

AN INVESTIGATION OF VISION SYSTEM DESIGN FACTORS WHICH AFFECT THE PERFORMANCE OF CAMERA CALIBRATION

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Abstract

A major concern often associated with the use of machine vision systems in manufacturing is the reliability of image processing algorithms used to determine part location and orientation. An algorithm's accuracy is influenced by the illumination technique employed, the complexity of scene geometry, the surface reflectance of both the background and the part(s), and myriad other factors. Although it has been shown that numerical simulation can aid in understanding the effects of the above factors, the utilization of image synthesis to aid in the evaluation of image-processing algorithms still remains a largely unexplored area. A study of critical design parameters using synthetic images, in which scene information (including source direction and distribution, object geometry and surface reflectances) is known precisely, provides a valuable tool to evaluate algorithm performance, since it leads to a better understanding of the magnitude and type of errors incurred. Numerical simulations of image capture can differentiate and report minute changes in design factors much more accurately than a physical prototype; therefore, the results presented here suggest that a study of synthetic images can be effectively used to investigate the effect of design factors on the performance of image-processing algorithms. While the synthetic images presented in this work do not fully emulate the real manufacturing environment, they do sufficiently predict captured-image intensity values; therefore, the effects of small variations in major design parameters are easily investigated. Finally, such a technique facilitates a means to correct for apparent errors introduced by similar variations in captured images.

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