33            174594  E ALAMEDA AVE / S BROADWAY ST  39.711158
2012-11-01 00:00:48            289271            1500 N WASHINGTON ST  39.740017
2012-11-01 00:03:27            239537      W 8TH AVE / N KALAMATH ST  39.728925
2012-11-01 00:04:21            316963     N MONACO ST / E COLFAX AVE  39.740154
2012-11-01 00:09:44            645990       E 51ST AVE / N PEORIA ST  39.789278


                            lng district precinct        type  \
date_time
2012-11-01 00:00:33 -104.987575        3      311    vehicular
2012-11-01 00:00:48 -104.978743        6      621   pedestrian
2012-11-01 00:03:27 -105.000176        1      123    vehicular
2012-11-01 00:04:21 -104.912430        2      223    vehicular
2012-11-01 00:09:44 -104.847087        5      521    vehicular


                          disposition  arrest_made  citation_issued  \
date_time
2012-11-01 00:00:33  T - Citation Issued        False             True
2012-11-01 00:00:48           In Service        False            False
2012-11-01 00:03:27        Warning Issued        False            False
2012-11-01 00:04:21          Arrest Made         True            False
2012-11-01 00:09:44          Arrest Made         True            False
```

```
                        warning_issued    outcome                       geometry
date_time
2012-11-01 00:00:33             False    citation  POINT (-104.98758 39.71116)
2012-11-01 00:00:48             False         NaN  POINT (-104.97874 39.74002)
2012-11-01 00:03:27              True     warning  POINT (-105.00018 39.72892)
2012-11-01 00:04:21             False      arrest  POINT (-104.91243 39.74015)
2012-11-01 00:09:44             False      arrest  POINT (-104.84709 39.78928)
```

```python
[24]: # check unique disposition
      denco_poli_gdf['disposition'].unique()
```

```
[24]: array(['T - Citation Issued', 'In Service', 'Warning Issued',
             'Arrest Made', 'Party Advised', 'Vehicle Towed',
             'K - Street Check Completed', 'Back Up / Cover Car', 'Detox Van',
             'No Police Needed', 'Z - Test', 'File Only', 'CIT Report',
             'L - Clearance', 'UTL / Unfounded / Unsuccessful', 'Report Made',
             'Arrest Made,T - Citation Issue', '1 - Alarm RP On Scene',
             'O - Veh Released to Owner', 'Y - Broadcast',
             'K - Street Check Completed,T -', '2 - Alarm False', 'GOA',
             'K - Street Check Completed,L -', 'X - Exchanged Info',
             'Supervisor Cancelled Inc', 'Arrest Made,K - Street Check C',
             'Evidence / Property', 'Report Made,T - Citation Issue', 'None',
             'K - Street Check Completed,Par', '1 - Alarm RP On Scene,K - Stre',
             'Vehicle Towed,Warning Issued', '3 - Alarm Good',
             'Detox Van,K - Street Check Com'], dtype=object)
```

```python
[25]: # only gets arrest made rows
      denco_poli_arrest_gdf = denco_poli_gdf[denco_poli_gdf['arrest_made'] == True]
      denco_poli_arrest_gdf.head()
```

```
[25]:                     raw_row_number                    location        lat  \
      date_time
      2012-11-01 00:04:21          316963     N MONACO ST / E COLFAX AVE  39.740154
      2012-11-01 00:09:44          645990        E 51ST AVE / N PEORIA ST  39.789278
      2012-11-01 00:12:35          206927       W 6TH AVE / N KALAMATH ST  39.725708
      2012-11-01 00:21:46           41838  S COLORADO BLVD / E EVANS AVE  39.678415
      2012-11-01 00:24:19          572410      E 45TH AVE / N CLAYTON ST  39.778931

                                 lng district precinct        type disposition  \
      date_time
      2012-11-01 00:04:21 -104.912430        2      223    vehicular  Arrest Made
      2012-11-01 00:09:44 -104.847087        5      521    vehicular  Arrest Made
      2012-11-01 00:12:35 -105.000148        1      123    vehicular  Arrest Made
      2012-11-01 00:21:46 -104.940748        3      314   pedestrian  Arrest Made
      2012-11-01 00:24:19 -104.954136        2      212    vehicular  Arrest Made

