Week 1 - Activity 6 - Maps and Representation Techniques - Case Studies

Case Study I

The first study that I am choosing involves creating a combination map which marks geographical locations of reported infectious disease cases obtained from routine surveillance or outbreak investigations. This will help public health experts to visualize both actuals and spatial trends in incidence of infection.

The reason to create a combination map was to avoid misinterpretations like not taking into account the population density distribution.

The two most used maps types for visualizing spatial outbreak are dot maps and choropleth incidence maps. In dot maps, every case is represented by a point on the map showing actuals. Dot maps do not take into consideration the geographical population distribution and also may give away information about the location of particular cases.

In a choropleth map, a quantitative attribute is displayed per spatial unit. Here, classes of incidence are represented with areas shaded according to the ranging values. Choropleth maps are used mostly for displaying surveillance data. They are less suitable when we want to display exact locations of interest. We do manage to represent regions of more incidence easily but it does have a major limitation: As the data is categorised across geographical locations and the attribute, this can lead to loss of information taking away important internal patterns for some/many cases of importance. [1] This can make the map misleading. Also, as the topic under consideration was dealing with infectious diseases, which is a rare event, it can become problematic using choropleth maps.

The technique proposed is called the “dot map cartogram” having combined advantages of both maps into a single map type. They created cartograms by reshaping the spatial units such that the area was proportional to the population using a diffusion based algorithm. The technique used involves displaying a dense point pattern in a big city as more dispersed, and a dense point pattern in a rural area will become even more dense. [1]

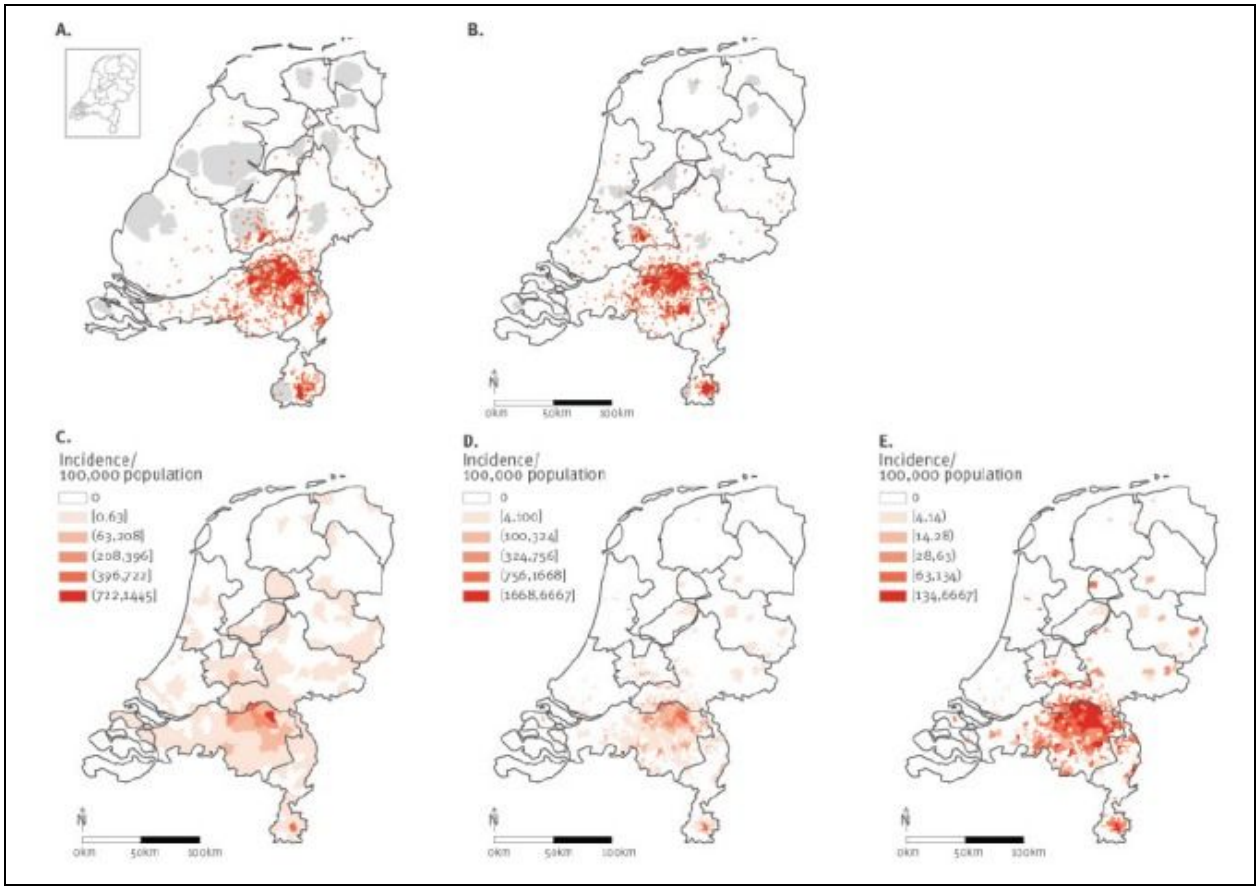
Real life data (Q Fever (Netherlands)) was used to compare dot map cartogram with dot maps and choropleth maps on the basis of four criteria.

