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OSM positional accuracy assessment and visualization for different user needs

Andriani Skopeliti *, Savvas Vasileiadis

Cartography Laboratory, School of Rural Surveying and Geoinformatics Engineering, National Technical University of Athens, Greece, askop@survey.ntua.gr, vasileiadhs.savvas@gmail.com

* Corresponding author

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Abstract:

Assessing the quality of VGI is an important research topic in recent years. A widely accepted method is to compare VGI data with authoritative data provided by NMAs or commercial companies. Most studies focus on OSM data due to worldwide coverage and data variety. In particular, the positional accuracy of the road network has been studied for several regions worldwide. The valuable conclusions of these studies contribute to a general understanding of VGI quality and the acceptance of OSM data by the geospatial community. However, little consideration has been given to how users need to be informed about quality and how visualization can be used for this purpose.

The positional accuracy of the road network can be assessed at different levels of details:

- Point/Vertex Level: the Distance (m)between the vertices of the OSM road network and the authoritative road network lines is calculated

- Line Level: The Average Distance (m) for each road line as identified by the unique OSM ID code

- Area Level / Grid Cell Level: The Average Distance or the Percentage of OSM road length in buffer zones of 1m, 2m, 3m and 5m created around the authoritative data is calculated for a 1km^2 cell grid

Since the positional accuracy of the road network is assessed at three levels of detail, the visualization can be carried out at different scales and inform the user according to his needs. For those users who wish to use OSM as a basemap in map composition, information on positional accuracy is provided at the grid cell level (Figure 1a). Users who want to use the road network for routing analysis or in combination with other thematic layers for spatial analysis or urban planning need to be informed at the line segment level (Figure 1b). Finally, positional accuracy at the vertex level, the most detailed level, can be used for studying error distribution or for large-scale activities, e.g. road construction and maintenance, maps for autonomous driving (Figure 1c). For the visualization of position accuracy, a diverging colour scheme from green to red is used for point, line and polygon symbols. The visualization of positional accuracy is made possible by the integration of symbols in OSM, which facilitates the simultaneous display of data and quality. Positional accuracy at the grid cells level is also portrayed with transparency for this reason.

The evaluation of positional accuracy and visualization at different levels of detail were applied in a pilot case study for a 35 square meter area in Western Attica in Greece. The OSM road network is compared with the most detailed and up-to-date large-scale geographic data for Greece. This data has been collected by the Hellenic Cadastre (HC) as part of the development of the Greek cadastre. Several studies have already assessed the quality and in particular the positional accuracy of the OSM road network in Greece by comparing it with authoritative datasets, but this is the first time that a comparison has been made with such a large-scale dataset collected under the quality requirements of a cadastre. On the other hand, OSM provides web maps at multiple scales. The maximum zoom level (value 19) allows display at a scale of around 1:1000. Hellenic Cadastre collects parcel data to create cadastral diagrams at a 1:1000 scale for the urban areas and a 1:5000 scale for the rural areas. Roads are captured as parcels i.e. polygons with a specific code (KAEK) that identifies them as roads. Based on the above analysis, the two datasets can be compared. Pre-processing involves the projection of OSM data (geographic coordinates in WGS84) to EPSG2100. Additionally, it is needed to extract the medial axis/centerline of each parcel/polygon that represents the road axis. Only OSM road network lines that are inside the HC road polygons are examined. In this way, corresponding lines are compared. Results show acceptable positional accuracy for the OSM road dataset: 95% of the OSM road length has a mean distance of less than 3 m from the HC dataset, 50% of the OSM vertices are 1 m away from the HC road lines and 90% are 3 m away. Positional accuracy visualization at different scales is presented on a web map to communicate the results. (Figure 1). Critical values in symbolization are set

