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ROBUST PERSON DETECTION IN FAR INFRARED IMAGES – METHODS BASED ON MULTI-SLITS AND GC MOVEMENT PATTERNS –

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Abstract. *Nowadays, person detection in far infrared (FIR) images toward realizing a night vision system becomes a hot topic. However, sufficient performance could not be achieved by conventional schemes. Since the properties of FIR images different from visible images, it is not known what kind of scheme is appropriate for person detection in FIR images. In this paper, we propose two novel methods for person detection using FIR images: (i) body parts detection method and (ii) Gravity Center (GC) movement pattern method. First, we introduce the multi-slit method along with vanishing line for extraction of head regions. After the head region is detected and segmented, the person body and legs regions are roughly estimated by size ratios. The histograms of Sobel edge of such estimated regions are used to confirm the segmented head. This method can be applicable to person detection at both near and far distances in indoor and outdoor scenes. Second, we propose a sequential decision method by investigating GC movement patterns. It is very simple and especially valid for images at near distances. Our experiments demonstrate the effectiveness of the proposed methods and the advantages in dealing with person detection. Finally, comparative study and further extendable potential applications of the proposed methods are pointed out to be focused in our future research.*

Keywords: Person detection, FIR image, Multi-slit method, Monocular vision, Vanishing line, Gravity center, Movement patterns

1. **Introduction.** Person detection remains a key topic in vision systems, because of its multiple applications. Many systems have been developed based on different approaches, as described in [1]. The majority of pedestrian recognition vision systems uses FIR imagery, because the heat emitted by human body causes pedestrians to appear as bright objects. This facilitates the image segmentation process and above all makes it possible to detect pedestrians in the absence of any natural or artificial lighting, and at great distances, even at night. Compared to the vast research on vision-based pedestrian detection [2-5], as summarized in [6-8], infrared-based pedestrian detection works [6-11] have recently become the cutting edge research. But these infrared-based approaches rely on highly limiting assumption that the person region always has a much brighter (hotter) appearance than the background. H. Nanda and L. Davis [7] introduced a probabilistic template matching on hot-spot Region of Interests (ROIs). F. Xu and K. Fujimura used intensity thresholds followed by a combination of support vector machine and Kalman filtering [8]. In [9], they used hot-spot analysis, stereo verification and ego-motion compensation. A. Broggi *et al.* [12] solved the problem of pedestrian recognition in FIR images using multi-resolution texture symmetry, edge symmetry and edge density ROI