

Environment Statistics and Risk Assessment

Geostatistics Homework (2)

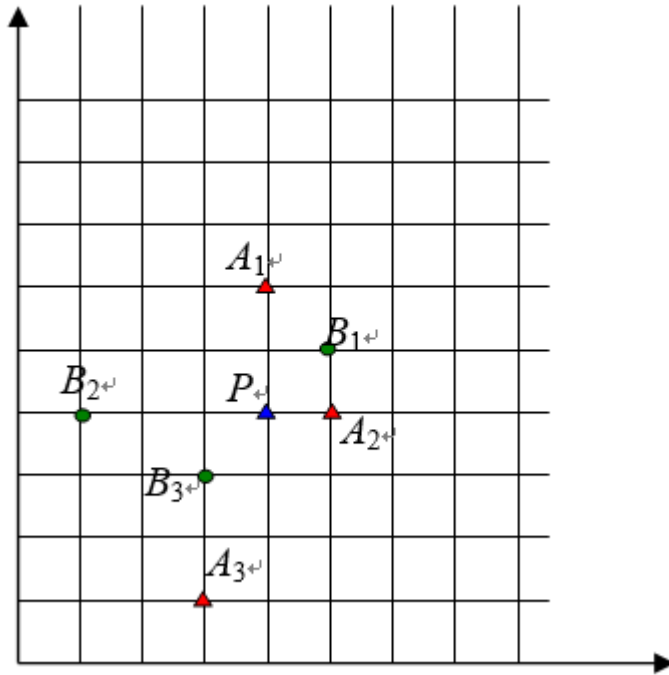
1. In following data set, (X, Y) represents a spatial location and $Z(X,Y)$ is the measurement of an environmental variable at (X,Y) . Calculate the experimental variogram and fit an exponential model to the experimental variogram.

X	Y	$Z(X,Y)$	X	Y	$Z(X,Y)$	X	Y	$Z(X,Y)$
288	311	11.5	441.6	160	12.1	386.4	216	11.8
285.6	288	8.5	432	140	0.9	412.8	216	11
273.6	269	7	444	119	0	439.2	216	16.7
280.8	249	10.7	254.4	172	3.2	465.6	216	11.6
273.6	231	11.2	254.4	128	1.2	492	216	6.9
276	206	11.6	254.4	299	1.7	345.6	216	9.9
285.6	182	7.2	333.6	301	1.2	434.4	312	5.5
288	164	5.7	333.6	271	7.6	451.2	295	4
292.8	137	5.2	333.6	194	11.6	448.8	268	7
278.4	119	7.2	333.6	163	8.7	432	252	5.3
360	315	3.9	412.8	285	5.8	441.6	228	11.6
355.2	291	9.5	254.4	257	3.8	441.6	204	9
367.2	272	8.9	412.8	172	10.4	444	182	14.5
367.2	250	11.5	412.8	150	10	360	195	6.8
352.8	226	10.7	492	282	7.1	345.6	210	10.8
350.4	203	8.3	492	249	4.4	254.4	216	14.9
369.6	180	6.1	492	315	10.4	280.8	216	9.9
369.6	165	6.7	492	150	1.6	307.2	216	11.6
357.6	139	6.2	444	190	15	333.6	216	6.5
355.2	118	0	436.8	240	3.4	360	216	10.1

2. An isotropic random field $Z(X,Y)$ has the following variogram:

$$\gamma(h) = 25\left[1 - \exp\left(-\frac{h}{3}\right)\right]$$

Two sets of measurements at locations (A_1, A_2, A_3) and (B_1, B_2, B_3) were taken. These measurements are to be used for estimation of the Z value at location P (i.e. Z_p). Calculate the variance of estimation error associated with estimate of Z_p using both sets of measurements. Which set of measurement will provide better estimate?



3. Assuming that $Z(X,Y)$ in Problem 2 is a Gaussian random field and the measurement values at locations (A_1, A_2, A_3) and (B_1, B_2, B_3) are shown in the following table.
- (1) Estimate the value of Z at location p using measurements at locations (A_1, A_2, A_3) and (B_1, B_2, B_3) , respectively.
 - (2) What are the associated 95% confidence intervals of the ordinary kriging estimator of Z_p ?

A1	A2	A3	B1	B2	B3
87	52	65	71	61	81