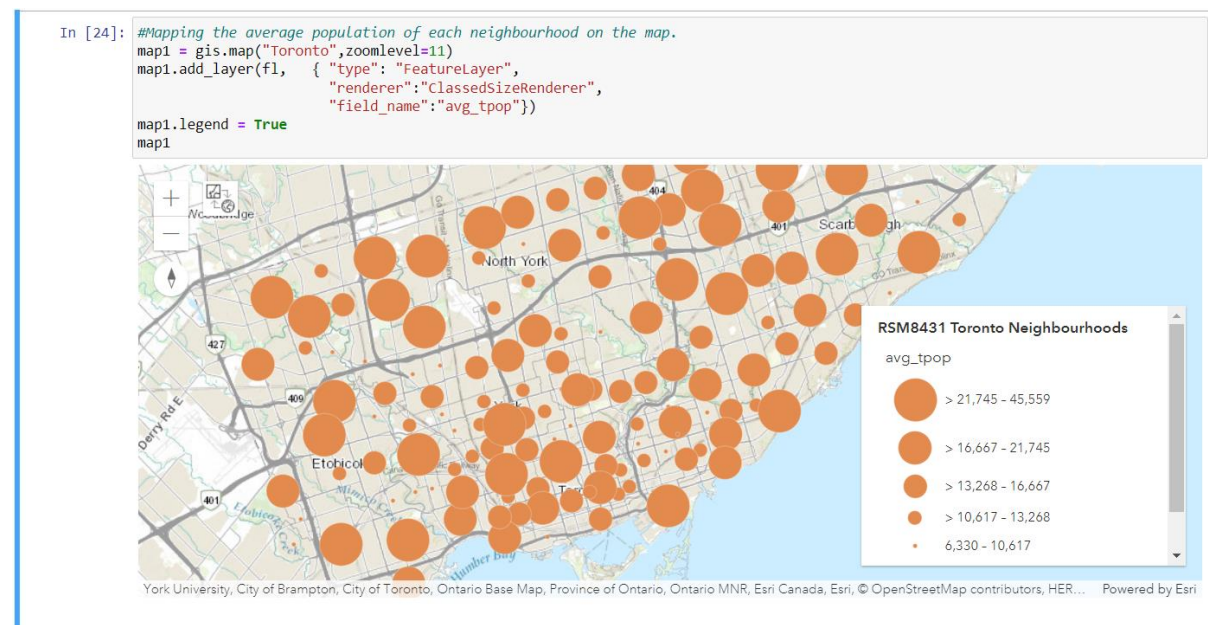


Python Assignment 4 README

Summary:

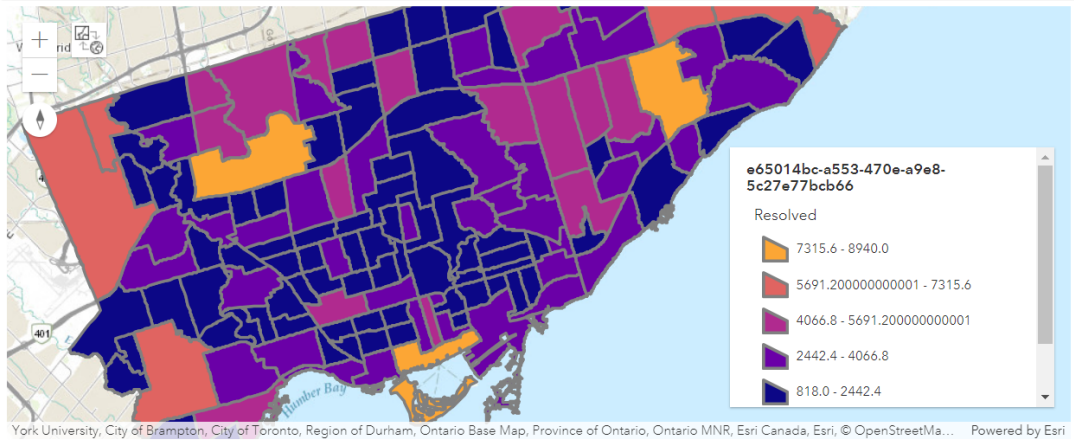
We utilize ArcGIS API for Python to visualize and analyse the geospatial maps while evidencing the data. We connect to the ArcGIS API and utilize the feature layer for Toronto Neighbourhoods created by Professor Michael MacDonald. From the feature layer, we take the neighbourhood names, shape, shape area, shape length & average total population. We utilise the "covid-19-cases-in-toronto" from the University of Toronto's comprehensive data repository on COVID-19. To utilize the huge dataset, we use pivot tables on excel to create the sheets containing the data to be mapped. Data cleaning is performed to ensure alignment between the names of the datasets prior to merging. We append the columns instead of merging as it results in the some of the neighbourhoods not being mapped. For the first map, we visualize the average total population in a simple map with each data point being evidenced by bubble with its size representative of the population. The following two choropleth maps evidence the resolved cases and fatalities based on each neighbourhood. Please refer to the jupyter notebook. Finally for our data visualization, we look at the number of cases per the date in a time series analysis. We see the cases spiked in the year 2022 and have stabilized post it. This maybe due to the increase mutations of the virus and the spreading of the virus through migration across the world. The decrease post this period maybe attributed to the lockdown implications and vaccines coming into play.

