BAYESIAN CALIBRATION OF A HIGH SPEED 3D LASER RANGING SYSTEM

Michael L. DeRouen, Stefan R. Schuet, Joseph P. Lavelle
Project Technology Branch, NASA Ames Research Center
Moffett Field CA, USA

Abstract

We present a work in progress describing the calibration of a high-speed 3D laser ranging system using a Bayesian framework. This system captures high-speed images of a laser line, which is projected onto the measurement surface. The position of the laser line at a particular point on the imaging sensor is used to compute the distance to a corresponding point on the surface. A real-time processing algorithm rapidly transforms the raw image data into a dense cloud of 3D points, which together comprise a representative surface. This algorithm depends on a number of instrument parameters, which must first be estimated. Given a known 3D surface, an expression describing the forward imaging problem is derived which predicts values for the acquired laser line images based on the system parameters. With this expression of the forward imaging problem, we perform a maximum likelihood estimate of the model parameters, thus calibrating the system. Currently, the algorithm calibrates the laser surface in relation to the imaging sensor via a MATLAB implementation of the Levenberg-Marquardt algorithm. The results of the calibration are discussed along with ongoing work in estimating the remaining camera system parameters.

Key Words: CALIBRATION, 3D, LASER, RANGING, IMAGING