

CE-317 GIS/RS Application to Civil Engineering Spring 2011

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- Lecture 06: Geographic Query And Analysis

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1

Presentation Outline

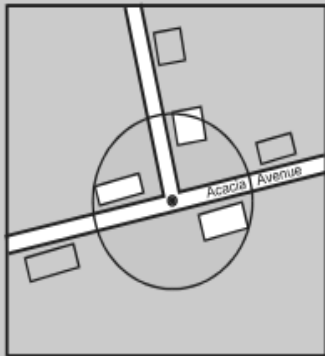
- Definition
- Application
- Spatial Relations and Analysis on Geometric Object
- 07 Methods
- 06 Types

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2

GEOGRAPHIC QUERY AND ANALYSIS



How many houses are within 50 m of this junction?



How many children live in this 100 m grid square?



Which households fall within the floodplain?

Spatial Analysis

- Spatial analysis is the process by which we turn *raw data into useful information*
- Spatial analysts can reveal things that might otherwise be invisible – it can make what is implicit explicit.

Spatial Analysis

- Spatial analysis is the crux of GIS.
- Some methods of spatial analysis were developed long before the advent of GIS
- Either carried out by hand, or by the use of measuring devices like the ruler.
- Spatial analysis can be used to further the aims of science, by revealing patterns that were not previously recognized.

Spatial Analysis

- If GIS is a method of communicating information about the Earth's surface from one person to another,
 - Then
- the transformations of spatial analysis are ways in which the sender tries to inform the receiver,
 - by adding **greater informative content**
 - and **value** and by **revealing things** that the receiver might **not** otherwise see.

Spatial Analysis

- It includes:
 - All of the transformations
 - Manipulations
 - Methods that can be applied to geographic data to add value to them
 - To support decisions
 - To reveal patterns and anomalies that are not immediately obvious

Application of Spatial Analysis

- Patterns in the occurrence of a disease may hint at the mechanisms that cause the disease.
- Some of the most famous examples of spatial analysis are of this nature, including the work of Dr. John Snow in unraveling the causes of cholera .
- Dr. John Snow, who had conceived the hypothesis that cholera was transmitted through the drinking of polluted water, rather than through the air, as was commonly believed.

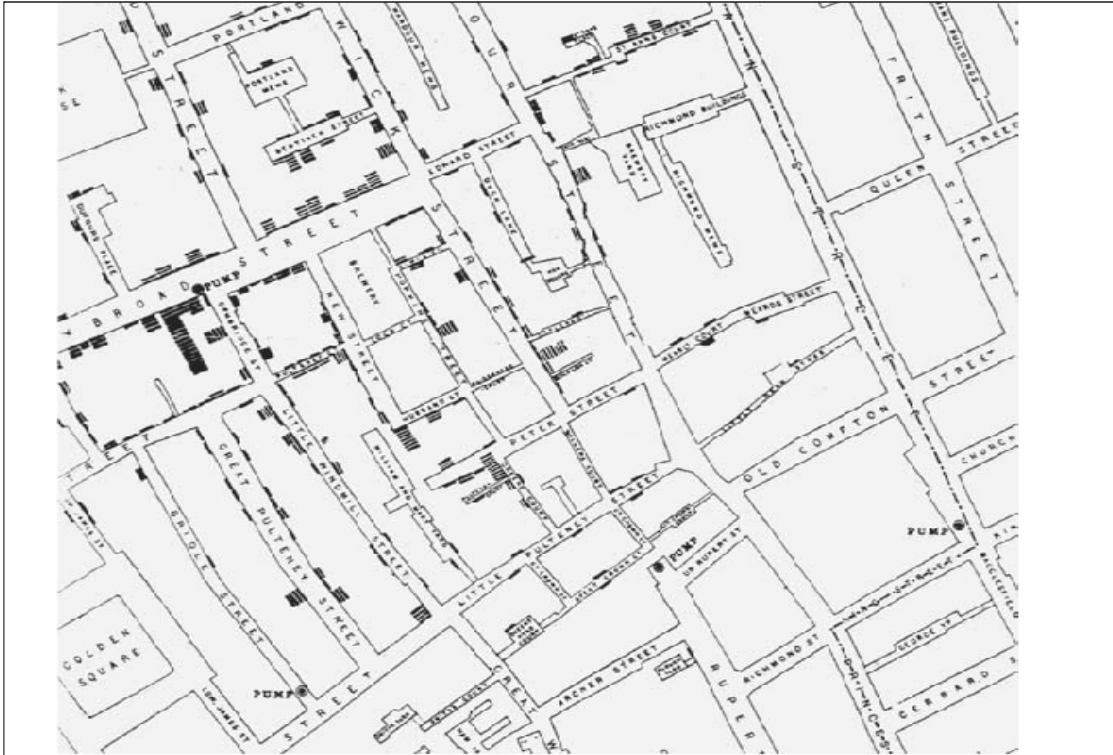


Figure 9.1: Dr. John Snow and the causes of cholera in London.

