SEGMENTATION OF TV IMAGES IN THE PROBLEM OF OBJECTS’ COORDINATE DETERMINATION

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A new algorithm is suggested for partition of television images when determining the coordinates of low-contrast objects. The algorithm has been investigated at various parameters of background-and-target situation. The results obtained characterize qualitative parameters of TV automatic systems.

The automatic television systems (ATS) occupy a peculiar place among the remote methods for object’s coordinate determination. A distinctive feature of a TV image, namely, a large volume of the displayed information, and its spatial and time redundancy, give ATS advantages over other radioelectronic systems due to high accuracy of determination of coordinates, small dimensions, and passive mode of operation.

When processing images in ATS, segmentation of images is often of fundamental importance because, on the one hand, it helps detect objects in the process of search and, on the other — the quality of segmentation has a considerable impact on the accuracy of determination of object’s coordinates.

Two general approaches to image segmentation are well known [1]. The first one reduces the task of segmentation to the threshold classification of the image, based on analysis of its brightness histogram, i.e., to breaking it into domains belonging to the object or to the background. An advantage of the histogram methods is their simplicity and clear physical sense of the selected threshold, which does not require large amount of a priori information about the image. The second approach is based on emphasizing the domain borders and is called “outline segmentation”. The advantage of this approach is accuracy of position of the displayed borders. The disadvantage consists in the availability of borders’ discontinuities arising from segmentation of blurred or obscured images. In the case of low-contrast objects, the histograms of the object and the background may overlap, the image borders become blurred, and the quality of segmentation turns out to be low (the object’s image outline has discontinuities hardly to be eliminated).

The ATS maintenance requires their reliable operation in the complex background situation when determining coordinates of low-contrast objects. One approach to resolving this problem consists in accounting additional a priori information when processing the images in ATS, for example, during the object motion. In this case we have to take into account the estimation of coordinates of the object under tracking, accumulate information about the scene as time goes on, and apply statistical methods of processing for segmentation of images.

Synthesis of the algorithm. The scene Ω to be watched is represented by an applicative-additive composition of images of background, object, and noise arising from the photodetection process. Both the object and background are being created during independent physical processes and, in the general case, may vary with time. The object constitutes a part of the scene — Ωo ⊆ Ω, and may be either of man-made or natural origin. Define the object as a set of points (pixels) in the image of a TV frame, bounded by some closed contour and following general physical laws of spatial movement of a solid. Assume also that the object shape, its size, and parameters of its trajectory at a time interval, sufficient for proper segmentation, remain unchanged. In this case the object, during the time interval between frames, is not rotating about its
REFERENCES


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