                          arrest_made  citation_issued  warning_issued outcome  \
```

4

```
            date_time
2012-11-01 00:04:21                    True                   False                    False   arrest
2012-11-01 00:09:44                    True                   False                    False   arrest
2012-11-01 00:12:35                    True                   False                    False   arrest
2012-11-01 00:21:46                    True                   False                    False   arrest
2012-11-01 00:24:19                    True                   False                    False   arrest


                                                              geometry
            date_time
2012-11-01 00:04:21  POINT (-104.91243 39.74015)
2012-11-01 00:09:44  POINT (-104.84709 39.78928)
2012-11-01 00:12:35  POINT (-105.00015 39.72571)
2012-11-01 00:21:46  POINT (-104.94075 39.67842)
2012-11-01 00:24:19  POINT (-104.95414 39.77893)
```

[26]:
```python
# gets state .shp data for generating state polygon image
states_gdf = gpd.read_file('tl_2019_us_state/tl_2019_us_state.shp')
states_gdf.head()
```

[26]:
```
   REGION DIVISION STATEFP    STATENS GEOID STUSPS            NAME LSAD   MTFCC  \
0       3        5      54   01779805    54     WV   West Virginia   00   G4000
1       3        5      12   00294478    12     FL         Florida   00   G4000
2       2        3      17   01779784    17     IL        Illinois   00   G4000
3       2        4      27   00662849    27     MN       Minnesota   00   G4000
4       3        5      24   01714934    24     MD        Maryland   00   G4000

  FUNCSTAT          ALAND        AWATER      INTPTLAT       INTPTLON  \
0        A    62266231560     489271086   +38.6472854   -080.6183274
1        A   138947364717   31362872853   +28.4574302   -082.4091477
2        A   143779863817    6215723896   +40.1028754   -089.1526108
3        A   206230065476   18942261495   +46.3159573   -094.1996043
4        A    25151726296    6979340970   +38.9466584   -076.6744939

                                    geometry
0  POLYGON ((-81.74725 39.09538, -81.74635 39.096…
1  MULTIPOLYGON ((((-86.38865 30.99418, -86.38385 …
2  POLYGON ((-91.18529 40.63780, -91.17510 40.643…
3  POLYGON ((-96.78438 46.63050, -96.78434 46.630…
4  POLYGON ((-77.45881 39.22027, -77.45866 39.220…
```

[27]:
```python
# read counties shp file that gest counties polygon shape
co_counties_gdf = gpd.read_file('co_counties/co_counties/co_counties.shp')

co_counties_gdf['county'] = co_counties_gdf['county'].str.title()

co_counties_gdf.head(1)
```

```
[27]:    co_fips county  househo_20  pop_2010      shape_st_1       shape_st_2  \
    0      1.0  Adams    154502.0   441603.0   3.064413e+09   392729.110497

       shape_star  shape_stle                                        geometry
    0         0.0         0.0  POLYGON ((-103.70574 39.99991, -103.70569 39.9…
```

```
[28]: # set x and y axis of points on the grid to lng and lat.
      geometry_s = gpd.points_from_xy(x = denco_poli_gdf['lng'],
                                       y = denco_poli_gdf['lat'],
                                       crs = 'EPSG:4326',
                                       )

