

Measurement of planar clothes by image processing for automatic inspection

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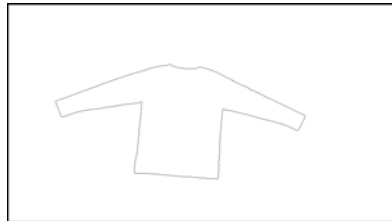
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(a) Input image



(b) Extracted contours



(c) Detection of inspection points

Detection of inspection points of a cloth by fitting lines to contours (T-shirt 1)

Results of measurements (True value / RMS error, Unit: cm)

	Cuff length		Bust	Hem length	Sleeve length		Cloth length	Shoulder width
	Left	Right			Left	Right		
T-shirt 1	10.18/0.20	10.34/0.35	50.22/1.28	51.90/0.65	60.58/2.07	60.82/6.96	67.82/0.24	42.86/12.96
T-shirt 2	9.12/0.54	9.12/0.33	37.86/0.91	37.56/1.11	58.30/0.75	57.66/0.80	60.74/0.51	35.78/4.16
T-shirt 3	16.66/1.10	16.72/0.75	48.96/0.82	48.62/0.47	17.58/3.56	17.94/4.13	68.54/1.56	51.36/9.81
T-shirt 4	19.24/0.90	19.36/0.95	52.64/1.58	52.42/0.64	20.56/1.62	21.04/3.65	70.96/1.87	51.80/2.42

Abstract

This paper presents an image processing system for measurement of clothes such as T-shirts automatically to make clothes inspection process more effective. The proposed system uses a camera arranged vertical to inspection stands and captures grayscale images of clothes. First, the contours of clothes in images are extracted by Level Set Method (LSM) [1][2]. The proposed system uses edge information in extracting the contours. The inspection stand's color is set to be different from the target cloth so that edge information can be obtained easily. Second, the contours are categorized as each part of clothes such as sleeves or hems. Third, straight or curve lines are fitted to the contours. In the fitting, regions near the inspection points to the contours are eliminated, so that the effect of local wrinkle at armpit by flexibility of T-shirts is reduced. The points of dimensional measurements are detected as each inspection point of fitted lines. Three-dimensional (3D) coordinates of each point in the world coordinate system are obtained by applying the homography matrix to two-dimensional image coordinates of the point. The homography matrix is obtained beforehand by a calibration procedure. Finally, the dimensions of clothes are calculated by obtaining 3D Euclidean distances of the inspection points.

Through the results of experiments, almost all measurements are suitable. However, in this system, the detection of shoulder points is difficult when the line from neck to sleeve of the target cloth is straight. Development of a new system that can measure the size of the shoulder for such a target is necessary in the future. The processing time of the prototype system is 10~20 [s], among which the processing time of LSM is the longest. Reduction of the processing time by not using LSM will be necessary. Besides, development of a system that can deal with not only the T-shirts but also other kinds of clothes such as pants.

Keywords: image processing, Level Set Method, measurement of clothes.

Reference

1. J. Sethian, Level Set Method, 1st ed., Cambridge University Press, 1996.
2. Y. Iwashita, R. Kurazume, T. Hasegawa, and K. Hara, Robust Motion Capture System against Target Occlusion using Fast Level Set Method, Proc. of ICRA, pp.168-174, 2006.