



B21 An Efficient CCTV Camera Calibration Method With an LED Ruler for Body Height Measurement

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After attending this presentation, attendees will understand some principles of height measurement and efficient calibration techniques for Closed Circuit Television (CCTV) cameras.

This presentation will impact the forensic science community by providing a simple method compared with a traditional method using chessboard. A proposed method is useful for crime investigators who pay special attention to morphological characteristics of suspects or subjects in photograms taken from CCTV cameras.

When investigating a crime, images taken from CCTV cameras are submitted as clues of investigation. Body height estimation for a suspect or suspicious person in the images is often requested. Camera calibration is a crucial step to extract morphological information from 2D images and much work for camera calibration has been achieved in the photogrammetry and computer vision community. A planar pattern plays an important role in camera calibration methods. The traditional technique for camera calibration with chessboard is usually accomplished by an effective algorithm based on automatic recognition and matching of chessboard pattern.¹ Camera calibration, however, using chessboard is not practical for wide-range images taken in premises of a station or a department store. In this report, a novel camera calibration method with 1D objects using a LED ruler is proposed. Camera calibration method with 1D objects was proposed by Zhang and the 1D objects (stick) was fixed at one point.² A LED ruler which stand perpendicular, that is, fixed at a vanishing point is used as 1D objects in a proposed method in this paper. 3W white LEDs put into eight places (200cm, 180cm, 160cm, 140cm, 120cm, 100cm, 60cm, and 5cm) on the scale of the ruler. The LED ruler move up and down automatically and is adjusted to ensure a vertical position. Calibration points are recorded at each places in a CCTV image. The coordinates of calibration points is used for vanishing point estimations and calibration of the lens distortion. For body height measurement, a virtual LED ruler interpolated by adjacent calibration points is provided on foot point. A prototype camera calibration system with a LED ruler was developed that successfully measure a suspect height. Attention is drawn to the uncertainty in body height measurements and the limitations of the number of the calibration points in an image. Results of testing the prototype in a laboratory setting could measure a height with a difference of less than 1cm. As the number of calibration points in an image decrease, the accuracy of height estimation become worse. Using nine calibration points in an image photographed above the specified size at 640*480 pixel resolution for 15m*20m region, Root Mean Square (RMS) for the height difference was 3.1cm. This is not significantly less, but the accuracy of body height measurements with cross-ratio method has been improved.³ The proposed calibration method using a LED ruler for body height measurement improves the speed of calibration work in the field.

References:

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3. A. Criminisi, I. Reid and A. Zisserman "Single View Metrology" International Journal of Computer Vision 40(2),123-148, 2000

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