



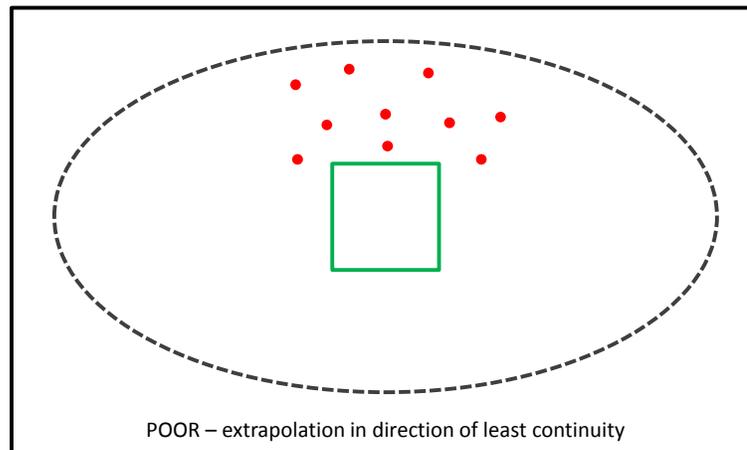
Choosing Kriging Search Neighbourhood Parameters

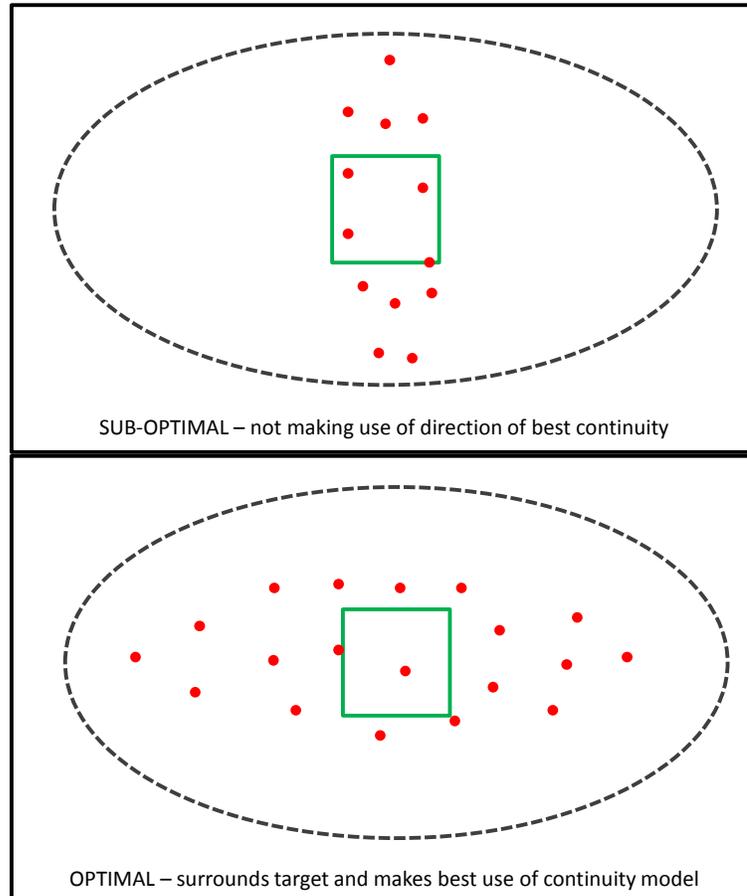
This paper will discuss the choice of Kriging search neighbourhood parameters, aside from the minimum and maximum allowable sample parameters that were covered in another paper in this series. Different geostatistical software packages allow for different search parameters to be set, but we will try and focus mainly on the principles that produce the most reliable estimates.

Optimising the Pattern of Sample Selection Relative to the Target

The orientation and size of the search are arguably the most fundamental and influential parameters that need to be considered when setting up a Kriging neighbourhood. In order to make the best choice, it pays to have some understanding of which sample selection pattern will produce the most reliable estimates. It is of prime importance to take note of the anisotropy in the variogram model being used for the Kriging and set the orientation of the search volume to match. Samples being used to estimate the target should be arranged so as to make the best use of the spatial continuity embodied in the variogram model.

