Solving mobile mapping positioning issues in urban canyons

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Abstract:

As an emerging platform, Mobile Mapping (MM) is predominantly used in urban areas. The close proximity between the object of interest and the platform carrying sensors, such as cameras or laser scanners, allows for very high resolution data postings.

High resolution and high relative accuracy are opposing a poor absolute positioning quality in urban areas. GNSS referencing requires a direct line-of-sight between the satellite and the GNSS receiver unit. High-rise buildings shape so called urban canyons which are hampering an accurate localisation. Complete GNSS signal outages lead to no position update at all while other signals are reflected at façades and other objects, thus signal transduction might be biased (multipath).

Additionally, Inertial Measurement Units (IMU) used for relative positioning are subject to drift effects, and require permanent absolute positioning updates from GNSS to ensure a correct localisation at all times. Thus, the position tracked by an IMU is either drifting in an event of a GNSS outage, or an IMU is propagating a wrong position posting in case of multipath. Hence, positioning accuracy and reliability cannot be guaranteed in urban areas.

A possible solution is introducing another external source of referencing, such as aerial images. At higher altitudes, unobstructed GNSS positioning enables highly accurate image acquisition. Consequently, aerial images' orientation parameters can be utilised to verify and/or correct Mobile Mapping data.

Based on feature matching algorithms, aerial and MM images can be registered. This registration allows for updating MM data's orientation in accordance with the aerial reference data. Due to great differences between these images, however, standard matching strategies may fail.

Therefore, MM images can be projected on artificial surfaces to increase the resemblance to their aerial counterpart. As the acquisition date may differ between the data, a registration strategy has to rely on permanent and reliable image features, such as road markings, façade details or building footprints. These features might occur to be repeated (e.g. zebra crossings or window frames), thus eventually leading to ambiguities in the registration procedure.

This contribution summarises these issues in question, and proposes feasible strategies to solve a matching problem with non-standard geometries.