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ANALYSIS AND SYNTHESIS OF DISCRIMINATORS OF SHIFT OF IMAGE'S DYNAMIC FRAGMENTS IN THE SPATIAL AND SPECTRAL DOMAIN

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The algorithms for estimating the vector of shift of dynamic image's fragments are synthesized in the form of discriminators of two types. The first-type ones perform processing of signals in the spatial domain. Others use decomposition of a signal into a spectrum in the basis of orthogonal polynomials. With the aid of analytical methods and of statistical simulation, characteristics of the estimation algorithms are determined depending on signal-to-noise ratio, true value of the shift parameter, and the number of modes to be processed.

The contemporary telecommunication systems are oriented to transmission of multimedia information, whose essential part represents various static and dynamic video images. Without effective compression of such signals the digital transmission of data over communication channels is hardly possible. Particularly, the use of inter-frame correlation of dynamic images makes it possible to eliminate efficiently the information redundancy of video sequences, when we employ prediction of image fragments' motion. The existing algorithms of assessment of the shift vector are based on optimization procedures, which minimize some metric of discrepancy between fragments of the reference and analyzed frames [1, 2].

At processing in the space of images, realization of such procedures usually demands large computational expenditures. The latter can be diminished by some or other technique. For example, when calculating the extremums of metrics, application of the discriminative algorithms may give a certain effect [3]. Also, the amount of computation can be reduced if passing from the space of images to the generalized spectral space in the basis of orthogonal polynomials. In the general case, the coefficients of expansion into such basis are invariant to signal's shift [4]. The purpose of this work is synthesis of discrimination algorithms for determination of shifts in the space of images and in spectral space, and calculation of their characteristics.

Algorithms of estimation. Assume that a two-dimensional field $s(\vec{r}, t), \vec{r} = (x, y)$ is set, representing a fragment of a spatial signal at a moment t in a domain Ω_0 (the macro-block of the reference frame). At the moment $t + \Delta t$, in the subdomain $\Omega \in \Omega_0$, we observe a field (the frame to be analyzed)

$$\xi(\vec{r}, t + \Delta t) = s(\vec{r} - \vec{\tau}_0, t) + \eta(\vec{r}), \qquad (1)$$

which is a mixture of the legitimate signal $s(\vec{r} - \vec{\tau}_0)$ shifted by an unknown vector $\vec{\tau}_0 = (\tau_{0x}, \tau_{0y})$, and a fluctuating interference $\eta(\vec{r})$. The interference has to be taken into account since it cannot be eliminated from optic-electron transformation of signals and their transmission over communication channels. The use of statistical approach also permits to avoid ambiguities in synthesis of algorithms for signal parameters' estimation. When processing field (1), we must consider variation of shape of the signal $s(\vec{r})$ in the subdomain $\Omega \in \Omega_0$, when the signal is displaced within the domain Ω_0. In what follows the discrete time variable t is not used and may be omitted.

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