GGRC30H3: Advanced GIS

Kamal Paudel, Department of Human Geography
University of Toronto Scarborough

Assigned Date: 2017-10-26
Due date: 2017-11-16
Assignment #3: Areal interpolation and demographic analysis

(Total of 20 Marks- 10% of the final grade)

Learning objectives:

a. **You should be able to use join tabular data to GIS files and conduct analysis**
b. **You should be able to follow areal interpolation methods to estimate values**
c. **You should be able to conduct demographic analysis to solve problems**
d. **You should be able to use SimplyMap software to download relevant data**

Problem background:

The direct health care cost has a very high impact in the livelihood of a lot of Torontonians. We are interested in exploring whether there is a lower direct health care cost per household if they live close to subways (TTC) vs further away. (i.e. because you are more likely to walk to use the subway (higher physical activities, instead of owning a car!)). To find the solutions, you will follow the guidelines from below:

1. Buffer 500m and 1,500m (or 1.5 km) from the subway lines and calculate the total population and population density.
2. Use SimplyMap and download the direct health care spending data and join them with the Census Tracts.
3. Use two apportionment methods (centroid based) and simple buffer containment to come up with the population density estimate and average direct health care spending estimates.
4. Conclusion: make a recommendation why one of the buffer methods is a better option to settle this debate and whether it is cheaper to live close to or further away from the subway line if the distance were the only factor in direct health care spending.

Y*our job is to go through multiple apportionments/areal interpolation methods to come up with the best results, fill out the table provided, answer the questions and come up with the conclusion to answer given questions (question #11). Of course, you need to make a map…GIS*

class it is after all! ***You are required to provide answers from item numbers 7, 9, 10 & 11 below.***

You will be using the following methods: refer to (Higgs & Langford, 2009) for more details.

Centroid based (single point) representation: if a source area intersects the target area, it gets the *whole* population value.

Areal Weighting or Simple Buffer Containment (SBC): which weighs source area population/data according to the proportion of its area that lies within the target area.

Data: Download the geodatabase and the "Assignment3" zip folder containing the following data from the blackboard under **Course Materials:**

a. GTA_CT
b. Subway lines (all merged)
c. City of Toronto
d. Excel data with population and a csv copy of the same data (you can use whichever one you want)

Data sources and data references:
SimplyAnalytics (Environics Analytics Data), 2017
Toronto open data, York Region open data and DMTI data
Stats Canada, 2011 census data
http://dc2.chass.utoronto.ca.myaccess.library.utoronto.ca/census/ Canadian Census Analyzer

Here are the summary steps for this assignment:

1. Download *direct total average healthcare cost* **(Average Total expenditure | Health care | Direct costs to household | Health care supplies, 2016)** by Toronto CMA with Census Tract (CT) geographic unit via **SimplyMap (**make sure that data is available by CT!).
2. Join *excel population data and direct total average healthcare cost data* with the **GTA_CT** and create a new layer with the permanent joins.
3. Create a new layer from GTA_CT that contains population and all other data.
4. Calculate density of the population (create a new field for the area in sq km or use the exiting sq m field and adjust the numbers accordingly). I want the **population density per square km.**
5. Make sure that the CT layer already contains population density and health care cost data by this time. You are going to need that information in the new file. Create centroid (use feature to point tool) from the census tract. It carries all the information you need to answer some questions later.

6. Buffer the subway line (it is merged for your convenience!) by choosing "dissolve all", side type "*full*" and end type "*round*" options; use the default options for others: 500m and 1.5 km (1,500 m) and create two layers.
7. **Create a map with the Direct Total Average Healthcare Cost (thematic map with 5 classes) by CT, subway lines, its buffers and all other cartographic elements (make sure that the City of Toronto boundary is highlighted and the map is focused on the City of Toronto). 8 marks**
8. Based on Higgs & Langford (2009) that we covered during our lecture, create two types of apportionment methods or areal interpolation on the data from above.
    a. **Single point containment:** It is a subset of what you studied (under multi-representative point containment), it is also called centroid method. This is based on our existing data. We have the centroids of the CT that we can use to calculate the necessary stats.
    b. **Simple buffer containment (SBC):** Use this method and assign the population stats to two buffer areas from the subway lines.
9. **Fill out the tables below. 6 marks**
    a. 500 m from the Subway lines:

Methods	**Total Population**	**Average Population Density (Sq km)** *For SBC, use intersected area for density- not the original*	**The average of the total household (average) direct health care cost with this method** *-For SBC, use intersected area for density- not the original*
Single point method			
Simple buffer method			

    b. 1.5 km (or 1,500 m) from the Subway lines:

Methods	**Total Population**	**Population Density (Sq km)** *For SBC, use intersected area for density- not the original*	**The average of the total household (average) direct health care cost with this method** *-For SBC, use intersected area for density- not the original*
Single point method			

Simple buffer method			

10. Why is there a difference in value for health care spending between the two different methods? Explain. **2 marks**

    10.a. Does the health care spending per household increase or decrease using *single point method* as you go further away from the subways? **1 mark**

    10.b. Does the health care spending per household increase or decrease using *simple buffer method* as you go further away from the subways? **1 mark**

11. Given the results from the limited data you have (averages of averages…not the strongest dataset!), how would you convince me that it is either better to live closer to or further away from the subways so that I would **spend less** per household on the direct health care if the distance were the only factor? Think of the actual numbers ($$ value) and the type of areal apportionment method and its accuracy on the data representation of the results - why do you think the method you chose to convince me is a better representation? **2 marks**

You are required to submit:

a. **Digital copy of your map in pdf format (#7) and a 1-page word or pdf document answering the questions from above, uploaded to the blackboard.**
b. **Hardcopy (from "a." above – including the map and the word/pdf document) by the due date before the lecture.**

Late submissions must be uploaded online (digital copies). The date and time stamp will be used for the late penalty. For the digital version, if you submit the wrong file online (late or early) by mistake, and need to re-submit it, go ahead and submit the second file with the tag "Final" at the end and email me about what happened and why I should use your second file with the tag "Final".

References:

Census Tract Boundary File, 2011 Census. Statistics Canada Catalogue no. 92-168-X.

Higgs, G. and Langford, M., 2009. GIScience, environmental justice, & estimating populations at risk: The case of landfills in Wales. Applied Geography: 29, 63-75.

SimplyAnalytics. 2017. Health Care Supplies Data, 2017. Retrieved Oct 25th, 2017, from SimplyAnalytics database.