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Terahertz images quality enhancement by means of multichannel processing.

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A typical problem for terahertz (THz) images obtained by raster-scanning imaging systems is the possible presence of impulse noise that might take a compact form localizing as strips extending in the direction of detector movement. The noise significantly degrades the visual quality of images and makes identification of studied objects problematic, so its elimination is highly desirable. In [1], it was shown that such noise can be reduced by using a digital median filter with a rectangular sliding window oriented perpendicular to the noise strips. However, to ensure an acceptable level of introduced distortion, the processed image or its region of interest must be at least 100x100 pixels in size, which is not always feasible in practice.

In this study, the possibility of increasing the processing efficiency of THz images distorted by compact impulse noise through the simultaneous processing of multiple channel images [2] was investigated. During the system's focus search, it is often necessary to obtain multiple images at different distances from the source. Among such "service" images there are the ones with luminance patterns formed due to the standing wave interference at similar phases. These images can be used as channels and the datasets for joint processing can be formed based on the analysis of linearity parameters of the abovementioned luminance patterns.

It is shown that joint processing of three channels allows to decrease the recommended in [1] sliding window sizes from 9x1…15x1 to 3x1…5x1, increasing the filtering efficiency by an average of 5...7 dB in accordance with the PSNRHVSM metric. Even for the images of size 20x20 pixels, for which at impulse noise probability about 0.5 in one-channel processing mode quality improvement was virtually impossible [1], multichannel processing provides up to 16 dB increase in quality by PSNRHVSM, while under favorable circumstances (e.g. low probability of noise and its loose localization), even noise elimination without introducing distortions into the object is possible.

REFERENCES

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