Exercise 2 - Structural analysis

Office hours: Friday 09:00-12:00

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The objectives of this second exercise are (1) to calculate the isotropic sample variograms of different metal concentrations in the "meuse" dataset and (2) to analyze the information associated with these variograms.

A R code (ex2.R) showing how to read and analyze the data is already provided. Information about the syntax and arguments of R functions is available via the *help* within R. A short but useful tutorial is also available on moodle.

1. Compute and plot the isotropic sample variogram of the percentage of organic matter using regularly spaced distance classes of 250 m width between 250 m and 1500 m. Roughly identify the value of the nugget, the sill and the range. Hint: the main part of the code is already provided.

2. How many pairs of points are there in each distance class? Hint: look at the column named "np" of the previously computed sample variogram.

3. Compute the same variogram using a width of 150 m and another one with a width of 50 m. Use the same maximum distance of 1500 m for both. Explain the differences and specify which class width you think is most appropriate. Explain you answer.

4. Compute the isotropic sample variogram of the lead concentrations using regularly spaced distance classes of width 250 m between 250 m and 1500 m. Roughly identify the value of the nugget, the sill and the range.

5. Compute the same variogram using Cressie's estimator. Analyze and explain the differences. Which one is more representative? and why? Hint: check the options of the function variogram() and have a look at the pdf of the lead concentrations.

6. Compute the variance of the lead concentrations and compare it to the sill of the variograms obtained in 4 and 5. What can you say?

7. Demonstrate the following equality: $\mathrm{Cov}[X, Y] = \mathrm{E}[XY] - \mathrm{E}[X]\mathrm{E}[Y]$