Addressing the unresolved proximity conflicts during the generalization of buildings using CartAGen

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Abstract:

The research aims to generalize buildings from 1:10K to 1:25K and 1:25K to 1:50K, relating to rural, semi-urban, and urban areas. The source datasets are from the Ordnance Survey, Great Britain (OSGB) (1:10K), and the Survey of India, India (SoI) (1:25K). The source and target scales are chosen based on the availability of the existing datasets from OSGB and SoI.

The study uses multi-agent generalization models like AGENT and CartACom, available in CartAGen (IGN France, 2022), an open-source map generalization research platform. The previous findings conclude that the AGENT model performs well in urban areas (Ruas & Duchêne, 2007); in contrast, the CartACom model suits rural areas (Duchêne, Ruas, & Cambier, 2012).

In the AGENT model, the micro agents (e.g., buildings) perform generalization to satisfy the internal cartographic constraints: size, granularity, squareness, elongation, and orientation. However, the meso agents (e.g., blocks) handle the constraints like density and proximity. Moreover, the CartACom model handles the relational constraints like proximity, parallelism, and topology preservation, between micro agents (e.g., buildings <-> buildings, roads <-> buildings, et cetera.). Ruas & Duchêne (2007) and Duchêne et al. (2012) explain the design principles, agent modeling, and their interactions in the AGENT and CartACom models, respectively.

The research combines these complementary generalization models sequentially to generalize buildings in rural, semi-urban, and urban areas, thereby taking advantage of the strengths of each model. First, the AGENT model is used to generalize the buildings. Then the CartACom model is used to resolve the conflicts within the generalized buildings and between generalized buildings and the roads of the target scale. Even though the combined use of models has resolved most conflicts, proximity conflicts still appear in semi-urban and urban areas. Table 1 summarizes the status of proximity conflict resolution in rural, semi-urban, and urban areas for two target scales, 1:25K and 1:50K. For semi-urban areas, the unresolved proximity conflicts appear only when the target scale is 1:50K. Duchêne et al. (2012) also reported the same observation.

Generalization	Rural	Semi-urban	Urban
1:10K to 1:25K			
1:25K to 1:50K			

	No unresolved proximity conflicts		Unresolved proximity conflicts exist

Table 1. Status of the proximity conflict resolution

Figures 1, 2, and 3 present the results of the generalization of buildings by combining AGENT and CartACom models sequentially. The results (Figures 1b, 2b, and 3b) show that the combination has improved the situation by resolving some proximity conflicts (marked in black circles). However, some conflicts still exist (marked in red circles) in semi-urban (when the target scale is 1:50K) and urban areas. Figure 2c highlights the discrepancies in the road data of 1:25K and 1:50K, i.e., the number of roads in 1:50K data is more than that of 1:25K data. Hence, in this case, roads of 1:25K

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are used instead of 1:50K (Figures 2a and 2b) to check and resolve the proximity conflicts between generalized buildings and roads of the target scale.

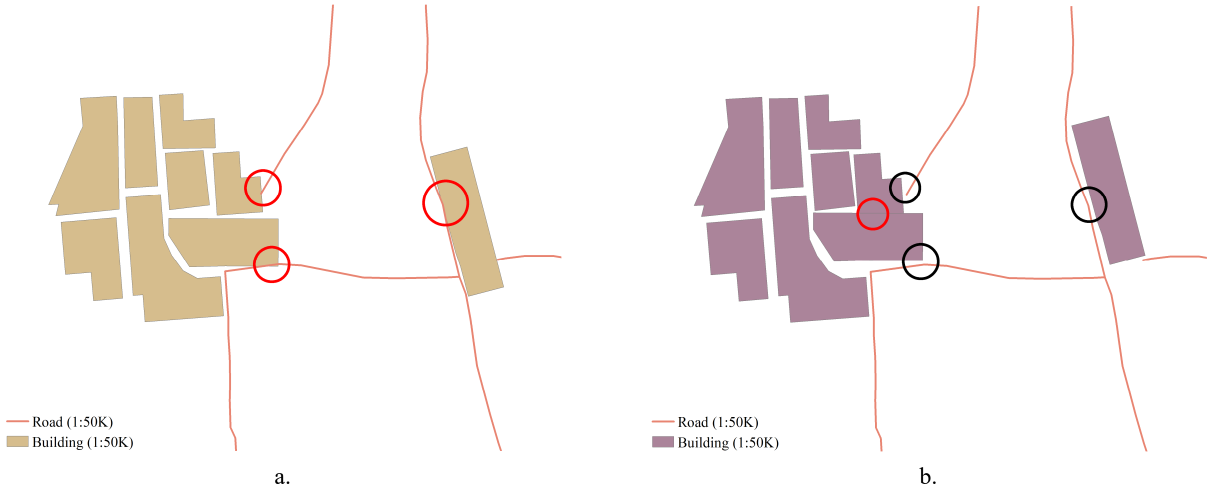

Figure 1. Proximity conflicts in semi-urban areas (target scale: 1:50K): a. Conflicts before applying the CartACom model, b. Conflicts after the application of the CartACom model. Data Source: Survey of India.

Figure 2. Proximity conflicts in urban areas (target scale: 1:50K): a. Conflicts before applying the CartACom model, b. Conflicts after the application of the CartACom model, c. Discrepancies in the input data. Data Source: Survey of India.

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a. b.

Figure 3. Proximity conflicts in urban areas (target scale: 1:25K): a. Conflicts before applying the CartACom model, b. Conflicts after the application of the CartACom model. Data Source: *Contains OS data © Crown copyright and database right (2017)*.

This work will discuss the improvements made in the generalization action proposals in the AGENT and CartACom models to address the unresolved proximity conflicts in semi-urban (when the target scale is 1:50K) and urban areas. Currently, we are working on the improvements by introducing actions like aggregation, deletion, et cetera in AGENT and CartACom models. Moreover, we plan to submit the improvements to the CartAGen project steering committee for evaluation and its inclusion as our contribution to the open-source platform.

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