GEOG476 Class Project

Fall 2019

The goal of GEOG476 is to teach students more advanced programming skills in object oriented programming languages (i.e. Python). In addition, students are expected to develop proficiency in applying these advanced programming principles to manipulating spatial data sources within the Geographic Information Systems (GIS).

For your class project, each group should apply the object-oriented programming principles you have learned in the class to develop a geospatial application that retrieve, process, analyze and visualize geographic dynamic phenomena.

The following scenario is an example that you can apply your object-oriented programming skills in. It's completely fine if your team have other ideas that you would like to work on for the class projects.

Hurricane is a commonly experienced natural hazard for the US. When hurricane lands, it can bring tremendous damage to communities. NOAA keeps a database of the tracks of all the hurricanes since the 19th century. Here is a link to the Atlantic hurricane database (1851-2018). You can find a data description in this file.

For example, here is a part of the track of 2017 Hurricane Harvey.

```
AL092017,            HARVEY,     74,
20170816, 0600,  , LO, 13.7N,  45.8W,  25, 1013,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170816, 1200,  , LO, 13.7N,  47.4W,  25, 1010,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170816, 1800,  , LO, 13.6N,  49.0W,  25, 1009,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170817, 0000,  , LO, 13.6N,  50.6W,  25, 1010,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170817, 0600,  , TD, 13.4N,  52.0W,  25, 1008,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170817, 1200,  , TD, 13.1N,  53.4W,  30, 1008,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170817, 1800,  , TS, 13.0N,  55.0W,  35, 1004,  30,   0,   0,  30,   0,   0,   0,   0,   0,   0,   0,   0,
20170818, 0000,  , TS, 13.0N,  56.6W,  40, 1003,  50,   0,   0,  50,   0,   0,   0,   0,   0,   0,   0,   0,
20170818, 0600,  , TS, 13.0N,  58.4W,  40, 1004,  50,   0,   0,  50,   0,   0,   0,   0,   0,   0,   0,   0,
20170818, 1000, L, TS, 13.1N,  59.6W,  40, 1004,  50,   0,   0,  50,   0,   0,   0,   0,   0,   0,   0,   0,
20170818, 1200,  , TS, 13.1N,  60.3W,  40, 1004,  60,   0,   0,  60,   0,   0,   0,   0,   0,   0,   0,   0,
20170818, 1500, L, TS, 13.2N,  61.2W,  40, 1004,  60,   0,   0,  60,   0,   0,   0,   0,   0,   0,   0,   0,
20170818, 1800,  , TS, 13.2N,  62.2W,  35, 1005,  60,   0,   0,  60,   0,   0,   0,   0,   0,   0,   0,   0,
20170819, 0000,  , TS, 13.4N,  64.0W,  35, 1005,  60,   0,   0,  60,   0,   0,   0,   0,   0,   0,   0,   0,
20170819, 0600,  , TS, 13.5N,  65.7W,  35, 1005,  60,   0,   0,  60,   0,   0,   0,   0,   0,   0,   0,   0,
20170819, 1200,  , TD, 13.7N,  67.5W,  30, 1006,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170819, 1800,  , WV, 13.8N,  69.2W,  30, 1007,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170820, 0000,  , WV, 14.0N,  71.0W,  30, 1007,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170820, 0600,  , WV, 14.2N,  72.9W,  30, 1007,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170820, 1200,  , WV, 14.4N,  75.0W,  30, 1006,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170820, 1800,  , WV, 14.7N,  76.8W,  30, 1007,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170821, 0000,  , WV, 15.1N,  78.6W,  25, 1007,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170821, 0600,  , WV, 15.7N,  80.5W,  25, 1008,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170821, 1200,  , WV, 16.4N,  82.5W,  25, 1008,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170821, 1800,  , WV, 17.3N,  84.6W,  25, 1008,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170822, 0000,  , WV, 18.0N,  86.4W,  25, 1008,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170822, 0600,  , WV, 18.6N,  87.8W,  25, 1009,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170822, 1200,  , WV, 19.4N,  88.8W,  25, 1010,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170822, 1800,  , LO, 20.0N,  89.7W,  25, 1010,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170823, 0000,  , LO, 20.5N,  90.7W,  25, 1009,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170823, 0600,  , LO, 20.9N,  91.6W,  25, 1008,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170823, 1200,  , TD, 21.4N,  92.3W,  30, 1006,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
20170823, 1800,  , TS, 21.6N,  92.4W,  35, 1005,  60,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
```

After transforming this into a geography object, it can be visualized as following:

You can then use both the spatial and temporal information of the hurricane track to report what state, what county will be on its path at what time.

Project tasks :

1. **Data preparation**
   a. Download the Atlantic hurricane database
   b. Select a 10 year period as your study time, and extract all the hurricane records for your study time.
   c. Download US national county data and primary road network data from the census bureau.

2. **Data modeling**
   a. Use object-oriented modeling approach to model **Hurricane**, **County**, and **Roads**.
   b. There is no specific requirements for what attributes and what methods should be included in your model of each geographic objects.

But all of your geographic objects should at least have these two methods:

    i. **intersect** method: determine whether current object intersect with other objects.

    ii. **visualization** method: plot the geographic objects

3. **Data analysis**
   a. For the study time period you have picked, create a map for each year
      i. This map should include all the hurricane paths in that year, together with county and road network
      ii. The county and road segments that have been passed by hurricane should have different color.
   b. For the study time period you have picked, create a map for the whole study time period
      i. This map should include all the hurricane paths in this period, together with county and road network
      ii. Create a choropleth map of counties based on the number of times a county has been passed by hurricanes.
      iii. Create a choropleth map of road network based on the number of times a road segment has been passed by hurricanes.
4. **Data report**
   a. Create a report for your study period that shows the following information for all hurricanes
      i. Hurricane XX passes county YY at YYYY-MM-DD HH

If you choose to work on this idea, your group will select a **10-year time period** to work on. If your team have other ideas, please discuss your idea with me.

Project Timeline

- Project proposal report: Your team have to submit a project proposal report by **Nov 18th.** The project proposal needs to include :
  - Introduction of *your group topic*, *background information.*
  - *Object-oriented analysis*
  - *Object-oriented design*
  - *Preliminary analysis of the data you have collected for your project.*
- Project proposal presentation on **Nov 20th.**

- Final project report **due by Dec 11th 5:00pm**
    - Code implementation
    - Analysis results, visualization
    - Results writeup
    - Your final project report should be in a Jupyter Notebook format.
- Final project presentation on **Dec 9th&Dec 11th during class time.**

    - Your final project presentation will also be presented live in a Jupyter Notebook.

Have fun and go chase some hurricane!