City of Vienna's activity in large scale Mobile Mapping and related image based Artificial Intelligence

Digitizing the public space – Project "Wien gibt Raum"

Lothar EYSN, City of Vienna, Department of Surveying and Mapping (MA41), Muthgasse 62, 1190 Vienna, Austria

Keywords: *Spatial Inventory — Surveying — Computer Vision — Kappazunder — Big Data*

CHNT Reference: Lothar EYSN. 2020. City of Vienna's activity in large scale Mobile Mapping and related image based Artificial Intelligence – Digitizing the public space – Project "Wien gibt Raum". Proceedings of the Conference on Cultural Heritage and New Technologies 2020.

Abstract

In 2017 the City of Vienna – Department of Surveying and Mapping (MA41) initially performed a large terrestrial mobile mapping campaign. The public space was digitized using a purely image-based car mounted mobile mapping system, collecting image data every three meters along track. Beside the data acquisition, where over 30 million images were collected and georeferenced with a spatial accuracy better than 10 cm, 3D Information was derived from the images using a dense image matching approach. Using an artificial intelligence approach, all images were anonymized by blurring areas showing people and license plates.

The processed data (100 Terabytes) are published in a web based viewing system, the so-called "Kappazunder", which is used by City of Vienna's staff to gain digital information with respect to administrative tasks within the public space. Examples for such tasks are simple distance measurements, or a visual inspection of the local situation. Based on this system, geodata was created and updated by semi-automatically extracting object information from the imagery, as for example the location of traffic signs (over 100.000 positions) or other aspects of selected city furniture. This task was carried out by using human intelligence. Information regarding the project "Wien gibt Raum" (Link) and the mobile mapping campaign can be found in Strondl et al. (2018), whereas information regarding the examination of city furniture can be found in Falkner and Eysn (2019).

In summer 2020, a new car based mobile mapping campaign was launched, using enhanced sensors to capture approximately 4600 km of the public space. A panoramic camera system with 250 Megapixels captures imagery, whereas a Lidar system captures dense 3D information. The acquired data is georeferenced and anonymized to a very high quality standard. Using these data, the web based viewing system Kappazunder is filled with fresh data. Two epochs of data (2017 and 2020) will be made available to City of Vienna's staff, to support tackling of their daily business.

Using the 2017 car based mobile mapping data, first tests in the field of image based artificial intelligence were performed. These activities were led by the information technology departments MA01 PACE and MD-OS PIKT. In a proof of concept, information regarding traffic signs is automatically determined from the data. The survey grade mobile mapping data enables the transformation of detected objects into 3D space, which is mandatory with respect to the idea of spatially inventorying the public space. Based on a subset of the mobile mapping data, neural networks are trained and applied. Two different neural networks cover the tasks of feature detection and feature classification.

The result are georeferenced and classified geodata, representing selected objects within the public space. Initial results show, that especially training the neural network can be time consuming, and the quality and quantity of the training set is highly correlated with the overall accuracy of the resulting objects after inference. However, the potential of this technology is high, and a completeness and correctness greater than 95 % can be achieved, if the system is well trained. Beside the statistical aspect, the processing framework (for example data handling, data standards, interfaces, data storage, processing power, quality check) is challenging and needs to be set up for future analyses.

In addition to the car based data collection in 2020, an aircraft based mobile mapping system captures nadir images (116 Megapixels) and oblique images (80 Megapixels), covering the whole city with aerial imagery. These data will be input for multiple applications, as, for example, refreshing the annual orthophoto or performing image based dense matching.

Both, the car based and the aircraft based mobile mapping data, can be a sufficient input for automatic analyses in a modern artificial intelligence framework, which is currently developed. However, the future intention of this framework is an automatic acquisition of spatial object information to update different geo-databases, which may feed a digital twin of the City of Vienna with updated object information.

Inventorying and updating the various objects within the public space of Vienna is complex, since a numerous number of challenges need to be tackled. The possibilities of modern mobile mapping and the related high resolution sensor technology opens up a wide field of applications, and are a fruitful input for statistical analyses, as, for example, the emerging technology of artificial intelligence. The City of Vienna and the Department of Surveying and Mapping (MA41) are heading towards this new technology, by acquiring high quality geodata and supporting the setup of an artificial intelligence pipeline.

