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A SIMPLE METHOD FOR DEFINING NEIGHBORHOOD OF CORRELATION IN DTM INTERPOLATION

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ABSTRACT

Point interpolation is a common method in digital terrain modeling. It is used to determine the height value of a point from the known heights of neighboring points. There are two implicit assumptions behind interpolation techniques: (a) the terrain surface is continuous and smooth and (b) there is a high correlation between the neighboring data points.

The process of point interpolation is carried in two stages:

a. The search for the neighborhood of point; and

b. The prediction of the value of an unknown point from the searched points.

Several methods have been used for searching neighborhood of point, during point interpolation process. However; the problem of correlation in data which is needed for accurate interpolation was given little attention.

Geostatistical methods of Kriging provide the method for apriori analysis of data, for correlation, however the complication of the method makes it of little use.

This work attempts to develop a simple graphical method to define the search neighborhood of correlated data.

THE SEARCH NEIGHBORHOOD

The search neighborhood is usually an ellipse centered on the point being estimated. The orientation of this ellipse is dictated by the anisotropy in the pattern of spatial continuity.

If sample values are much more continuous in one direction than in another, then the ellipse is oriented with its major axis parallel to the direction of maximum continuity.

SIMPLE GRAPHICAL METHOD

This approach executed by analyzing the contour map of the study area (figure1) using a tiny contour interval; then we can mark area of correlation manually and sort out sampling points that correlated to point of interest.

The method is simple as shown, quite flexible and very suitable for apriori analysis of data over small areas.

CASE STUDY

In this work a Semi-flat area with a water channel in the middle running in the East-West direction, was selected to carry out recommended observations. The study area is located at the south of Khartoum. The total area of the study area is 96550 m2. The area is divided into 10 Sections. Each Section lies within a circle of about 100 meter diameter with the tested point at the centre. 129 sample points, with 10 test points were observed, 50 of these points were taken along the water channel. The minimum and maximum elevations of the site area are respectively 381.064, 385.259 meter above mean sea level. A random sampling was designed for this field of work, the data was obtained by field surveying technique using total station instrument, the interpolation package applied in data analysis is SURFER 7.0, and the method used to predict the values of the tested points is inverse distance to a power.

ANALYSIS OF THE RESULTS

Table 1 compares measured values of the tested points with interpolated ones either they are interpolated using all observations or only correlated observations; the differences between measured values of the tested points and the interpolated values using all observations are shown in Table 2; whereas Table 3 shows the differences between the measured values of the tested points and interpolated values using only correlated observations.

Finally Table 4 compare the accuracy of the interpolation process using all observation, to the same process using only correlated observations.

From the above Tables it is obvious that:

1. The differences between observed and interpolated height values using all observations (Table 1) give the maximum and minimum values of 1.548 and 0.626 meter, respectively;

2. The differences between observed and interpolated height values using correlated observations (Table 2) give the maximum and minimum values of 0.064 and 0.000 meter, respectively; and

3. The predicted values obtained using correlated data give better results (with the mean difference and standard deviation of 0.007, 0.031 respectively) compared to the prediction using all observations (with the mean of difference and standard deviation of 1.034, 0.365 respectively).

CONCLUSIONS

1. This graphical method proves to be effective and simple to apply; and can generate an accurate digital terrain model in a cost-effective way, but it is very time consuming process.

2. The efficiency of the graphical method compared with the geostatistical methods may need to be investigated.

REFERENCES

1. Zhilin Li, Qing Zhu, and Christopher Gold, 2005, DIGITAL TERRAIN MODELING Principles and Methodology, CRC press,USA.