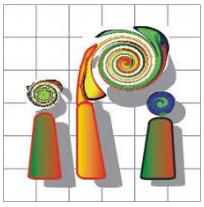

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Extrinsic Calibration of a 3D Lidar and Camera using Mutual Information

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Abstract

With the advent of different sensor technologies, data acquired from more than one type of sensors are fused to solve the problem in hand. The image or image sequences(videos) acquired using Aerial photography and the 3D point cloud from LIDAR.

The reflectance value or brightness information from LIDAR also varies for different objects like buildings, roof tops, vegetation or water bodies. Using this brightness information (reflectance) or radiometric grayscale data of the LIDAR, synthetic image (J) is generated from 3D point cloud. Pose estimation between the synthetic image (J) and the Aerial image (I) is performed. Here the assumption is that, a calibrated camera is used to get 6 DOF for pose estimation.

The 6 DOF for pose estimation are computed here in the following ways:

- Sparse correspondences between the images are obtained using SIFT/SURF.
- The closet 3D points LiDAR and the 2D image points are used to estimate the initial camera matrix using the PnP method.
- From the initial camera matrix, dense matching is established using Mutual Information.

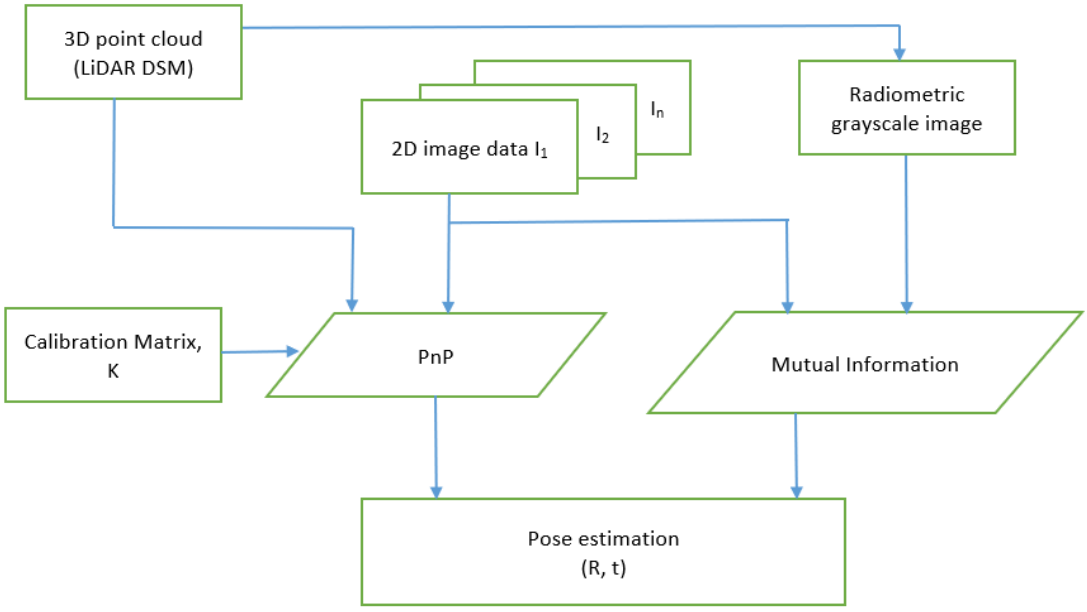

Figure: Pose estimation using sensor data fusion

With this, correspondences between LIDAR point cloud and image are obtained. The transformation between the image used for correspondences above I_1 and rest of the image sequences (I_n) can be obtained using the traditional 2D image matching techniques.

Eventually, leads to a processing chain where different sensor data are combined and linked, which could be used to feed as input to a 3D model for geo-referencing and texturing.