

Due: 11:59pm, Mar. 31, 2023

Learning Objectives

You will gain experience with GeoPandas and Plotly Express in this assignment.

Instructions

Download the following data sets from Brightspace for this assignment:

- fuel-efficiency.csv
- students.csv
- canada.shp and associated files
- universities.geojson

`fuel-efficiency.csv` contains information about the average fuel efficiency (in units of L / 100 km) for Toyota Corolla vehicles throughout Canadian seasons.

`students.csv` has the number of university students enrolled in each province of Canada.

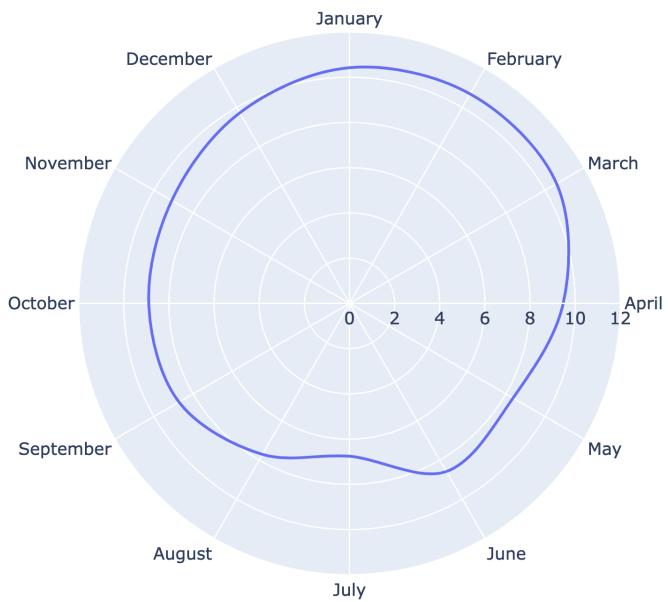
`universities.geojson` contains a selected number of universities throughout Canada, with information on their total number of students, research funding, and location.

`canada.shp` and associated files contain a geographic map of Canada with boundaries specified for each province.

Using the provided data sets, create a Jupyter notebook that answers the following questions. You may only import the pandas, GeoPandas, Matplotlib, Seaborn and Plotly libraries.

Question 1: (30 pts)

The radar plot below shows the average fuel efficiency (in units of L / 100 km) for Toyota Corolla vehicles for each month of the year. There is greater fuel efficiency in Summer (~8 L / 100 km) and worse fuel efficiency in Winter (~10 L / 100 km), representing roughly a 25% decrease in fuel efficiency.

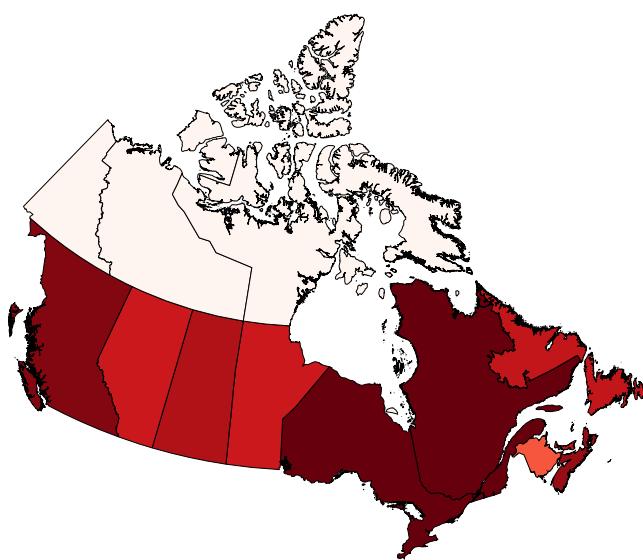


Re-create the above radar plot using Plotly and the `fuel-efficiency.csv` data set. The radar plot uses a smooth curve to join the points, called a spline (hint: `line_shape`). Make sure the ordering of the days of the week match the figure above.

Question 2: (30 pts)

The choropleth map below shows the percentage of each province's population that are university or college students. Plotting relative data works well for spatial data, as plotting the absolute number of students would just highlight the most populous provinces. Instead, we can see that the proportion of students has only modest variations throughout Canada.

