DWSI: AN APPROACH TO SOLVING THE POLYGON INTERSECTION-SPREADING PROBLEM WITH A PARALLEL UNION ALGORITHM AT THE FEATURE LAYER LEVEL

* The polygon intersection-spreading issue was addressed using a dual-way seeds indexing (DWSI) technique based on R-tree and the Open Geospatial Consortium (OGC) simple feature model. To verify the viability of the data partition technique, the parallel polygon union algorithm, based on the enhanced DWSI and the OpenMP parallel programming model, was created. The experimental findings show that by resolving the polygon intersection-spreading issue, the enhanced DWSI approach can implement a reliable parallel work split. When compared to the serial proposal, the parallel union algorithm utilised DWSI speeded up computing in addition to scaling up data processing. It also demonstrated improved computational efficiency with higher speedup benchmarks in the handling of larger-scale datasets.
* In this study, the intersection-spreading problem was solved and the parallel polygon union algorithm was implemented at the feature layer level using a data decomposition technique termed a DWSI. The experimental outcomes supported the viability of DWSI for the implementation of parallel algorithms that are computationally demanding in GIS. The outcomes demonstrate that the polygon union technique can be parallelized and accelerated based on DWSI, and the efficiency increase will be significantly more pronounced with more data. The DWSI has a substantially lower time complexity than the Vatti method. As a result, the DWSI approach does not make the union algorithms more difficult or time-consuming.
* We enhanced the DWSI approach to fully address the issues of parallel failure and load imbalance, which are brought on by the fact that the majority of features are grouped together. The experimental findings demonstrate that the parallel robustness of the union technique was improved by the enhancements based on a specification of the predicted group size and the recording of the segmentation features. Both the serial and parallel union methods benefit from some accelerated processing thanks to the improved DWSI approach. By allocating about equal numbers of polygons to each thread, load balancing can be accomplished if the element quantities in the disjoint subsets produced by the enhanced DWSI approach remain under control. When compared to the standard grid-based data partitioning approach, the optimised.
* In contrast to standard grid and feature sequence-based data division, the improved DWSI approach may thereby address the issue of polygon intersection-spreading and conduct data decomposition independently in a more reliable manner approaches. Certain serial spatial analysis techniques, such the polygon merge algorithm and polygon symmetrical difference algorithm, can be parallelized based on the DWSI method. The polygon overlay operations have been effectively parallelized using MPI and this data partition algorithm in a cluster context. In order to parallelize the polygon union technique and certain other overlap algorithms in GIS at the feature layer level, we suppose that the DWSI algorithm can be a suitable method for performing data decomposition.