ACCURACY ASSESSMENT OF GIS DATA USING SIMULATED SPATIAL ERROR MODELING TECHNIQUES

Abstract: Barundev Paul, Mirnal Kanti Ghose

GIS databases are an ever-evolving entity from their humble beginning as paper maps., through the digital conversion process to the data maintenance phase. It represents aspects of our (infinite!) world in finite computer systems. GIS users want to make decisions based on the geographic data stored in their GIS by combining multi layer data of different topics. A combination of several geographical aspects leads to an understanding of their relation and thus provides a helpful tool in complex decision making and obviously the computer map must not be adapted to the accuracy of their represented topics. Thus there is always a question mark on the reliability of the results and the assessment of impact on the decision making.

In the multistage process of GIS analysis and processing, errors are inevitable to be introduced at every stage either explicitly or implicitly and thus propagating to output. Moreover, the error propagation continues when output from one operation is used as input to ensuing operation, leaving no room for the record of the accuracy of the intermediate results, sometimes leading to a complete mess at the final output. It is unfortunate that until recently, little attention has been paid to this problem. No professional GIS software currently in use can present the user with information about the confidence level that should be associated with the results of GIS analysis. As GIS gains more importance, it is necessary to learn more about the features of the combination of the errors occurring in such a system. (i.e. functions for the error rules when applying an overlay operation).

Problems of hybrid GIS – a combination of raster and vector, concern the spatial data model and to represent geographic information. Different error models (mathematical models) are associated with two different data models – raster and - vector based GIS and if the two models are to be integrated, the error models must be reconsidered by generating functions for the combination of input errors.

Following Thomas K. Windholz (2001), the concept of transforming accuracy values into probability areas is used to arrive at a propagation model respectively for raster, vector and raster-vector layers. The model presented here, takes into account of the spatial relationship of the database attributes. It is based on the generation of error surfaces depending upon the nature of the spatial relationship of the attributes under examination. It is akin to the spatial Monte-Carlo simulation. The main advantage of this model lies in its ability to give the error assessment for each ‘pixel’ which is the smallest unit of spatial representation. It can be very well integrated with vector layer to enable the GIS user to get the overall / cumulative or stage error assessment of the GIS database