Dense Matching Quality Evaluation - Towards Updating National Point Clouds

Zhenchao Zhang
Faculty of ITC, University of Twente

Abstract:

Point clouds are taking more and more important roles in 3D building modelling and water management. It is necessary to keep point clouds, DTMS and DSMs up-to-date in order to promote better data utilization and decision making. This project aims at detecting changes in the outdated airborne laser point clouds and updating the point clouds as well as DTMs and DSMs using multi-view airborne images and dense image matching (DIM) points. The value of our project is to explore the potential of using dense matching points as a replacement for laser scanning points. In order to update the nationwide airborne laser scanning data, the proposed workflow includes three steps: 1) DIM quality evaluation; 2) Scene classification and 3) Change detection and updating. In the end changes will be detected through comparison between land cover types in different epochs.
Before change detection and updating, the quality of DIM point clouds needs to be evaluated with reference of ALS data. In our current work, planar roofs are empirically extracted from ALS data using rule-based workflow. For each roof segment, the distance between the DIM points and fitted ALS plane is calculated as the measures of DIM quality. Two point clouds, DIM1 and DIM2 are generated using different imagery of downtown Enschede, the Netherlands. DIM1 is generated using 102 nadir images; DIM2 is generated using 102 nadir images and 408 oblique images. Fig. 1 shows the accuracy plot of DIM1 based on individual roof segment. The colour scale shows the residuals between ALS plane and DIM points. The red segments indicate large residuals or possible changes in this location.
Fig.2 shows the distribution of mean and standard deviation per roof segment. The mean residuals of both DIM1 and DIM2 are not centered around 0, but around 3 cm. The majority of mean residuals is between -5 cm to +10 cm. Overall, the DIM2 points tend to produce a smaller standard deviation compared to DIM1 data (8 cm vs. 9 cm). The reason might be that more images are involved in the matching in DIM2. Further work in DIM quality evaluation includes evaluation with surfaces e.g. bare ground or road, study on the influence of roof materials or slope on the DIM quality etc.

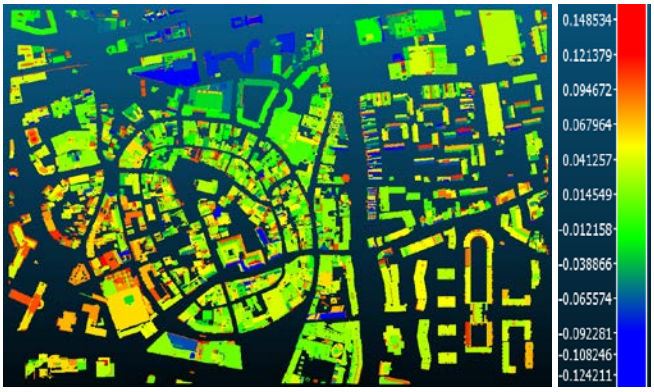

Fig. 1. Accuracy plot based on individual segments for DIM1 in downtown Enschede

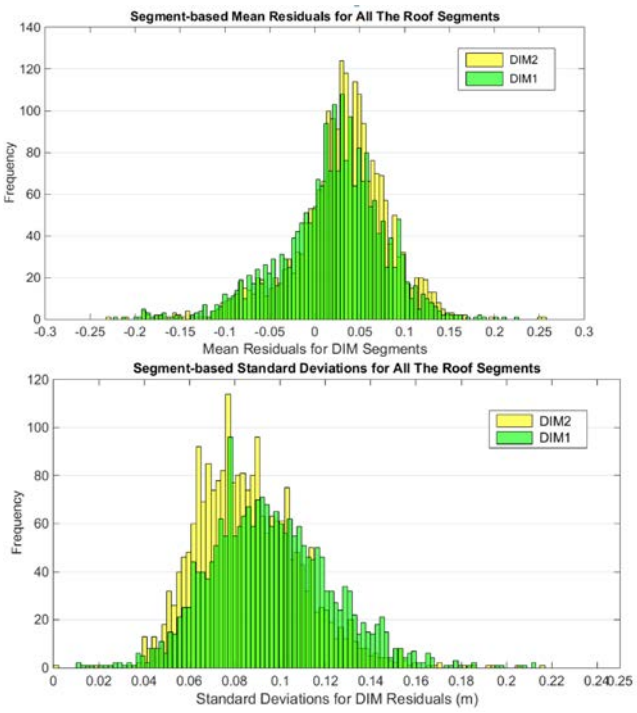

Fig. 2. Distribuition of mean residuals (left) and standard deviations (right) per roof segment in DIM1 and DIM2.