ABSTRACT

Benziger, Ronald R. M.S.C.E, Purdue University, August 2013. Stereo Model Setup and 3D Data Capture For iOS Programming Environment. Major Professor: James Bethel.

Stereo model setup and 3D feature extraction represent existing technologies in photogrammetry and computer vision. But these are mainly restricted to high end workstations and desktop computers due to the resources necessary to sustain these applications. To make this feature available for smartphones,two methods have been implemented, manual and automated approach.

For the manual app, the image conjugate point measurement process is performed manually and the user is required to input an approximate base-height ratio. The relative orientation process is performed with conventional modeling using least squares estimation. For the automated app, interest point detection is done with the Hessian corner detector using principal curvatures derived from integral images. Image matching is done using image cross-correlation and the matched points are subject to a RANSAC based 8 point algorithm to generate the essential matrix with the most number of inliers. Relative orientation (RO) parameters are extracted from the essential matrix using Singular Value Decomposition(SVD). The RO parameters are then refined via a conventional coplanarity approach.

The relative orientation parameters obtained are used for pairwise rectification of the two input images to generate a 3D stereo image. The stereo images are presented in a stereo environment with stereo cursors that can be controlled using touch input to perform measurements. Since no similar engineering apps currently exist for a mobile device, the results are compared to traditional photogrammetry methods done on desktop workstations. Finally the digitized points from the stereo environment can be used to generate a 3D CAD model using flat shading or texture mapping using the Open Graphics Library (OpenGL).