DOI 10.1007/s12647-018-0252-x

Reconstruction Method Adopting Laser Plane Generated from RANSAC and Three Dimensional Reference

G. Xu[1], J. Yuan[1], X. Li[2]* and J. Su[1]

[1]Department of Vehicle Application Engineering, Transportation College, Nanling Campus, Jilin University, Renmin Street 5988#, Changchun 130025, Jilin, People's Republic of China

[2]Mechanical Science and Engineering College, Nanling Campus, Jilin University, Renmin Str. 5988#, Changchun 130025, Jilin, People's Republic of China

*Corresponding author, E-mail: lixiaotao@jlu.edu.cn

Received: 26 October 2017 / **Accepted:** 25 January 2018 / **Published online:** 8 February 2018

Abstract: A reconstruction approach is proposed based on a laser plane derived from the Random Sample Consensus (RANSAC) and three dimensional (3D) reference. The Hessian matrix is performed to extract the center points of the two intersection lines between the laser plane and the reference. The initial laser points are divided into two parts: the inner and exterior points. The inner points are chosen by the RANSAC method to fit the laser line, which avoids the interference of the exterior points. The intersection lines between the laser plane and the reference are represented by Plu¨cker matrices. The laser plane is modeled by the intersection laser lines in the coordinate system of the reference and solved by the singular value decomposition method. The cylinders with known radii are employed to evaluate the accuracy of the laser plane, by comparing the reconstructed radii with the real values of the cylinders. The effects of the Gaussian noise, the distance from the camera to the 3D reference and the cylinder radius are investigated in the experiments. The average reconstruction errors of the three methods of RANSAC, Hough and least squares are 0.68, 1.47 and 2.32 mm in the four groups of experiments, respectively. The experimental results show that reconstruction method using the laser plane generated from the RANSAC and the 3D reference is reliable to present a high accuracy reconstruction for the vision reconstruction system.

Keywords: Active vision; Image reconstruction; Calibration; RANSAC