University of California, Los Angeles
Department of Statistics

Statistics C173/C273 **Instructor: Nicolas Christou**

Lognormal simple kriging

Suppose $Z(s_1), \ldots, Z(s_n)$ denote the geostatistical data. Let $Y(s) = \ln[Z(s)]$ and consider the model $Y(s) = \mu + \delta(s)$ where μ is known and $E[\delta(s)] = 0$, $\text{var}[\delta(s) - \delta(s+h)] = 2\gamma(h)$. Given $Y(s_1), \ldots, Y(s_n)$ we want to predict $Y(s_0)$. Finally we want to back-transform $\hat{Y}(s_0)$ to find an unbiased predictor of $Z(s_0)$.

Assume that $\mathbf{Y} \sim N_n(\mu\mathbf{1}, \mathbf{\Sigma})$, where $\mathbf{\Sigma}$ is constructed based on the choice of a covariance function.

Find the distribution of $Y(s_0)$.

We assumed that $Y(s_0) = \ln[Z(s_0)]$. Find $EZ(s_0)$.

The predictor for simple kriging is: $\hat{Y}(s_0) = \mathbf{w}'(\mathbf{Y} - \mu\mathbf{1}) + \mu$. Find the distribution of $\hat{Y}(s_0)$.

Back-transformation: We assumed that $\hat{Y}(s_0) = \ln[\hat{Z}(s_0)]$. Find $E\hat{Z}(s_0)$. Is it unbiased?

Adjust $\hat{Z}_(s_0)$ to be unbiased. The unbiased estimator will be denoted with $\check{Z}(s_0)$. Begin with $\check{Z}(s_0) = c\hat{Z}(s_0)$ to find c such that $E\check{Z}(s_0) = EZ(s_0)$.