Spatial Analysis Categories

- Queries and reasoning,
- Measurements
- Transformations
- Descriptive summaries
- Optimization
- Hypothesis testing

Spatial Relations and Analysis on Geometric Objects

- There are **nine** methods for testing spatial relations between geometric objects.
- Each takes as input two geometries and evaluates whether the relation is true or not.

Spatial Relations and Analysis on Geometric Objects

- 1. Equals** – are the geometries the same.
- 2. Disjoint** – do the geometries share a common point
- 3. Intersects** – do the geometries intersect
- 4. Touches** – do the geometries intersect at their boundaries
- 5. Crosses** – do the geometries overlap

Spatial Relations and Analysis on Geometric Objects

6. Within – do the geometries within another

7. Contains – does one geometry completely contain another

8. Overlaps – do the geometries overlap

9. Relate – are the intersections between the interior, boundary or exterior of the geometries.

Seven Methods Support Spatial Analysis

▪ **Seven** methods support spatial analysis on these geometries:

1. Distance – determines the shortest distance between any two points in two geometries.

2. Buffer – returns a geometry that represents all the points whose distance from the geometry is less than or equal to a user defined distance.

Seven Methods Support Spatial Analysis

3.Convex hull – returns a geometry representing the convex hull of a geometry (convex hull is the smallest polygon that can enclose another geometry without any concave areas).

4.Intersection – returns a geometry that contains just the points common to both input geometries.

5.Union – returns a geometry that contains all the points in both input geometries.

Seven Methods Support Spatial Analysis

6.Difference – returns a geometry containing the points that are different between the two geometries.

7.SymDifference – returns a geometry containing the points that are in either of the input geometries, but not both.

Spatial Relations and Analysis on Geometric Objects

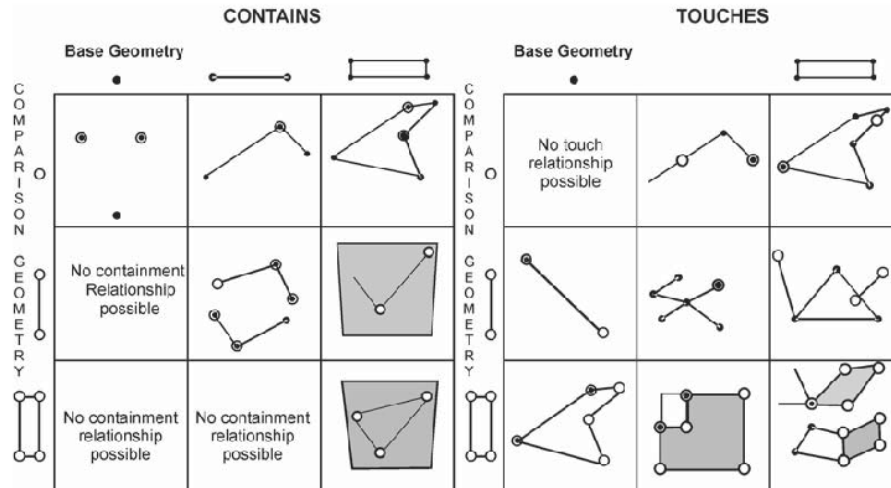


Figure 9.2: Examples of possible relations for two geographic database.

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17

Types of Spatial Analysis

1. Queries and reasoning are the most basic of analysis operations, in which the GIS is used to answer simple questions posed by the user.

- No changes occur in the database.
- No new data are produced.
- *'how many houses are found within 1 km of this point'*
- *'which is the closest city to Peshawar going east'*

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18

Types of Spatial Analysis

2. **Measurements** are simple numerical values that describe aspects of geographic data.

- They include measurement of simple properties of objects like *length, area, or shape, distance or direction*.

3. **Transformations** are simple methods of spatial analysis that change datasets.

- Combining them or comparing them to obtain new datasets, and eventually new insights.

Types of Spatial Analysis

4. **Descriptive summaries** attempt to capture the essence of a dataset in one or two numbers.

- *the mean and standard deviation*.

5. **Optimization** techniques are normative in nature, designed to select ideal locations for objects given certain well-defined criteria.

- *package delivery industry*

Types of Spatial Analysis

6. Hypothesis testing focuses on the process of reasoning from the results of a limited sample to make generalizations about an entire population.

- For example, *to determine whether a pattern of points could have arisen by chance, based on the information from a sample.*

Q n A

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