Interpolation Functions and GIS Application for Houston Soils

Figen Ramirez and C. Vipulanandan, PhD., P. E.
Center for Innovative Grouting Materials and Technology (CIGMAT)
Department of Civil and Environmental Engineering
University of Houston, TX 77204-4003
Tel: 713-743-4291; email: fyucel@uh.edu

Abstract: Applicability of various interpolation functions for use in GIS to predict the spatial variation of natural moisture content of soil in Houston, TX was investigated. Of the interpolation functions investigated, Universal Kriging method better predicted the spatial variation of natural moisture content.

1. Introduction:

Interpreting large volumes of geotechnical data without any visual aid might be a hard task. GIS can help to query the data and help to interpret data. The interpolation functions play a critical role in estimating the properties from limited data available. For this reason, borehole data from greater Houston area were used in this study. The area along the highway I-10 at loop 610 intersection was chosen and the natural moisture content of soil was selected for the study. Total of 55 boreholes were used in the test run. ArcGIS 9.1 was used for the whole process.

2. Objective:

The primary objective was to test the different interpolation approaches available in the GIS software to predict spatial variation of the natural moisture content in the Houston area soil.

3. Methods:

Data from 55 boreholes were used for this project. From descriptive statistics it is found that the mean of the data was 12.4 and median was 11.9 which was less than the mean. The data was arranged in increasing order along NW to SE. Standard deviation of the data (3.51) showed that the data is spread widely and clustering around the mean is loose. Although it has a very low value, the skewness of the data was positive. The kurtosis of the distribution was less than 3. The data was very random and has sudden localized changes in a few locations. The spatial dependency, randomness, trends and isotropy of the data has been analyzed by using trend analysis and semivariogram clouds. The trend of the data appears to be quadratic trend. Over all, the data can be interpreted as normally distributed.

4. Analysis and Result:

Interpolations for natural moisture content at the 5 ft depth by using different methods and accuracy of the methods has been checked. Data interpolated using Inverse Distance Weighted, Ordinary Kriging, Universal Kriging and Spline methods. Each method was checked with the existing data and checked for their accuracy (Figure 1). From interpolation functions used, it was found that the universal kriging was the best match for natural moisture content of soil interpolation (Figure 2)

5. Conclusion:

Based on the data analyzed the predictions of spatial variation of natural moisture content was better interpolated with Universal Kriging method.

6. Reference:

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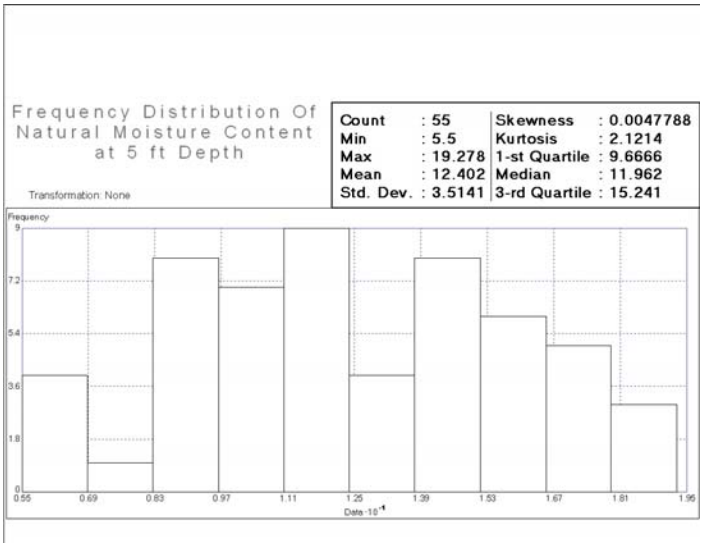

Figure 1. The Frequency Distribution of the Natural Moisture Content at 5ft Depth.

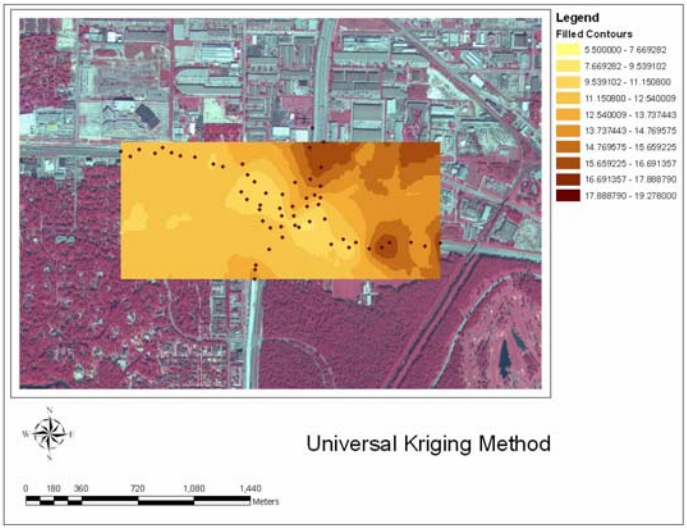

Figure 2. Different Interpolation Method Results.