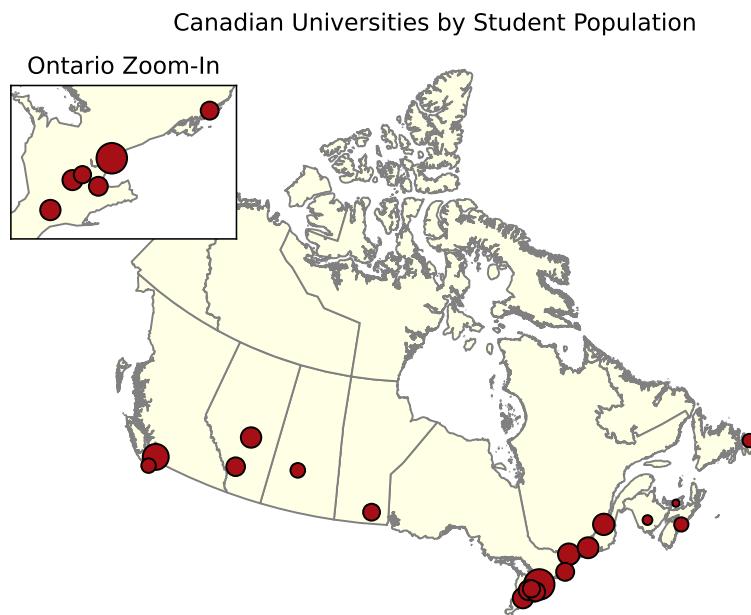
Students as Percentage of Population



Re-create the above choropleth map using GeoPandas and the `students.csv` data set. The map of Canada is given in the `canada.shp` file and associated files. The colour map uses the “Reds” colour map from ColorBrewer. Make sure to highlight the borders of each province and territory, and to include the title.

6934 Students Only – Question 3: (40 pts)

The map below shows the location of a number of universities throughout Canada. Each university is represented by a point, and the size of each point corresponds to the number of students enrolled at that university. Inset into the map is a close-up view of Southern Ontario, where there is a high density of universities.



Using the `universities.geojson` data set and map of Canada shapefiles, re-create the above visualization with GeoPandas. The universities data set uses the world geodetic system (EPSG:4326) as its coordinate reference system, which is based on latitude and longitude. The Canada shapefiles use the North American Datum geodetic system with Lambert conformal conic projection (EPSG:3347). Its units are in metres. You will need to reconcile the differences between these coordinate reference systems.

Make sure to include the inset with a zoom-in view of Southern Ontario. It contains the 6 universities of The University of Toronto, the University of Waterloo, the University of Guelph, McMaster University, Queen’s University, and the University of Western Ontario.

The point size for each university should be scaled to the total number of students. The background colour of Canada is a pale yellow (#FFFFE5) and the universities are red (#A50F15). Make sure

to highlight the borders of each province and territory. Include the titles for the visualization and Ontario zoom-in.

Submission

Submit your Jupyter notebook (`.ipynb`) through Brightspace. Late submissions will be subject to a 10% penalty for each hour past the deadline.

Attribution

Submissions should include an attribution section indicating any sources of material, ideas or contribution of others to the submission.

Submissions must represent your independent work.

You are encouraged to use any resources to help with your solution, but your solution must represent independent work. If your submitted work includes unacknowledged collaboration, code materials, ideas or other elements that are not your original work, it may be considered plagiarism or some other form of cheating under MUN general regulations 6.12.4.2 (4.12.4.2 for graduate students) and academic penalties will be applied accordingly.

Avoid academic penalties by properly attributing any contribution to your submission by others, including internet sources and classmates. This will also help distinguish what elements of the submission are original. You may not receive full credit if your original elements are insufficient, but you can avoid penalties for plagiarism or copying if you acknowledge your sources.

Github

I encourage you to store and version your work on GitHub. It is good practice to do so as everyone uses git in the real world.

However, **it is a requirement that git repositories containing assignment material be private.** University regulations (undergraduate 6.12.4.2 and graduate 4.12.4.2) consider it cheating if you allow your work to be copied. There will be zero tolerance for this.