A COST-EFFECTIVE PEOPLE-COUNTER FOR PASSING THROUGH A GATE BASED ON IMAGE PROCESSING

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Abstract. *Based on area estimation and color analysis, this paper proposes a cost-effective bi-directional people counter for the pedestrian flow passing through a gate or a door. Firstly, the passing people are roughly counted by the area of people image captured by a zenithal video camera. To refine the initial count, the pedestrians will be recognized by tracking their image patterns with intersection of their bounding-boxes or color-vector matching. Besides, both inherent problems of image pattern overlapping and merge/split phenomenon will be also overcome. Experimental results show that 100% accuracy of bi-directional counting can be achieved if the pedestrians walk in a normal speed and the people number of an image pattern is less than three. When compared to other reported methods of using a zenithal camera setting scheme, the proposed method can obtain higher count accuracy over 95%.*
Keywords: People counter, Color image processing, Object segmentation, Object tracking

1. **Introduction.** An accurate automatic counting of pedestrian flow through a gate is very attractive for the entry control and access surveillance of the important military, building security and commercial applications. Without losing the generality, the early automatic counting approaches, such as turn stiles, rotary bar, and light beams, had suffered one intractable problem: they could not count the passing people accurately unless there is only one pedestrian through the gate at one time. To solve this problem, many image-processing based approaches with various applications [1-12] are hence motivated and all provide a real-time automatic counting for passing people through a specific region of interest by analyzing a series of images captured with a video camera.

For the transportation applications, Bartolini *et al.* [1] and Albiol *et al.* [2] addressed the problems of determining the number of people getting into and out of a bus and train, respectively. To avoid the occlusion problem, Rossi and Bozzoli [3] and Sexton *et al.* [4] mounted the camera vertically with respect to the floor plane and set the optical axis of the camera in such a way that the passing people could be observed from just overhead. Though, the system [3] based on template motion-estimation tracking may be very time-consuming because the computation complexity increases substantially with the increasing number of pedestrians and it may suffer from people-touching overlapping problem. Focused on dynamic backgrounds, Zhang and Sexton [5] developed an automatic