Point Pattern Analysis

Points are zero dimensional, so no geometric properties to analyze.

Instead, quantitative techniques for evaluating:
- spatial distribution
- arrangement or pattern
- ... of a set of points

Occurrence is sufficient, but may also consider attributes values.

Descriptive Measures

- **Distribution** of points can be described by:
  1. 
  2. 
  3. 
  4.

- Useful when evaluating:
  1. 
  2. 
  3.
**Frequency & Density**

- **Frequency**
  - Total points per defined area
  - Good for?
    - 
- **Density**
  - Number of points per unit area
  - Good for?
    - 

**Measures of Central Tendency**

- Geometric Centre
- Median Centre
- Centre of Minimum Travel

**Measures of Dispersion**

- Dispersion is spacing around the mean centre
- Standard Distance
- Standard Deviation Ellipse
SPATIAL ARRANGEMENT (PATTERN)
- Location of points relative to one another
- May result in a pattern
- Typically described as:
  - clustered
  - scattered
  - random

NEAREST NEIGHBOUR ANALYSIS
- Based on measure of mean distance between each point and nearest neighbour
- Basic idea is that mean distance will be:
  - large for scattered patterns
  - small for clustered patterns
  - and somewhere between for random patterns
- Nearest Neighbour Index compares observed mean distance to expected distance

NEAREST NEIGHBOUR ANALYSIS
- Expected distance for a random distribution of points

\[ D_{\text{ran}} = 0.5 \left( \frac{N}{A} \right)^{1/2} \]

where:
- \( N \) = number points
- \( A \) = area
NEAREST NEIGHBOUR ANALYSIS

- Nearest neighbour index (NNI) is ratio of observed dist over expected NN dist
  - NNI ranges between 0 and 2.1491
    - NNI = 0 for perfectly clustered points
    - NNI = 2.1491 for perfectly scattered
    - NNI = 1 for perfectly random
  - Limited because it only considers neighbouring pts.

SPATIAL AUTOCORRELATION

- Spatial autocorrelation determines extent to which:
  - occurrence (and value) of one point affects occurrence (and value) of adjacent points
  - Traditionally viewed as a bad thing since it violates assumptions of correlation and regression
  - However, it can also tell us something about the distribution of point features

SPATIAL AUTOCORRELATION

- Moran’s I common measure of spatial autocorrelation
  - If occurrence of a point facilitates or increases probability of occurrence of another point nearby, then I will be closer to +1.0 (clustered)
  - If occurrence decreases probability of another point nearby, I will be closer to -1.0 (scattered)
  - If a point has no influence on the probability of another point being located nearby, I will be closer to 0.0 (random)