GENERATION OF TOPOGRAPHIC MAP *APPLYING AUTOMATIC GENERALIZATION*

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ABSTRACT

In Colombia the production of small scale topographic maps, specifically scale 1:100.000 it is not a regularly production line, because a lack of standard methodology to make it is possible. The objective of this project is to generate a methodology to produce a topographic map scale 1:100.000 from 16 topographic maps sheets in scale 1:25.000, using the concepts of automatic generalization and geo-processing with python. The result of the project will we be very useful, due the fact the topographic digital information in a medium scale, could be used to generate a new maps in small scale.

Keywords: automatic generalization, cartography, topographic maps, Arcpy

Introduction

The production of topographic maps is a very time consuming process, therefore there is a necessity of creation a new approaches that contributes to generate base maps from different sources. The aim of this paper is to present a proposal methodology to produce a topographic map scale 1:100.000, from a source of 16 topographic maps sheets in scale 1:25.000, using the concepts of automatic generalization and geo-processing with python. The result is a new map scale 1:100.000, where some elements were eliminated and the others elements generalized using an Arcpy functions such as: simplify building, aggregated polygons and others depending of the characteristics of the elements.

This methodology will be very useful for the producers of topographic data, because it will allow improving the production time and machining resources expended in the generalization typical process made in the country. These results will contribute to the optimization of the cartographic generalization process that produces cartography, based in the reuse of previously acquired information in the National Cartographic Agency of Colombia as well.

Objective

The main objective of this project is to generate a proposal methodology in order to create a map scale 1:100.000 using automatic generalization by applying Arcpy algorithms.

Methodology

Cartographic generalization process responds to the needs of scaling, preserving information while reducing the amount of data on the map (Cuenin, 2002). Therefore, cartographic generalization is a necessary step in the cartographic production at smaller scales. This project looks for the implementation of the methodology of cartographic generalization, making it necessary to establishing a working chain, that permits to have results of consistent and good data.

To produce the map scale of 1: 100.000, we used as a source 16 sheets 1: 25,000 scale produced by the IGAC; national organization responsible for the production of the cartography of the country. Once the analysis of the data set of each scales was done, we proceeded to select the ArcPy operations, in Arcgis, for generalization and the functions applicable, which were subsequently tested. The result of this selection was the algorithms and functions more appropriate for each coverage, using the following criteria: geometry of each layer, the form of the implementation as a result of generalization process, the cartographic specifications given by the USGS that match quality parameters (USGS, 1992) and the minimum area elements considered by the IGAC for maps scale 1:100.000.

As a synthesis product used in carrying out the tests applicable to the elements functions, was the test script with parameters that gave the best results. Because these items on the map are present in each of the 16 sheets, it was required to create a programming function to apply the methods of generalization massiveness. The function was implemented in a cycle of iterations between the ordered sheets and the data set. These two elements are arrays or matrices that specify the sheet number and the data set to which each element belongs. When one of them is selected by specific coverage; we apply the same combination of processes to all elements with the same name in each of the 16 sheets, thus obtaining the desired result.

RESULTS

The results of cartographic generalization were both; generalization scripts and the generalization of each of the selected items. As a result of the selection and elimination operations, were eliminated in total 22 elements. Different combinations of functions were executed, for each coverage, using ArcPy in Arcgis, as follows:

- Union of 16 sheets at 1: 25,000 by "Merged_Shapes" feature implemented

- Selecting and removing restriction of minimum area of polygons, through the "Select_analysis"
- Selection through consultation restricted by a specific category.
- Adding polygons with a given tolerance (meters) using the "Aggregate_Polygon" function
- Selection of polygons based on the specifications of the USGS, for each coverage through the "Select_analysis"
- Harmonization of coverage, by using the algorithm "Paek" to a certain tolerance (meters)
- Simplification of buildings using the "Simplify Building" function, by using the parameters of tolerance (meters) and restriction minimum area of the specifications of the USGS.
- Simplification of coverage, using the algorithm "Bend Simplify" and the match tolerance parameter (meters)

Figure 1: Example of the generalization process

Forest	AggregatePolygons_cartography	Nearby polygons are consolidated according to the assigned tolerance (200 to 250 meters)	

CONCLUSIONS

Once applied both processes and functions of generalization to each elements, it showed an important reduction in both time and resource production machine in turn, allowed to observe that the percentage reduction in generalized elements was significant.

Table 1: Generalization process quantification

Cobertura presente	Elementos iniciales	Elementos finales generalizados	Reducción (%)
Bosque	833	83	90,0
Construcción P	26590	86	99,7
Construcción R	406	17	95,8
Administrativo P	418	109	73,9
Administrativo R	18	14	22,2
Puente P	238	8	96,6
Curva Nivel	9318	1416	84,8
Drenaje Doble	56	5	91,7
Drenaje sencillo	13.433	462	96,6
Isla	65	29	55,4
Laguna	337	12	96,4
Orografía	80	66	17,5
Pista Aterrizaje R	7	1	85,7
Vía	7.682	465	93,9
Vía Férrea	5	3	40,0

Implementing the processes of automatic cartographic generalization depends on the base information, because it is needed high quality criteria to achieve results that meet the criteria for the scale.

Applying the USGS specifications is important because it helps to follow the standards for the production of topographic maps at scale 1: 100.000, which allowed determine the quality of the data generalized, based on these standards, giving greater reliability to the proposal methodology and the opportunity that this processes could be implemented in different areas of the country with different spatial data.

Using Arcpy algorithms allow to create a very good quality map, and the automated procedures let use standardized data, so subjectivity is minimized in a massive processes such as generation of maps at different scales by generalization process

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