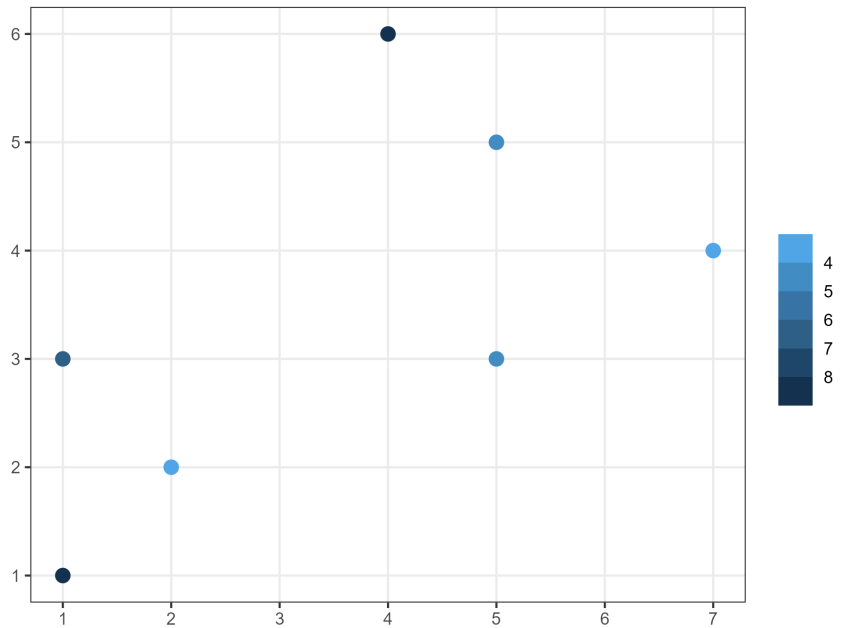
Spatially continuous data

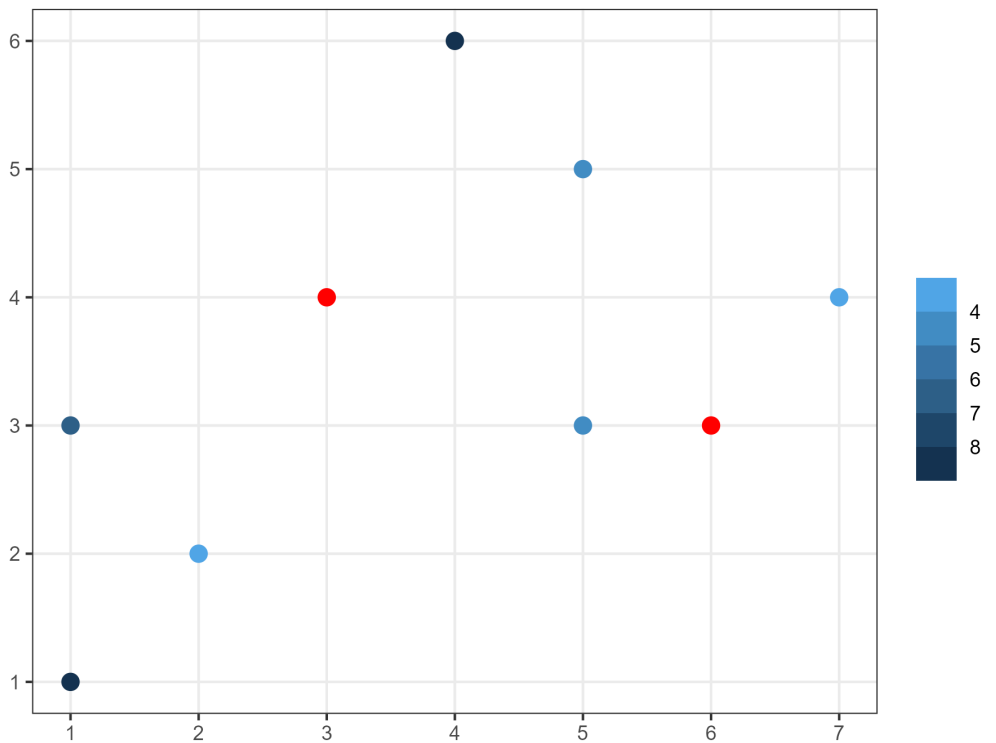
- Previously, we explored point data and area data, which are associated with discrete events, such as store locations or individual residents.
- In contrast, spatial phenomena can be continuous rather than discrete.
- Examples of continuous phenomena include elevation and temperature.
- Continuous data are typically stored in raster formats but can also be represented as vector points.

