Introduction to Spatial Analysis

III. Spatial analysis of field data

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Session organization

- Module 1: Conceptualizing space
- Module 2: Spatial analysis of lattice data
- Module 3: Spatial analysis of point patterns
- Module 4: Spatial analysis of field data

Module organization

- Basic concepts
- Kriging
- Semi-variogram

- Spatial continuous (fields) → Geostatistics

- Points (objects) → Point Pattern Analysis

- Irregular / Regular lattice (objects) → Spatial Econometrics

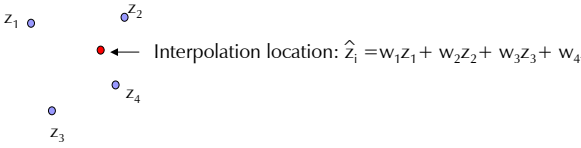
- Volume of interaction among areas → Spatial Interaction Model

Basic concepts:

- Challenge is to recover prediction of continuous field from sample points
  - Underlying data truly is continuous (air pollution, oil pocket, vein of ore)
- Univariate and multivariate applications
- Objectives:
  - Model covariance structure
  - Predict continuous surface
  - Evaluate prediction error

Kriging

- Optimal statistical interpolation given control point data
- Problem: Given control point data, find optimal weights to assign to interpolation locations



Kriging

- Three steps:
  - Describe spatial variation, $C(z_i,z_j)$
  - Summarize spatial variation by mathematical function
  - Given mathematical function, find interpolation weights

Step 1. Describe variation

- $C(z_i,z_j)$
- Experimental semivariogram

$$2\hat{\gamma}(d) = \frac{1}{n(d)} \sum_{d_{ij}=d} (z_i - z_j)^2$$

Step 2. Fit function

$$\gamma(d) = c_0 + c_1[\frac{3d}{2a} - 0.5\frac{d}{a}^3]$$