Literature Survey: Scale Estimation in the Monocular SLAM

Alex Kreimer

May 2016

1 Absolute Scale in Structure from Motion from a Single Vehicle Mounted Camera by Exploiting Nonholonomic Constraints [1]

The authors propose a method to estimate the absolute scale of the camera motion for a single camera. The method exploits non-holomicity of the car motion (e.g. the presence of the Instantaneous Center of Rotation during the turns.) This will work for every robot that adheres to Ackerman steering principle, and will not work for other types of vehicles). The camera needs to be offset from the non-steering axis of the car and then it is possible to exactly derive the scale of the motion from the system geometry and the the camera odometry estimation.

2 Reliable Scale Estimation and Correction for Monocular Visual Odometry

The authors estimate ground plane homography that related subsequent images. The feature points are taken from an a-priory selected ROI. The contribution of the paper is to separate motion parameters and plane parameters. The camera motion is estimated from all the feature points available in the image (not just the ROI), which makes it more robust. Subsequently this estimate is used to compute the geometry of the ground plane from the homography (e.g. $H = K(R - tn^T/d)K^{-1}$)

References

[1] Davide Scaramuzza, Friedrich Fraundorfer, Marc Pollefeys, and Roland Siegwart. Absolute scale in structure from motion from a single vehicle mounted camera by exploiting nonholonomic constraints. In *2009 IEEE 12th International Conference on Computer Vision*, pages 1413–1419. IEEE, 2009.