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Title: Point Data Spatial Interpolation: An Experimental Analysis of Efficiency of Selected Commonly Applied Methods on Continuous (Kosi Alluvial Fan) and Discontinuous (Southern Rajasthan) Land Surface

Abstract

Interpolation methods are used quite indiscriminately as traditional statistical methods in almost all GIS packages in researches concerning different fields of geography. A selected interpolation model may be theoretically and analytically very accurate but may be grossly inaccurate in the characterisation of spatial surfaces. This uncertainty can significantly alter the output of a GIS based research. Therefore, the main objective of the present research is to ascertain the accuracy level of the most commonly used interpolation models in the contrasting case of surface continuity and discontinuity. In order to achieve these objectives the present thesis addresses the following research questions:

1. Does a varying sampling design (regular, random, cluster) bear significantly on the accuracy of different selected interpolators?
2. Does varying density of sample points has a significant impact on the predictive power of an interpolator?
3. Does the nature of surface selected (continuous and discontinuous) has a pronounced effect on the efficacy of the different interpolation models?

The six interpolation models used for assessment are inverse distance weighting, modified Shepard's, minimum curvature, spline, radial basis functionsand kriging. The static phenomenon of Elevation is taken as point attributes for this experiment.

Two study areas with strongly defined continuity and discontinuity in their elevation features have been chosen *i.e.* Kosi alluvial fan and part of Southern Rajasthan, respectively.18 control point datasets comprising of distinct sampling design/strategy/pattern (regular, cluster and random) and an equal number of sample size (100 per cent, 75 per cent and 50 per cent) datasets are created in GIS environment. These datasets are placed on the Google Earth

image of the two respective areas and the elevation values of the points are recorded. Other than these reference point datasets are also generated randomly and their elevation values are also recorded which are to be used for evaluation. The reference points are 10 per cent and 6 per cent of the original control point datasets in case of Kosi alluvial fan and part of Southern Rajasthan. The control point datasets are imported to GIS environment and then interpolated using the six interpolation methods with their variants to generate surfaces.

The generated surfaces are evaluated visually and quantitatively. Visual analysis judges the method on the basis of the graphic preciseness of the features in the region. In case of quantitative evaluation, the reference points are overlaid on the generated surfaces and their elevation values are attributed again. These values serve as the predicted values tested against the original reference point values in terms of the mean absolute error and mean absolute percentage error indicators. The results are compared and assessed on an individual basis and ranked to investigate the best and worst model in each of the circumstances and also to find out the effect of sample design and size on performance of interpolation method. The results show that no model is best in each case of sample size and sample design. However, kriging interpolation method has given good results in most of the cases followed by spline and inverse distance weighting. Inverse multiquadric and multilog of radial basis function gives the worst performance in most cases of sample designs and size. Areal coverage and sample size do not have any pronounced effect on the performance of an interpolator. In the case of areal complexity, the discontinuous land surface results in lower MAPEs as compared to continuous land surfaces. Also, interpolators perform better with the regular sample design as compared to other sample designs.