

## Spatial Variograms

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**Definition:** In order to describe the spatial or the temporal correlation of observations in geostatistics, three functions are used. They are the correlogram, the covariance and the variogram.

The variogram is the key function in geostatistics used to fit a model of the spatial/temporal correlation of the observed phenomenon. A variogram is a visualization of a possible spatial/temporal correlation, and the variogram model is further used to define the weights of the kriging function. Note that the experimental variogram is an empirical estimate of the covariance of a Gaussian process. As such, it may not be positive definite and hence not directly usable in kriging, without constraints or further processing. This explains why only a limited number of variogram models are used. The most frequently used are the linear, the spherical, the Gaussian and the exponential models.

Cross-variograms are used to describe the correlation of different variables and are used in co-kriging. If the variable is binary or represents classes of values, one is then talking about indicator variograms. Indicator variograms are used in indicator kriging.

The experimental variogram is computed by measuring the mean-squared difference of a value of interest evaluated at two points,  $L$  and  $(L+H)$ . This mean squared difference is the semi-variance and is assigned to the value  $H$ , which is known as the lag. A variogram is the plot of the semi-variance versus  $H$ .

### Application:

Since a spatial variogram allows us to understand the spatial relationship of interest, it is widely used to capture spatial continuity, such as the connectivity of alpine precipitation (Germann and Joss, 2001) and soil moisture (Western, et al., 1998).

### References/Sources:

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