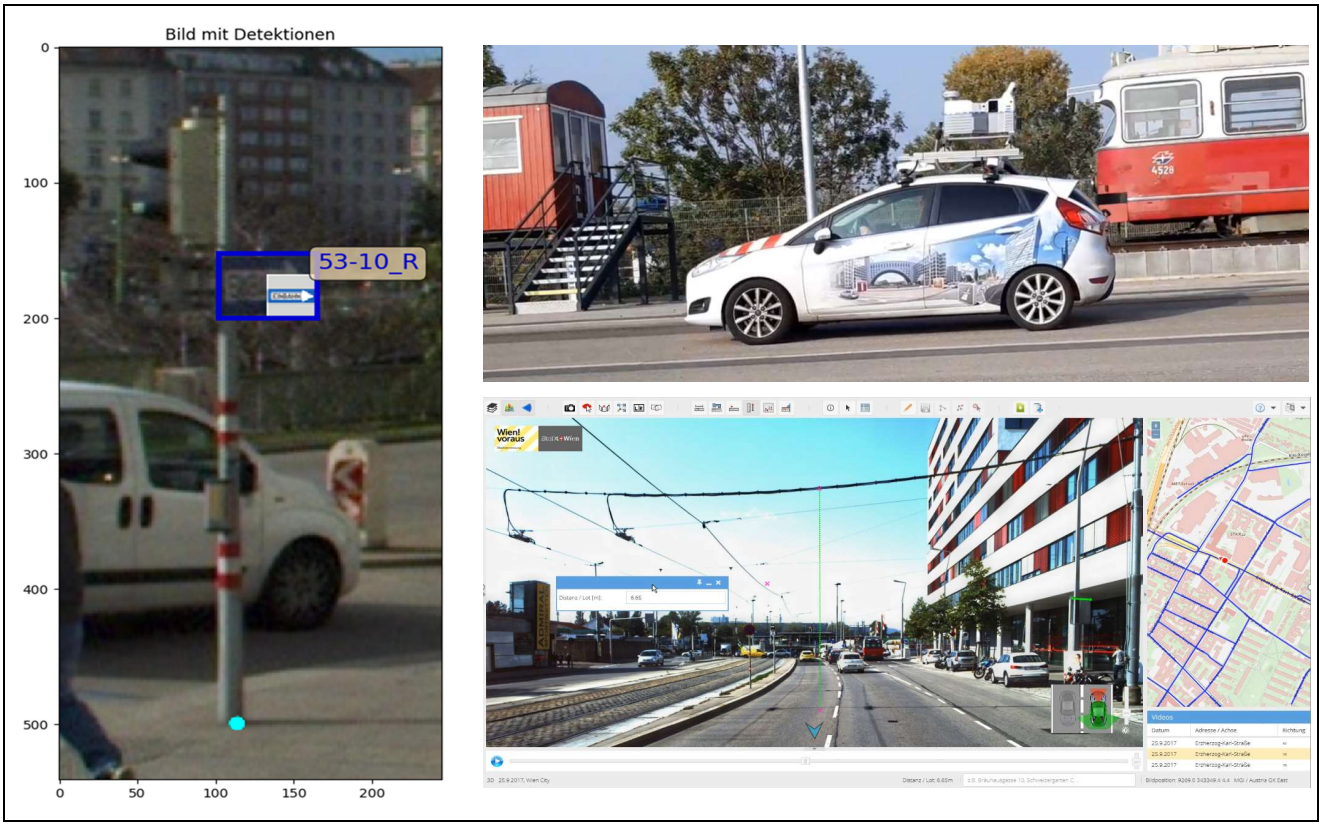

Fig. 1. Left: Automatically detected and correctly classified traffic sign; Top: Mobile Mapping Car 2020 equipped with GNSS, IMU, Lidar and a panoramic camera system; Bottom: Web based viewer system „Kappazunder“, showing a simple height measurement.

References

Strondl, M., Vladar, D., Dürauer, S., Eysn, L., Falkner, J., Jakli, T. & Obin, A. (2018). Wien gibt Raum: Vom Konzept einer innovativen Verwaltung des öffentlichen Raums zum Mobile Mapping einer Großstadt, *VGI: Österreichische Zeitschrift für Vermessung & Geoinformation, 1/2018, Tagungsband 13. Geodätentag*, Steyr, 44-52. Available at https://www.researchgate.net/publication/325314027_Wien_gibt_Raum_Vom_Konzept_einer_innovativen_Verwaltung_des_offentlichen_Raums_zum_Mobile_Mapping_einer_Grossstadt_English_title_The_program_Wien_gibt_raum_and_the_related_concept_for_an_innovative_ma (Accessed: 30.07.2020)

Falkner, J., Eysn, L. (2019). Kappazunder - Ein Mobile Mapping Tool als Lösung für Fragestellungen der Verwaltung im öffentlichen Raum!, *Conference Proceedings: 39. Wissenschaftlich-Technische Jahrestagung der DGPF e.V. (Dreiländertagung) – Band 28,* Vienna, 12 pages. Available at https://www.researchgate.net/publication/331223068_Kappazunder-Ein_Mobile_Mapping_Tool_als_Losung_fur_Fragestellungen_der_Verwaltung_im_offentlichen_Raum (Accessed: 30.07.2020)