Spatially continuous data



- Here, each point represents a measurement of the underlying continuous process, rather than a discrete event.
- The methods we'll discuss this week are specific to continuous data and are not suitable for point pattern analysis, and vice versa.

Motivation for spatial interpolation



- Since it is impossible to observe an entire continuous process, there are infinitely many points that remain unobserved.
- To understand the process at a specific, unknown location, we aim to estimate its value based on available data.
- Spatial interpolation techniques address this challenge by providing methods to predict values at these unmeasured points.

Spatial interpolation

Voronoi Polygons/Tessellation:

- Predict the value of an unknown point by assigning it the value of the nearest known point.

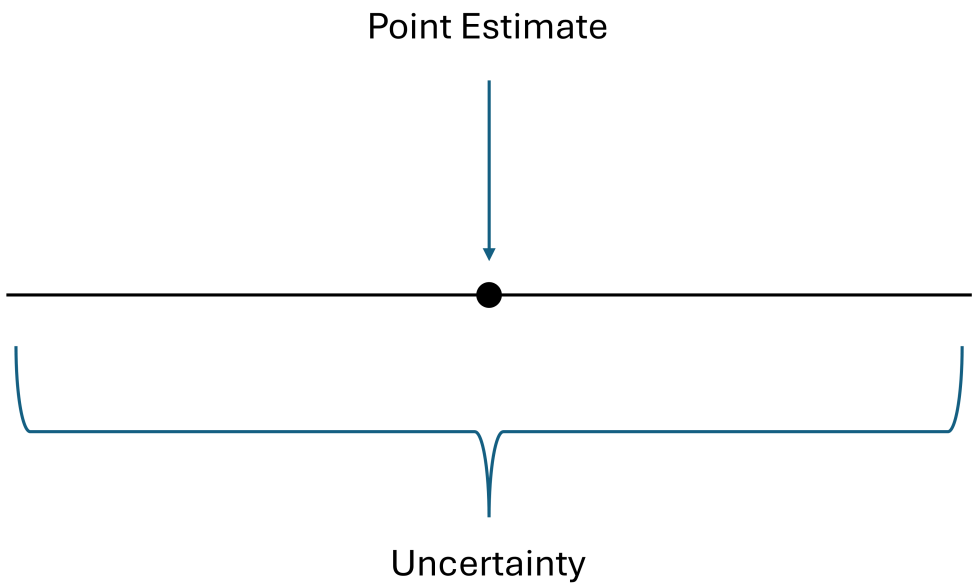
Inverse distance weighting (IDW): $\hat{z}_p = \frac{\sum_i \frac{z_i}{d_{pi}^\gamma}}{\sum_i \frac{1}{d_{pi}^\gamma}}$

- Here, d_{pi} represents the (Euclidean) distance between the unknown point p and a known point i.

k-Point Means/k-Nearest Neighbours:

- Predict the value of an unknown point using the average value of the k-nearest known points.