      denco_poli_gdf = gpd.GeoDataFrame(denco_poli_gdf,
                              geometry = geometry_s)
```
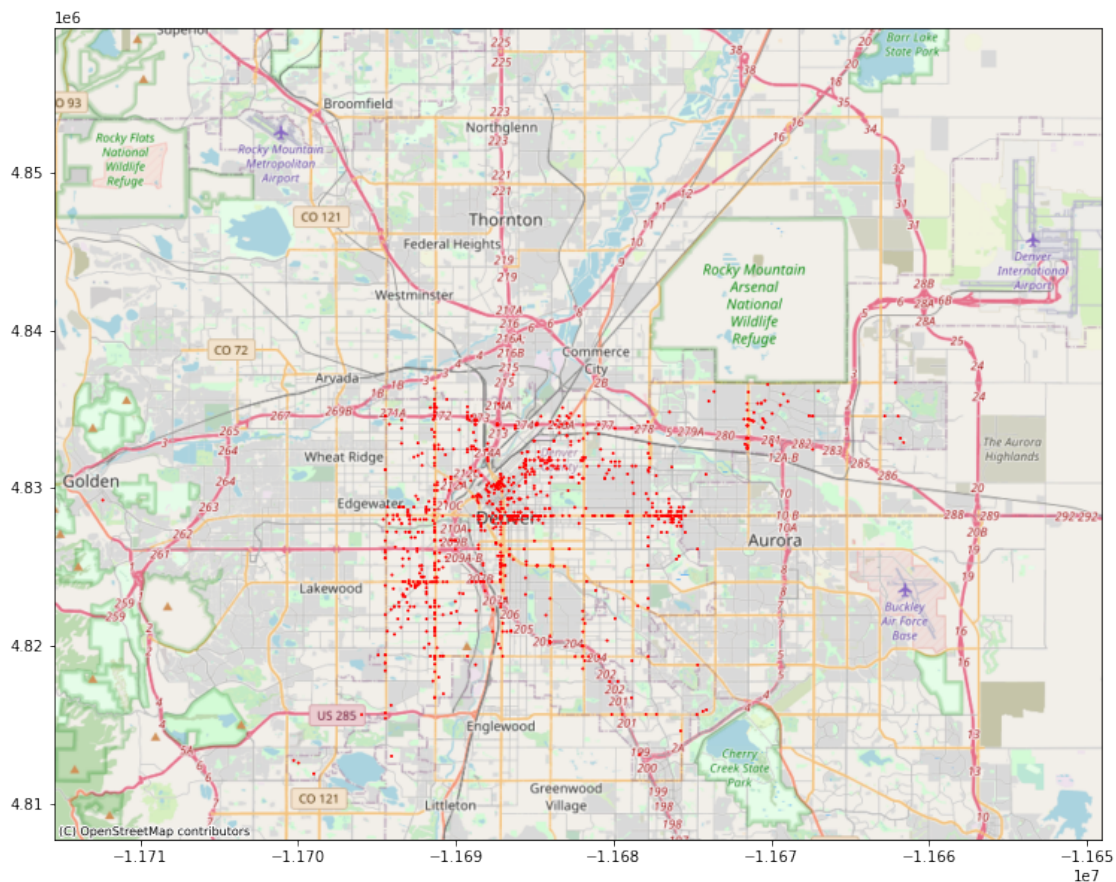
```
[34]: # Visualize arrest made data points on map
      denco_poli_arrest_3857_gdf = denco_poli_gdf.to_crs("EPSG:3857")

      f,ax = plt.subplots(figsize=(15,10))