Average Total Population Map



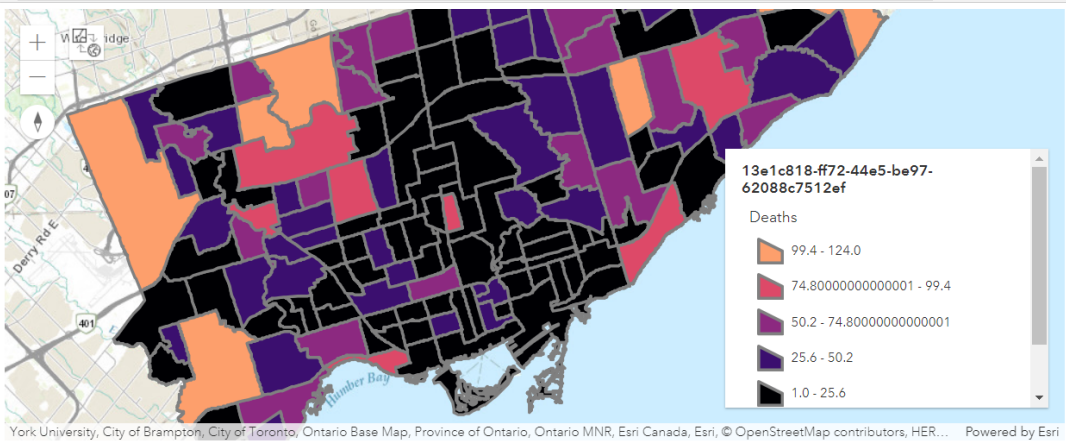
Resolved Cases Map

```
In [27]: #Mapping resolved cases per neighbourhood.
toronto_map1 = gis.map("Toronto", zoomlevel=11)
toronto_map1.clear_graphics()
try:
    df_toronto.spatial.plot(map_widget=toronto_map1, renderer_type='c', method='esriClassifyNaturalBreaks', class_count=5, col='Resolved')
    toronto_map1.legend = True
except:
    print("Error in mapping. Please check data. Possible depreciation in functions used by code.")
toronto_map1
```



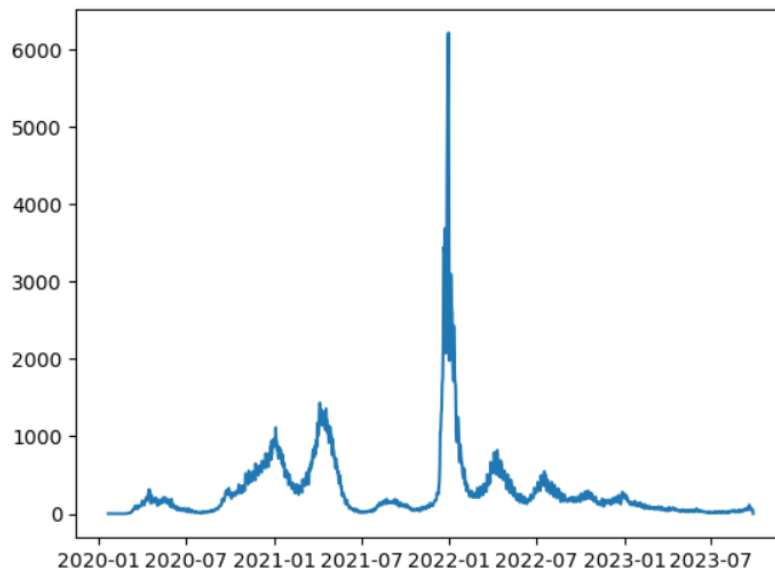
Fatalities Map

```
In [28]: #Mapping fatalities per neighbourhood
toronto_map2 = gis.map("Toronto", zoomlevel=11)
toronto_map2.clear_graphics()
try:
    df_toronto.spatial.plot(map_widget=toronto_map2, renderer_type='c', method='esriClassifyNaturalBreaks', class_count=5, col='Deaths')
    toronto_map2.legend = True
except:
    print("Error in mapping. Please check data. Possible depreciation in functions used by code.")
toronto_map2
```



Time Series Analysis

```
In [30]: #Plotting function to identify trends.
def plottingtool(x,y):
    """Plot graphs between x & y to identify trends."""
    try:
        plt.plot(x,y)
    except:
        print("Mapping variables need to be checked.")
    #Visualizing the data of the number of cases against dates to see the trends across the years.
    plottingtool(covidcases.EpisodeDate,covidcases.NumberOfCases)
```



Required Dependencies:

- **Python Version 3.9**
- spatial.plot uses the np.int function to render the choropleth map which was depreciated in numpy version 1.20. Therefore, we have to uninstall the latest numpy version and installed **numpy 1.23** to ensure the function works.
- arcgis.gis
- arcgis.features
- pandas
- matplotlib.pyplot

Challenges:

- Installation of python version 3.9.
- Selecting the appropriate feature layer.
- Use of the function merge to join datasets resulted in certain neighbourhoods not being plotted, therefore sorted and aligned data between datasets and append the columns to the data for plotting.
- Plotting the choropleth map resulted in an error due to a np.int being depreciated as part of the newer versions of numpy. Therefore, had to reinstall the appropriate version of numpy to help plot the choropleth maps.