Point estimate and uncertainty

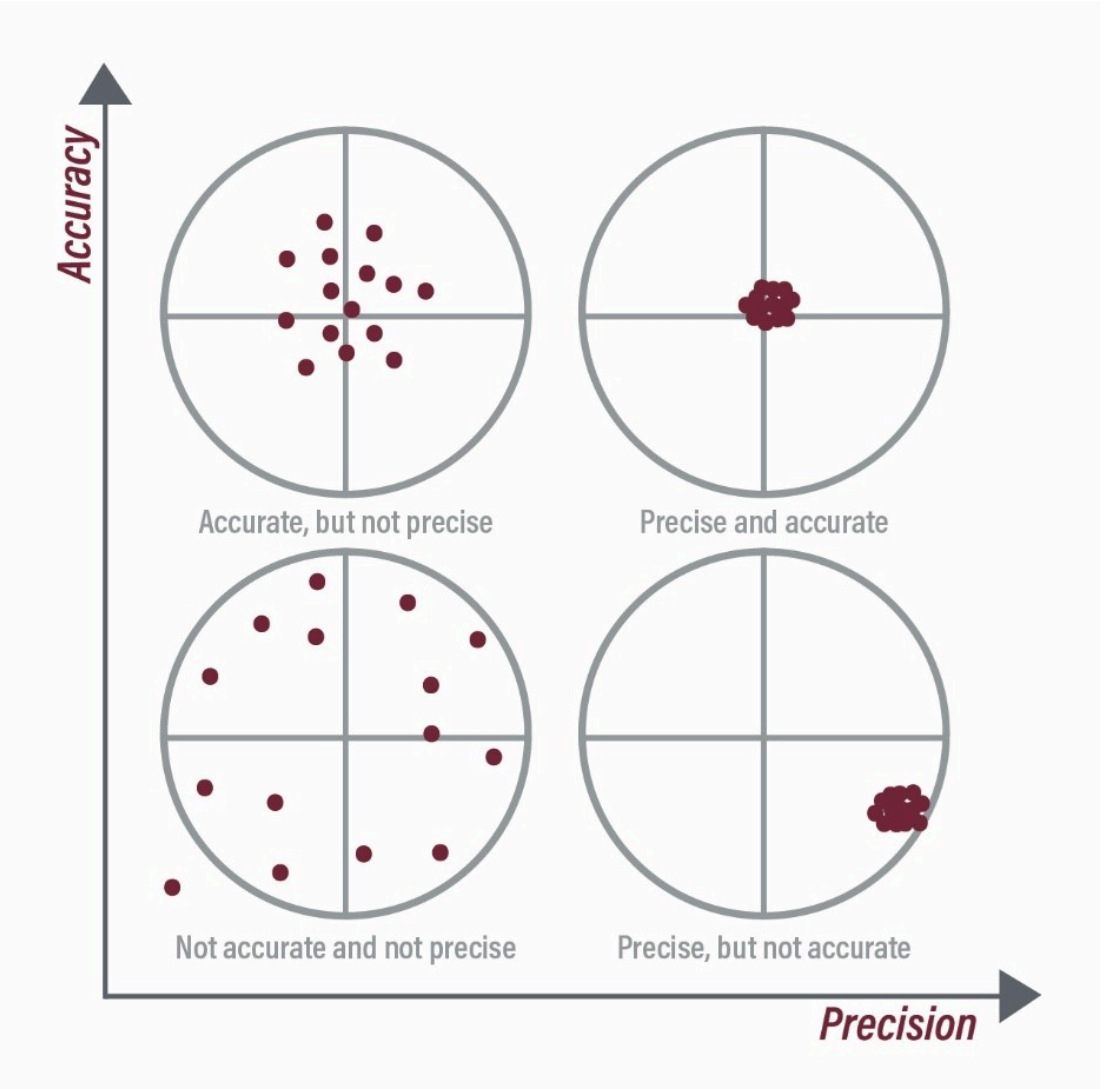


Spatial interpolation: $z_i = f(u_i, v_i) + \epsilon_i$

Where $\hat{f}(u_i, v_i)$ represents the point estimate.

Uncertainty is the interval that is likely to capture the true value, z_i.

Accuracy and precision



Activities for today

- We will work on the following chapter from the textbook:
  - Chapter 32: Activity 15: Spatially Continuous Data I
  - Chapter 34: Activity 16: Spatially Continuous Data II
- The hard deadline is **Friday**, **March 21**.

Reference

- https://blogs.extension.msstate.edu/theriskproject/accuracy-and-precision/