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MODEL GENERALIZATION OF THE HYDROGRAPHY NETWORK IN THE CARGEN PROJECT

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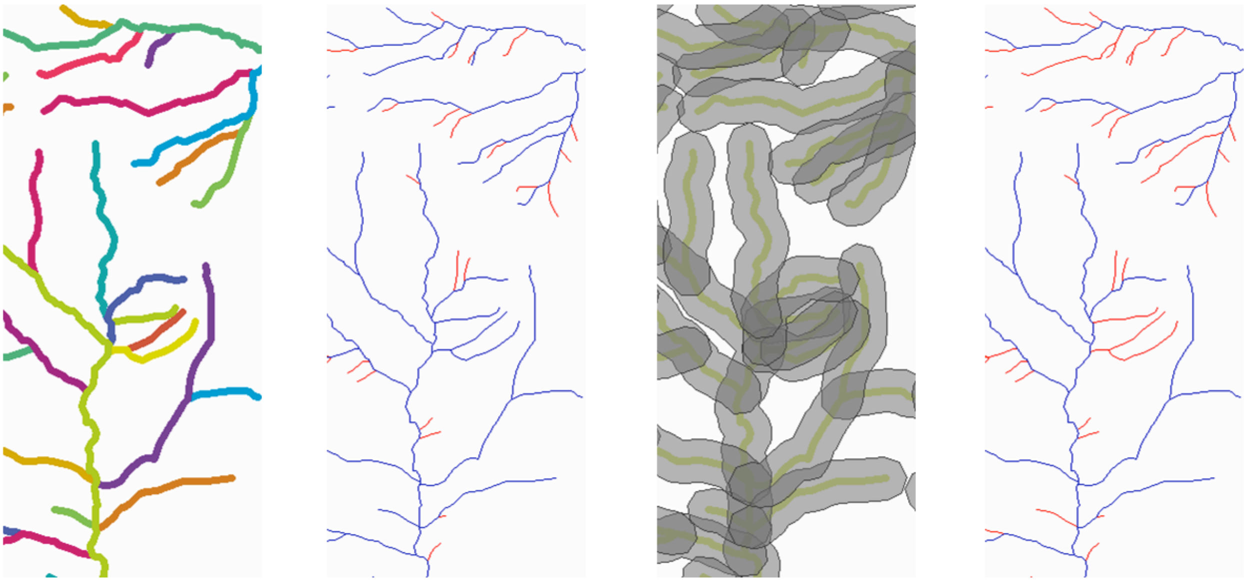
This paper will present the process developed for the generalization of the hydrography in the CARGEN project. CARGEN (CARtographic GENeralization) is a research project under development at the Department of Information Engineering of the University of Padua in cooperation with the Italian NMA, the IGMI (Istituto Geografico Militare Italiano) and the Regione Veneto; its aim is to design algorithms for the automatic generalization of the IGMI DB25 geodatabase in 1:25000 scale from the regional GeoDBR geodatabase in 1:5000 scale. As the hydrography is one of the most important themes in the two data models, its generalization was one of the main topics that the research focused on.

The paper will describe the generalization of the rivers; although the process could be applied to canals, they are not explicitly mentioned; ditches too are not treated, as a special typification algorithm has been developed for their generalization. Still waters as lakes or ponds are not covered in this paper.

The GeoDBR and DB25 data model share some similarities: in both of them the hydrography network is represented with a node-edge graph and the feature classes describing flowing waters (both man-made as canals and natural as rivers) use linear geometries but the broadest of them, using areal geometries. The classification of rivers is based in both cases on their width, with the GeoDBR taxonomy listing only two different classes ("narrow" and "broad" rivers, respectively wider less and more than 1 meter) and the DB25 comprising four classes ("very small", "small", "medium", "large"): this made necessary to re-classify the input data. Furthermore the DB25 specifications require that rivers shorter than 250 meters should be not present in the generalized data and that in areas where the hydrography network is very dense it should be pruned to reduce its density.

The process developed handles then two type of transformation of the data: classification of the source data according to the target data model and pruning of the network according to the target specifications. These two objectives required to implement different algorithms; in particular to reclassify the source data it was necessary to develop an algorithm to measure the width of each river and a harmonization algorithm that could correct and improve the results of the reclassification; to prune the network it was necessary to reconstruct from the graph the course of the rivers in order to apply a length threshold, then it was necessary to enrich the data model gathering further information in order to assess the importance of a river course and decide whether to delete it or not if it was too close to other rivers. As the source data lacks explicit information on the flow direction of the rivers, this information is extracted from the z-coordinates of the geometries, with an algorithm able to handle flat river sections and also to cope with errors in the source geometries that will make a river section to flow "uphill".

The paper describes the overall process, focussing on the most original aspects of this works, that are the harmonization of the classification, the flow reconstruction and the density pruning. The results of the process, evaluated by professional cartographers, have been found generally good. Some improvements to the reconstruction of the river courses are being tested, while further research is needed to provide a better solution to the generalization of braided streams.



In the image: four steps in the pruning process; from left to right: reconstruction of the river courses (different color means different river course), selection of the river courses under the length threshold (red lines), buffers are drawn to calculate the proximity between the river courses, river courses are pruned by density (red lines).