

Team ID: BMES204

School Name: Barranca Mesa Elementary School

Area of Science: Epidemiology

Project Title: Code versus Cholera

Problem Definition:

John Snow believed that cholera was spread by drinking dirty water. He believed that the source of the cholera outbreak of 1854 was a public water pump on Broad street. He convinced the local council to remove the pump handle and the outbreak stopped. My research problem is to show the infected water pump that caused the 1854 cholera outbreak in London using code.

Problem Solution:

I will use a Voronoi graph around the water pumps and then compare the area in which people are sick to the output of each segment of the graph. Then the area that matches up is the area with the infected pump.

The procedure that I will follow is as follows.

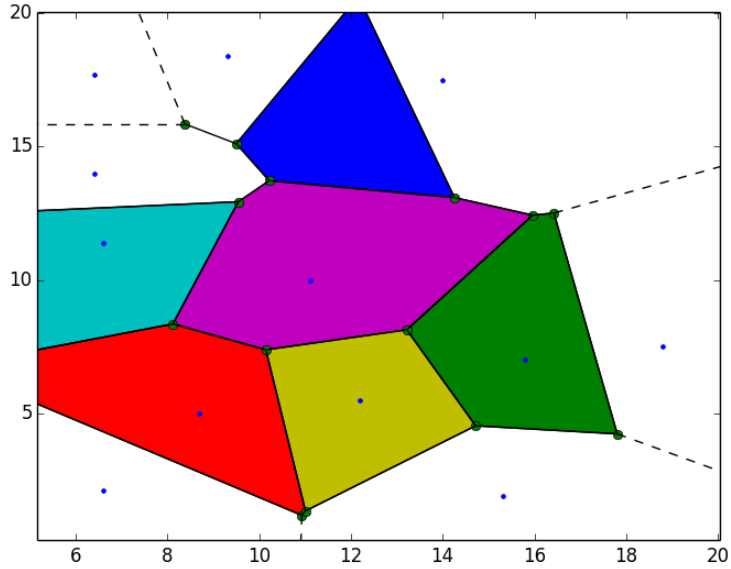
1. Download python 3 and scipy
2. Get the code for making a Voronoi graph.
3. Print the map of the area in which the outbreak was occurring that also has the pumps shown on it.
4. Label the pumps with a bright colored pen.
5. Find the coordinates of the pumps relative to the bottom corner of the map.
6. Put the coordinates into the Voronoi graph coding.
7. Run the code to make the Voronoi graph.
8. Then match the area in which people are infected to each of the areas around a pump. The area around a pump that matches the area of the infected people is the infected pump.

Progress to Date:

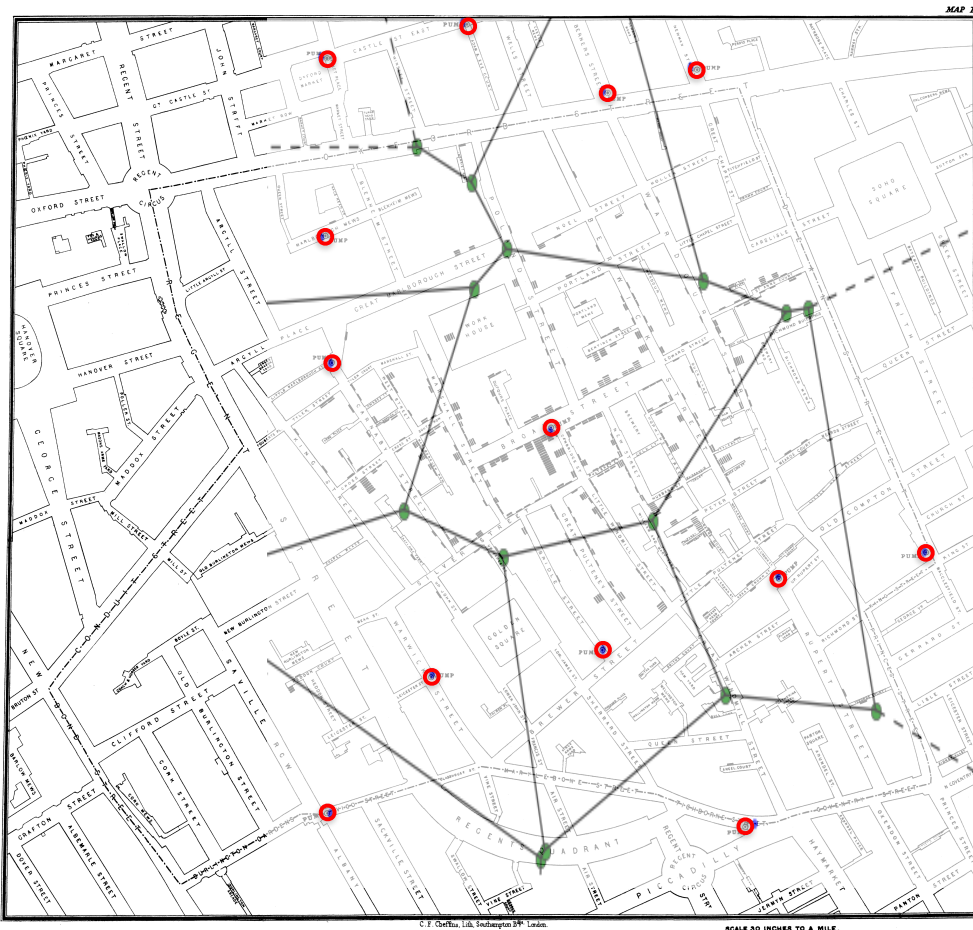
I followed the procedure above and produced Voronoi plots.

Results:

My result for this project is a Voronoi graph given below:



and placing this plot over the map by John Snow,



The black lines are the borders around an area in which people would go to a pump to get water. The blue dots are water pumps in the top plot. The bottom plot has red rings around the blue dots that are the water pumps. The number of ill people are shown with black bars next to the road where they live in the bottom plot. A longer black bar means more ill people than a short bar. The section that is purple in the top plot is the area that contains most of the ill people so it has the contaminated pump and is the Broad Street pump. The infected area is nearly the same size as the Voronoi region and it shows the people that would likely get water from the pump on Broad Street.

References:

1. https://en.wikipedia.org/wiki/Voronoi_diagram
2. <http://mathworld.wolfram.com/VoronoiDiagram.html>
3. <https://www.python.org/about/>
4. https://en.wikipedia.org/wiki/John_Snow
5. K. Tuhill, "John Snow and the Broad Street Pump on the trail of an epidemic", Cricket 31(3), pp. 23-31, Nov. 2003. <http://www.ph.ucla.edu/epi/snow/snowcricketarticle.html>
6. <https://www.cdc.gov/cholera/general/index.html>
7. <http://www.who.int/mediacentre/factsheets/fs107/en/>

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