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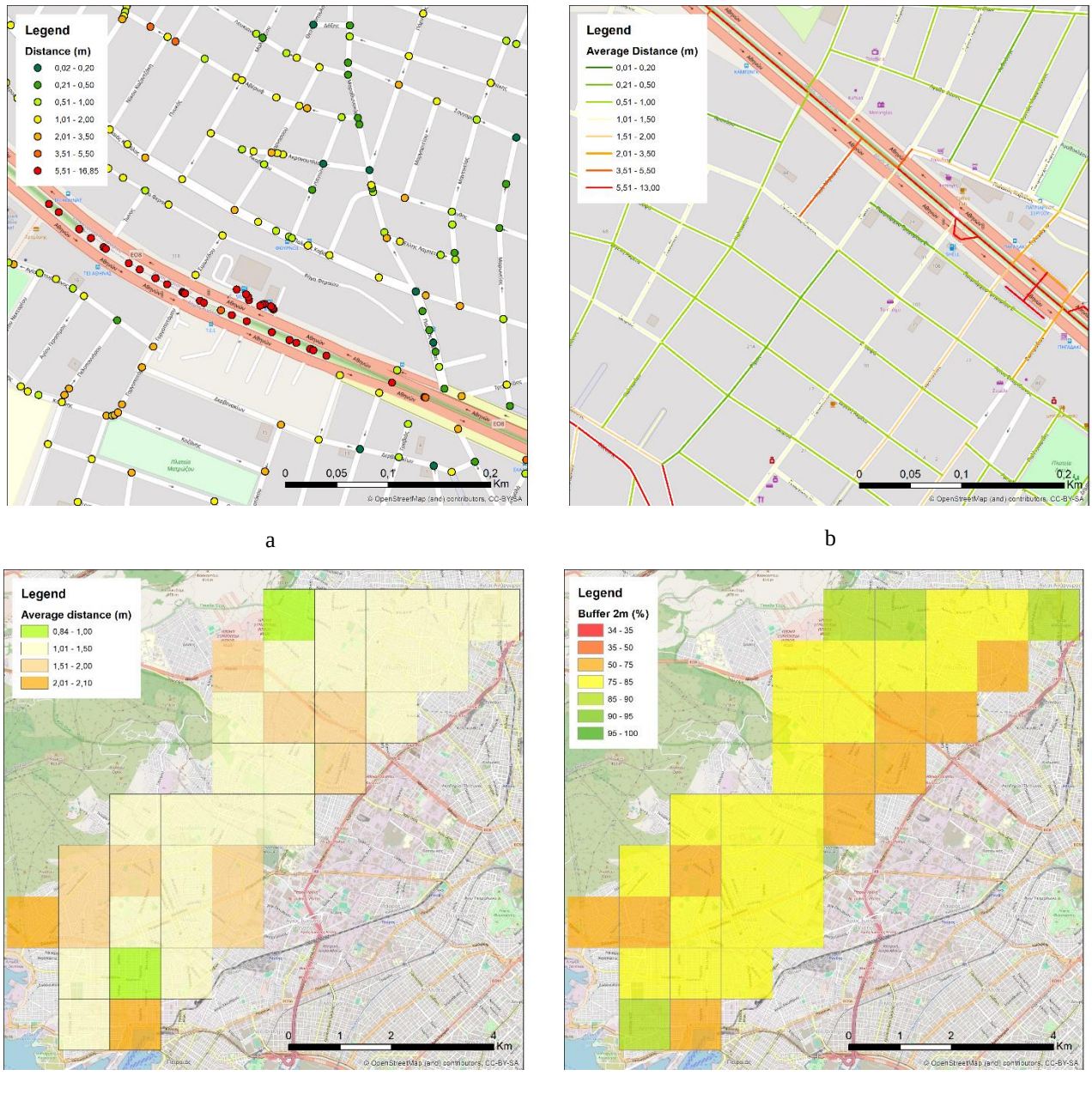
based on the average sidewalk width (i.e., 2 m), the average street lane width (i.e., 3.5 m), and at 5.5 m by adding the sidewalk width and a single-lane street (Zacharopoulou et al., 2021). In the future, quality assessment and visualization at different levels of detail will include additional quality elements such as thematic accuracy and will be expanded to several settlements.



a b

c d

Figure 1. The positional accuracy of the road network can be evaluated and visualized at different levels of details Point/Vertex Level (1a), Line Level (1b) and Area / Grid Cell Level (1c) or (1d) to satisfy user needs.

References

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