Department, University, and/or Company Logos (optional)

The Title Should Be Large and Easy to Read

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SIGGRAPH2016
Render the Possibilities

Problem

In this work, we estimate the camera pose using an overhead image captured by a low-altitude aerial device as query and a corresponding building point cloud as 3D model.

Related Work

- Image database
  -- Multiple nearest neighbor feature matching [Zamir and Shah, 2014]
- Image captured on the ground
  -- 2.5D map [Arth et al. 2015]
- Image captured in high altitude
  -- Extended Chamfer matching [Zhang et al. 2014]

Challenges

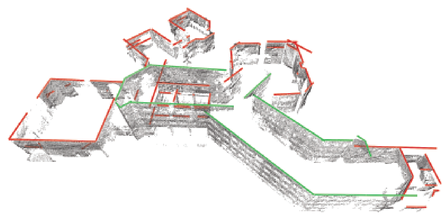
- Low-altitude aerial image is not able to take advantages of vanishing points.
- Low-altitude aerial image suffers from more critical perspective effect.

Our Approach

- Observations: vertical facades of a point cloud correspond to edges of building roofs in the overhead image.
- We propose a geo-localization algorithm based on multi-altitude shape matching and iterative optimization.

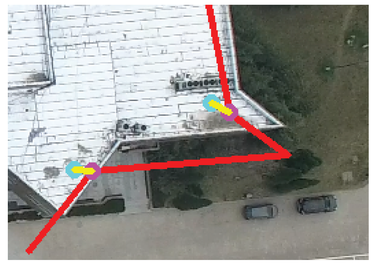
Input

An overhead image captured by an aerial device in low altitude.



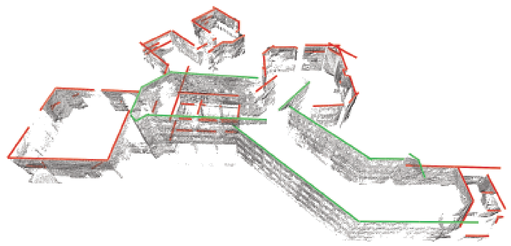
A point cloud captured by a laser device on the ground. <to be modified>

Paried feature points



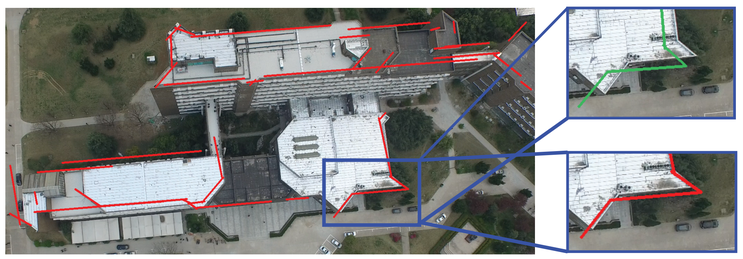
- For a 3D feature point, we project it on the overhead image (magenta points) using current project matrix and search in its neighborhood for a corner (cyan points). These 3D feature points and corresponding corners will form pairs of feature points for next iteration of calculating global matrix.

Method



- Step 1: Fit sets of lines in different altitudes as contours of building roofs and extract corners of these contours as 3D feature points.
- Step 2: Match contours with the overhead image respectively and achieve one local project matrix for each contour.
- Step 3: Achieve a global project matrix by iteratively minimizing the average distance between projected contours and the edges of the overhead image.

Results



Befor global optimization

After global optimization

References<to be modified>

Clemens Arth, Christian Pirchheim, Jonathan Ventura, Dieter Schmalstieg, and Vincent Lepetit. 2015. Instant Outdoor Localization and SLAM Initialization from 2.5D Maps. IEEE Transactions on Visualization and Computer Graphics 21, 11 (2015),