The problem of optimizing hierarchical correlation algorithms for the automatic detection of objects in images is considered in detail. The advantages of hierarchical algorithms when interference which partially screens the objects and fluctuation noise are present are discussed and proved.

Correlation methods, based on a comparison of a set of current images with a standard one [1], are widely used in automated image-processing systems. An improvement in the properties of correlation algorithms can be obtained by using a hierarchical approach in them [2]: initially the similarity of the individual parts of the image and the standard is analyzed, and a final decision is then taken using the results of this analysis. Such processing enables one, for example, to increase the interference protection of the correlation image considerably and to recognize objects despite local distortions of the image. In particular, a local distortion of 20-30% of the points of the image for existing methods reduces the correct-detection probability of objects to a value of 0.5-0.6, whereas the use of hierarchical methods enables a correct detection with a probability of 0.5 to be obtained for a local distortion of 70% of the image points.

We will formulate the problem of detecting an object in an image as follows. By calculating the similarity between the initial image \( B(x, y) \) and a standard \( G(x, y) \) it is required to take a decision on the extent to which they correspond to one another. The signal of the standard in the initial image may undergo certain changes with respect to \( G \) due to the possible effect of illumination and geometrical transformations. As a result of these changes, the signal in the initial image becomes a random function \( Q(x, y) \) with a known brightness distribution. Moreover, when measurements are being made fluctuations in the brightness function occur, which will be described as additive interference \( U(x, y) \). Such problems are characteristic for television robots when detecting objects in images or estimating their coordinates [3].

We will specify in more detail the mathematical formulation of the problem for the discrete case taking into account the splitting of the image into fragments. Suppose the image is the function \( B(x, y) \), specified inside a square (in general rectangular) region of side \( N \). This region is then divided into nonintersecting fragments of dimensions \( n \times n \), their number being equal to \( s \) (Fig. 1).

![Fig. 1](image-url)
REFERENCES


Revised 23 September 1986