(i) ability to show both absolute numbers and incidence of the disease, (ii) sensitivity to choices regarding spatial scale and classification system, (iii) ability to ensure the privacy of individual cases, and (iv) ability to recognise locations. [1]

Points to Note:

- Dot map cartograms minimise misinterpretation of data
- They protect privacy issues
- No need to buy expensive GIS software. Can be used in settings with limited resources.

Link to Q fever cases comparison between different map types:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5779165/bin/eurosurv-22-30562-f1.jpg



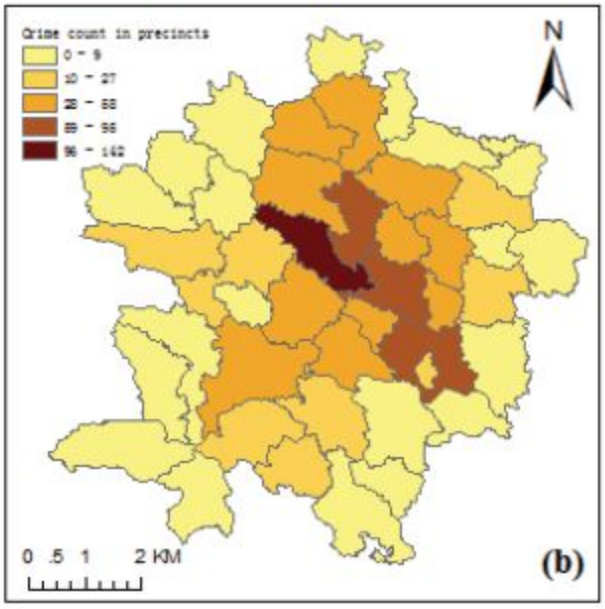
Case Study II

The second study I am choosing is about a GIS based tool for crime mapping and supporting decision making. Timely mapping of crime locations and precise detection of spatial clusters of crime helps in identifying where crime tends to occur in space and time, thus helping with important and relevant information for law enforcement agencies. [2]

Clusters of crime are referred to as hotspots. These hotspots are of high importance to law enforcement agencies as it helps in finding places where future crimes could occur thus helping preventing crime in advance by taking decisions accordingly.

A major portion of crime mapping effort is devoted to the identification of crime hotspots. [2] Various hotspot mapping techniques such as choropleth mapping and grid mapping are used in the study to display the techniques that can be used while using the tool.

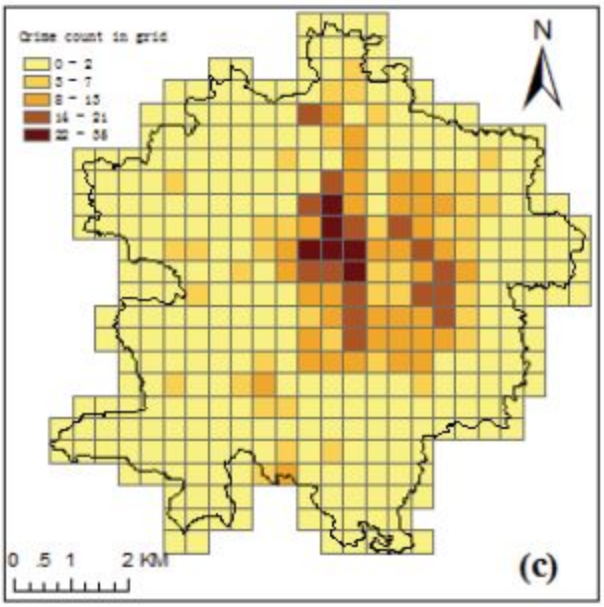
Choropleth mapping is widely used to represent spatial distribution of geographic phenomena as is the case with crime data. To develop the map, the study area is divided into various geographic areal units and each areal unit is shaded based on the number of crimes happened within it. [2] Following is an example for a choropleth map from the study.



[2]

A problem with choropleth maps for crime mapping is the ranging sizes and shapes of the aerial units. To overcome that problem the study shows usage of uniform grids and how they can be

shaded based on the number of crimes falling in each grid. The uniform dimension of grids helps in the comparison and identification of hotspots. [2]. Following is an example for grid thematic mapping from the study.



[2]

Other hotspot mapping methods like spatial ellipses and kernel density mapping are also incorporated into the web based tool created for the enforcement agencies.

As my interest involves working in computer vision based AI, I primarily think of use cases involving object detection and tracking, thus dot maps may be of most use to me, if I select a particular object to map (for eg : pothole / manhole). Also, I plan to work with ODM (Open Drone Map), so may come up with a use case which involves that too for the final project. Not sure yet!

Reference(s)

[1] Soetens, L., Hahné, S., & Wallinga, J. (2017). Dot map cartograms for detection of infectious disease outbreaks: an application to Q fever, the Netherlands and pertussis, Germany. *Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin*,*22*(26), 30562. doi:10.2807/1560-7917.ES.2017.22.26.30562

[2] Guiyun Zhou, Jiayuan Lin and Wenfeng Zheng, "A web-based geographical information system for crime mapping and decision support," *2012 International Conference on Computational Problem-Solving (ICCP)*, Leshan, 2012, pp. 147-150. doi: 10.1109/ICCPS.2012.6384228