      denco_poli_arrest_3857_gdf.plot(ax=ax,markersize='arrest_made',color='r')
      contextily.add_basemap(ax,source=contextily.providers.OpenStreetMap.Mapnik)
```
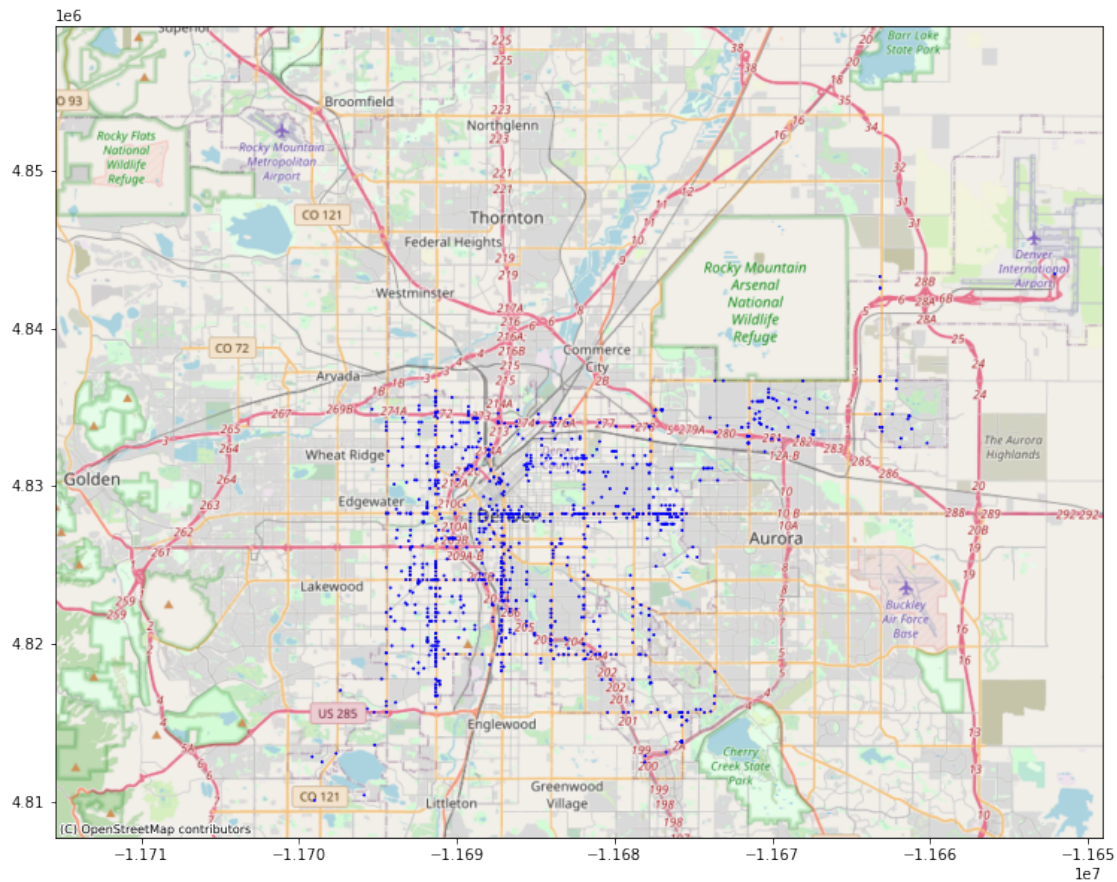
```
[30]:  # plot citation made points location on basmap
       #counts = denco_poli_df.loc[denco_poli_df['disposition']=="Arrest Made"].
        ↪groupby(denco_poli_df.index()).count()
       denco_poli_3857_gdf = denco_poli_gdf.to_crs("EPSG:3857")

       f,ax = plt.subplots(figsize=(15,10))

       denco_poli_3857_gdf.plot(ax=ax,markersize='citation_issued',color='b')
       contextily.add_basemap(ax,source=contextily.providers.OpenStreetMap.Mapnik)
```
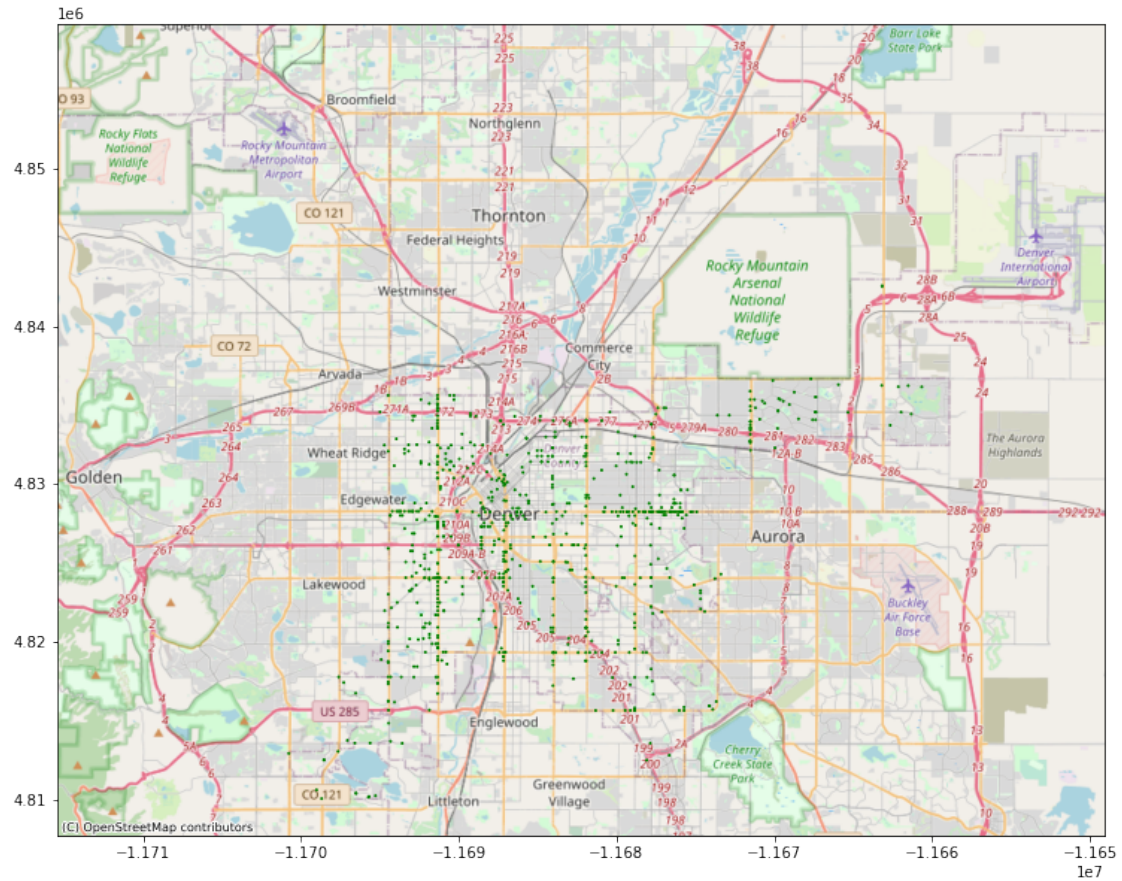