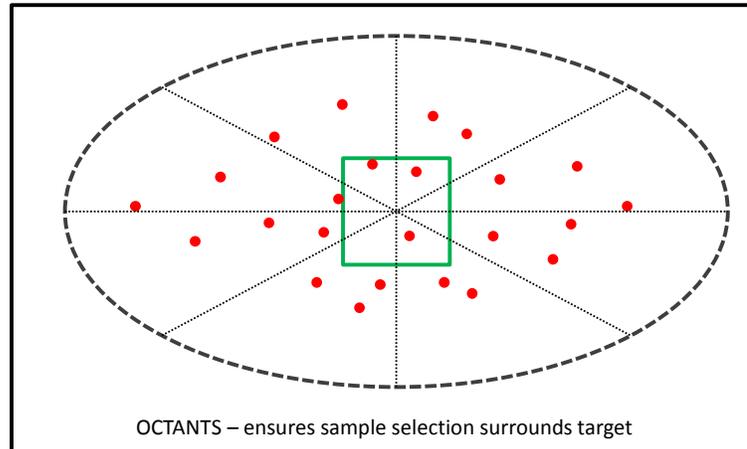
The following three pictures give an idea of the sort of sample selection pattern that is optimal – the examples are in 2D but the same idea applies in 3D. Assume that the ellipsoidal neighbourhood is oriented in such a way as to match the major and minor axes of the variogram model:





The best estimates are generally achieved when the sample selection surrounds the target, in this case the green block, and when the pattern of selection reflects the orientation of the axes of continuity defined by the variogram model. It can be quite tricky to achieve this optimal pattern in practice, but there are a few tools at our disposal that can assist. For instance, most software packages allow us to subdivide the neighbourhood volume into a number of sectors. We can then specify that we want a maximum number of samples from each sector. This forces the selection to surround the target.

The following picture shows an example of a neighbourhood divided into eight sectors, or octants, with a maximum value of three samples per octant:



Some software packages allow one to specify the selection of a maximum number of samples per drillhole, which can help to spread the selection around the target. Sometimes you may find that too many samples are being selected down the hole because of the relatively tight spacing in this direction – using the option of maximum number of samples per hole can help alleviate this problem.

If this setting is not available, one can drastically reduce the neighbourhood radius in the direction that most closely parallels the hole traces. Another option included in some software packages is to specify that the distance of the samples to the target should be calculated as a proportion of the anisotropy defined by the neighbourhood shape.

Whichever method is available to you, the objective is to make the best use of the spatial model by optimising the sample selection pattern and, wherever possible, to ensure that you are interpolating into the target rather than extrapolating. It is important to note that with extrapolation comes a rapid decrease in the confidence of the estimate.

More Advanced Options

Some software packages offer more advanced neighbourhood parameter settings, which allows you to tailor the Kriging even further. Most notable is the ability to limit the distance from the target at which specific samples will be used, even if they would have been otherwise selected. For instance, a well-known geostatistical software package can be set to ignore samples with a value above a given threshold when it is situated beyond a given distance from the target. This is a useful way to limit the influence of high grade outliers in a deposit, (e.g. nuggetty gold) especially when it is known that high grade mineralisation has limited spatial continuity.

You can also choose to be less harsh and just replace the original sample values with a capped value beyond a chosen distance threshold. Some knowledge of the likely range of continuity of such high grade mineralisation features would prove useful in such an instance. The same type of option could be

available for small values, in the case where we might have negatively skewed grade distributions – e.g. iron grades.

Each software package has its own useful set of parameters for defining the search neighbourhood and it is well worth familiarising oneself with these features in order to produce the best results when Kriging.

Cube's Experience and Capabilities

Cube Consulting has extensive experience and skills in geostatistical estimation and Cube's Resource Geologists and Geostatisticians frequently apply the kriging outputs discussed in this document for the choice of optimal numbers of samples to use in kriging search neighbourhoods.