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Polygonal Line Simplifying Methods Applied to GIS

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Polygonal Line Simplifying Methods Applied to GIS

Geographic Information Systems (GIS) have tools to produce **cartographical generalizations** that are based in spatial transformations which alter the geometrical data and topological representation. The major spatial objects use vector as the basic entities for representation. Vectorial generalization has been well studied and is the most common transformation used in existent systems. The three basic elements for vectorial representation are **points, lines and areas** and are translated to geographical objects. This article discusses **polygonal line simplifying methods** explains the experiments and evaluation processes for two algorithms to improve line simplification applied to GIS: an adaptation of Douglas-Peucker algorithm, an area/perimeter quotient, and an adaptation of Wang, algorithm applying arc technical recognition.

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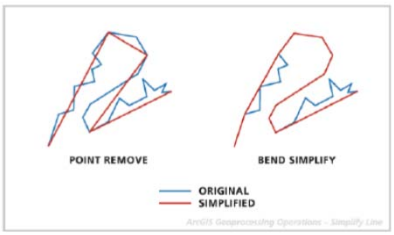
In light of the perspective of reaching cartographic precision pertinent to registering scale, this article reports the evaluation and experiments of two line simplifying algorithms applied on ArcGi - ESRI :



An adaptation of the Douglas-Peucker algorithm – POINT-REMOVE, which uses the area/perimeter quotient, and an adaptation of the Wang algorithm– BEND SIMPLIFY, which applies arc recognition techniques, analyzes its characteristics and eliminates the most meaningless ones. Since the system is not translucent to the user, subjective criteria were used to apply the algorithm, which represent chosen and tested tolerance values.

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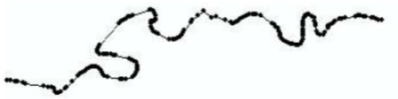
Following, we have the original line and its respective number of vertices, and the result of applying the two algorithms for the established parameters:

Original line representation with 263 vertices (spots).

Simplified line representation using POINT-REMOVE algorithm and 10 m parameter among vertices – Number of resulting vertices: 16.

Simplified line representation using POINT-REMOVE algorithm and 20 m parameter among vertices – Number of resulting vertices: 9.

Simplified line representation using BEND-SIMPLIFY algorithm and 10 m parameter among vertices – Number of resulting vertices: 171.



Simplified line representation using BEND-SIMPLIFY algorithm and 20 m parameter among vertices – Number of resulting vertices: 147.

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TABLE 1 – Line Simplifying Comparison

Simplifying Parameter	*POINT-REMOVE algorithm*	*BEND-SIMPLIFY algorithm*
10 meters	16	171
20 meters	9	147

As seen on table 1, from a total of 263 vertices on the original line, upon applying the POINTREMOVE algorithm, adapted from Douglas & Peucker, a 94% decrease of vertices was obtained when applying the 10 meter parameter among vertices and 97% when applying the 20 meter parameter.
Yet, upon applying the BEND-SIMPLIFY algorithm, adapted from WANG, a 35% decrease of vertices was obtained when applying the 10 meter parameter among vertices and 45% when applying the 20 meter parameter.

About topological relations (figure 11), simplified lines were brought together with layers referent to level curves and it was observed that, upon applying the POINT-REMOVE algorithm, despite having a larger decrease of vertices on the line, it loses its original geometry completely, which impairs its vicinity topological relations.
On the other hand, upon applying the BEND-SIMPLIFY algorithm, there is not a significant decrease of vertices, but the line presents a closer-to-the-original geometry, which outcomes in a better topological relation with the other elements in the map.