A Localized Geometrical Alignment Technique for Updating Geo-Spatial Databases

Wadembere M. Ismail

ABSTRACT

Spatial data capture is becoming easier due to reduction in cost and technologies thus attracting many players at different times for the same location who often use different methods, instruments and data storage structures. These datasets can be integrated through direct merging however, it creates geometrical errors in form of slivers and danglings emanating from the openings and overlaps of objects. Attempts to address this limitation have not achieved the duo objective of removing the errors and maintaining the geometrical characteristics of objects. The study therefore developed a Localized Geometrical Alignment Technique (LGAT) for updating geo-spatial datasets. The technique provides an innovative approach of integrating multitude of vector datasets having spatial topological and attributes inconsistencies from different agencies.

The study used a mixed methods' approach of design science by employing document review and gap analysis to identify the most appropriate level to manipulate spatial dataset geometries which was triangulated with system approach, design thinking as well as prototyping to develop and test LGAT. The methods created a relationship between quantitative and qualitative findings making them applicable. The key innovation in developing LGAT was representing every unique identifiable spatial geometry instance in the data structure using points which were computed via text to get parameters to update only the changed parts of objects, thus avoiding several iterations during updating while maintaining topology and attributes. The developed LGAT was tested by coding algorithms in MatLab for each required function and running them as a method.

LGAT accomplished 98% of the 22 updating requirements when it was applied on 14 datasets that were chosen due to their geometrical type, composition, characteristics, errors and precision, attributes variation. LGAT performance time varied inversely proportional to the number of points which made up the dataset and according to the geometry type in order of points, lines and polygons. The time taken to update the different datasets varied with polyline geometry type taking 19% and polygons 25% more than points.

LGAT provides an easy and accurate way of updating spatial datasets without copying objects. Its application ranges from updating to quality improvement and standardization of geospatial datasets. Further studies can look at how to handle more than two datasets simultaneously and topologically when updating spaghetti datasets which may ease and enhance the updating process.