“Ohsome” OpenStreetMap Data Evaluation: Fitness of Field Papers for Participatory Mapping

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Crowdsourced information can support disaster management in different ways. Up-to-date information is provided by local citizens, which can be used to enhance flood models [1] or to capture flood risk perception [2]. Anyone with internet access can contribute new data to the collaborative mapping project OpenStreetMap (OSM), edit, and freely use the data provided by OSM. For an adequate use, the quality of the data needs to be known beforehand, and thus, the quality assessment of OSM is an important research topic. If reference data are available, extrinsic quality evaluation is possible [3]. However, often there is a lack of such resources. Therefore, intrinsic quality measures are required. Raifer et al. [4] developed the OpenStreetMap History Database (OSHDB) to analyze the temporal evolution and spatial heterogeneity of the OSM data at large scale.

Our study uses the OSHDB for analyzing OSM in Brazil, where we investigate flooding in São Paulo and Rio Branco within the Waterproofing Data Project. We apply the method of participatory mapping, which is based on OSM Field Papers [2]. Participants can mark their experiences on the Field Papers and these resulting Sketch Maps can automatically be georeferenced and thus, the collected data can be processed in a fast way. However, due to heterogeneous OSM data in different areas, it is necessary to evaluate the fitness for purpose of the Field Papers first. If the required base data are not available, it is difficult to use the Field Papers for the Sketch Maps. Participants might find it difficult, for example, to orientate themselves on the map due to a lack of the representation of important points of interest (POIs) and landmarks in OSM. Moreover, OSM data, which have not been updated for a long time, might be wrong and therefore can lead to errors in the drawing of the participants.

We developed a tool which bundles several intrinsic analyses to evaluate a study region's fitness for usage in Field Papers. Results are delivered in written form combined with recommendations for the person who wants to apply the Field Papers for participatory mapping. These recommendations include details to check beforehand and possible problems to be aware of during the usage of the Field Papers. The results are summed up by

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a general score, which is displayed via a traffic light, to provide an easily accessible insight into the fitness of the OSM data. The analyses can be directly performed on multiple bounding boxes. In contrast to many other approaches, this tool does not require a local database to work on, but accesses the OSHDB via the ohsome-API developed by the HeiGIT. This is both time and resource saving for the user, who can directly use the program. The ohsome-API allows us to get already accumulated and calculated results for some requests like the density of features with certain tags. For other analyses we can access all features and versions of features that existed during the last year (of available data) with all their tags and coordinates. On these raw data, we can perform further operations which we cannot request directly. We can look at different versions of the same features, for example, to calculate the number and extent of positional changes.

The results of the evaluation are shown on a web page and the users can decide based on the given recommendations whether they want to apply the Field Papers. For a tested region in Heidelberg our results indicate a good fitness for usage in Field Papers (rated as green on the traffic light), and only one recommendation is given: every street and way feature was changed 0.17 times on average, which we consider as increased based on our experience, and which might indicate that some ways or streets are still mapped inaccurately; we advise users to be aware of this. In contrast, our results for Rio Branco indicate that there might be problems for the usage as the data are overall rated as yellow and more recommendations are necessary, e.g., users should take into account that streets and ways are possibly mapped inaccurately (average number of changes: 0.2), and explore how well participants can orientate themselves on the Field Papers because there is a low POI and landmark density (combined: 5.25 features per km²).

In conclusion, the presented tool enables detailed analyses of OSM data to support the decision making process in cases of the application of OSM Field Papers for participatory mapping. It offers a sustainable approach because local authorities, for example, can apply these methods themselves without expert knowledge. The presented tool will be integrated in a web portal which will facilitate the participatory mapping activities and present the data in combination with authoritative data. We are further developing the tool to allow for new forms of application.

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