A Procedure for Choosing an Appropriate Interpolation Method

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Interpolation is an important task when preparing data for mapping. The phenomenon to be mapped often has been sampled at irregularly distributed points but is thought to be mapped as spatially continuous information. Thus the point information must be interpolated into unsampled locations which often is done with kriging interpolation. Kriging offers a multitude of methods, such as ordinary kriging, co-kriging, soft kriging, kriging with an external drift and many others. This variety often makes it difficult to choose the appropriate method, i.e., the method that meets the spatial behaviour of the real world phenomenon, and the characteristics of the data representing it, respectively. Also, users may not have the statistical background and sensitivity that is necessary for the evaluation of an appropriate kriging method. Working with a method that not fully meets the data characteristics, however, may yield additional uncertainties that could have been avoided with the use of a more appropriate kriging method.

This paper presents a procedure that supports the evaluation of an appropriate kriging method. This evaluation procedure is a decision support system and is based on a decision tree. At each node of the decision tree, specific data characteristics are investigated. These investigations may be analytically, i.e., computing statistical measures, and/or graphically, i.e., by producing diagrams. To be more precise, at each node, the user is provided with both a set of just relevant data characteristics and corresponding test procedures. Beyond that, information is provided for the interpretation of the test results that supports the user in correctly navigating through the decision tree. Moving through the decision tree, the user is guaranteed to investigate the relevant data characteristics in a logical order, and ending up with the evaluation of an appropriate kriging method.

The objectives of this evaluation procedure are twofold: In a first stage, the data are investigated for potential effects that may affect the results of the kriging interpolation. These examinations include the evaluation of regions with either clustered or sparse sampling sites, tests on heterogeneities in the variance, e.g., due to proportional effects, or tracking the data for outliers. In a second stage, various data characteristics are evaluated in order to select a kriging method that meets the spatial behaviour of the real world phenomenon as well as possible. Beyond that, these evaluations may help in reasonably parameterize the kriging method. These evaluations include investigations on (i) the spatial dependency pattern, e.g., the range and distance function of spatial autocorrelation, and effects of anisotropy, e.g., by variograms; (ii) heterogeneities in the mean, i.e., a spatial trend; (iii) the availability of additional data that may improve the interpolation; and (iv) how a spatial trend may be represented, e.g., by multiple linear regression or by higher order polynomial function.

This decision tree may serve as a conceptual framework for the design of a digital tutorial, e.g., for user training in kriging, or for the implementation of a simple expert system within software systems that support spatial interpolation, such as GIS .