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A Second Look at Label Density in Large-Scale Online Maps

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Abstract:

Large-scale representations from multi-scale pannable (MSP) map providers like Google, Microsoft Bing, OpenStreetMap, ESRI and Mapbox are often the only maps available for local environments. Evaluating these services helps to determine the quality of the underlying spatial data and the rendering process (Antoniou & Skopeliti 2015; Hecht et.al 2013; Peterson 2021; Siebritz & Sithole 2014). One aspect of that evaluation is annotation: the amount of labelling of features.

In our previous research, manual and automated procedures were developed to compare label density between MSP map services. The manual approach generated a pairwise comparison between map services at random locations using JavaScript and the associated Application Programmer Interface (API). Representations were then evaluated for North America, Europe and Africa. In the experiment, map pairs at the 19th zoom level for North America, Europe and Africa for Google, Bing and MapBox are visually compared. It was found that Google maps from North America had consistently higher label density than those from Microsoft Bing and Mapbox. Google Maps also held an advantage for Europe. Maps from Microsoft Bing, based on data from HERE and TomTom, were more detailed in Sub-Saharan Africa in comparison to both Google Maps and Mapbox. Relying exclusively on data from OpenStreetMap, MapBox had the lowest label density for all three continents.

In the automated approach, a python script downloaded random tiles from Google, Bing, OSM, and ESRI. The Amazon Web Services (AWS) tool called Rekognition was used to count the number of characters on each tile. As opposed to Optical Character Recognition (OCR) that requires horizontal text with a consistent background, Rekognition uses artificial intelligence (AI) with image object recognition to recognize text. It can detect characters and words in English, Arabic, Russian, German, French, Italian, Portuguese and Spanish. This service produced a measure of map annotation for each service (see Fig. 1). The results closely mirrored the results for the manual approach.

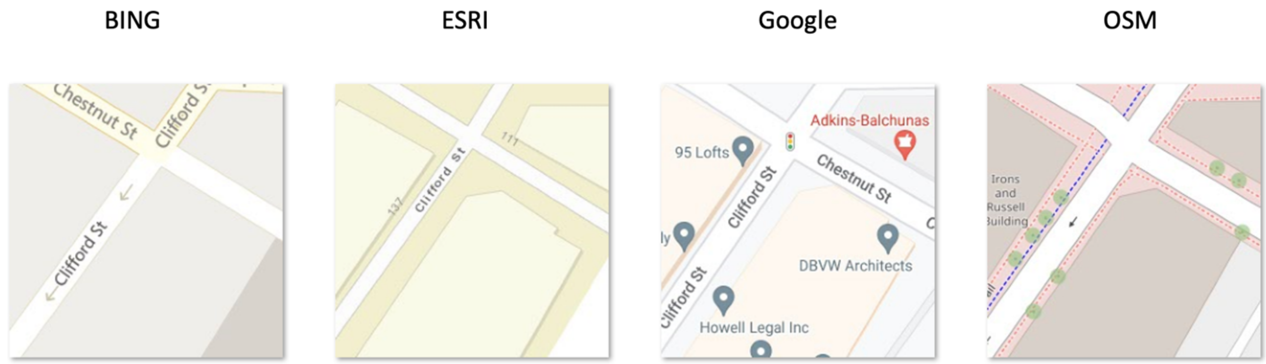

Figure 1. Randomly-selected map tiles of the identical location from Bing, ESRI, Google, and OSM. As can be seen, the tile from Google includes more features and text.

A major problem in the automated evaluation of the tiles were certain types of shadings used in OSM and ESRI maps. Shadings, depicting different types of land cover, included shapes that could be interpreted as text. An OSM symbol indicating a mix of deciduous and conifer trees was interpreted as the characters 4 and 9. Methods were employed to identify these shadings and remove these tiles from the character count procedure.

In this second look, we repeat the automated procedure and compare the results between 2023 and 2024. Slight differences were found. These differences may be the result of either the map service provider including more features on their maps

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to label, or increased labelling of existing features. Either scenario represents an improvement to the map provided by the service provider.

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