```
[31]:  # plot warning issued points location on base map
       denco_poli_3857_gdf = denco_poli_gdf.to_crs("EPSG:3857")

       f,ax = plt.subplots(figsize=(15,10))

       denco_poli_3857_gdf.plot(ax=ax,markersize='warning_issued',color='g')
       contextily.add_basemap(ax,source=contextily.providers.OpenStreetMap.Mapnik)
```

```
[33]: denco_poli_gdf.head()
```

```
[33]:                          raw_row_number                     location        lat  \
      date_time
      2012-11-01 00:00:33             174594  E ALAMEDA AVE / S BROADWAY ST  39.711158
      2012-11-01 00:00:48             289271            1500 N WASHINGTON ST  39.740017
      2012-11-01 00:03:27             239537      W 8TH AVE / N KALAMATH ST  39.728925
      2012-11-01 00:04:21             316963     N MONACO ST / E COLFAX AVE  39.740154
      2012-11-01 00:09:44             645990        E 51ST AVE / N PEORIA ST  39.789278


                                   lng district precinct       type  \
      date_time
      2012-11-01 00:00:33 -104.987575        3      311   vehicular
      2012-11-01 00:00:48 -104.978743        6      621  pedestrian
      2012-11-01 00:03:27 -105.000176        1      123   vehicular
      2012-11-01 00:04:21 -104.912430        2      223   vehicular
      2012-11-01 00:09:44 -104.847087        5      521   vehicular


                              disposition  arrest_made  citation_issued  \
```

```
                  date_time
2012-11-01 00:00:33    T - Citation Issued              False                True
2012-11-01 00:00:48              In Service             False               False
2012-11-01 00:03:27         Warning Issued              False               False
2012-11-01 00:04:21            Arrest Made               True               False
2012-11-01 00:09:44            Arrest Made               True               False


                          warning_issued    outcome                      geometry
date_time
2012-11-01 00:00:33              False     citation  POINT (-104.98758 39.71116)
2012-11-01 00:00:48              False          NaN  POINT (-104.97874 39.74002)
2012-11-01 00:03:27               True      warning  POINT (-105.00018 39.72892)
2012-11-01 00:04:21              False        arrest  POINT (-104.91243 39.74015)
2012-11-01 00:09:44              False        arrest  POINT (-104.84709 39.78928)
```

[40]:
```python
# count arrest made
denco_poli_gdf.arrest_made.value_counts()
```

[40]:
```
False    5380
True      985
Name: arrest_made, dtype: int64
```

[42]:
```python
# count citation issued
denco_poli_gdf.citation_issued.value_counts()
```

[42]:
```
False    5300
True     1065
Name: citation_issued, dtype: int64
```

[43]:
```python
# count warning issued
denco_poli_gdf.warning_issued.value_counts()
```

[43]:
```
False    5633
True      732
Name: warning_issued, dtype: int64
```

[44]:
```python
# export a json file for chart js web plot
import json
with open("Denco_poli_outcome.json", "w") as outfile:
    outfile.write(json.dumps({"Arrest made":985, "Citation Issued":1065,
    ↪"Warning Issued": 732}))
```

[ ]: