ТЕХНОЛОГИИ ПЕРЕДАЧИ И ОБРАБОТКИ ИНФОРМАЦИИ

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Title of the article In English (applied style title)

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**Abstract.** An algorithm for searching for single-pixel extremes of halftone images based
on centrally symmetric scanning is proposed. It is shown that the algorithm works much faster
than the best known algorithms for detecting key points of images. (abstract style was applied, word "abstract" in bold)

*Keywords:* local extremum search, centrally symmetric scanning. (keywords style was applied, word "keywords:" in italics)

# Introduction (applied style subtitle)

The search for local extrema is a basic operation for many image processing tasks. Text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles text of articles [1]. Article text article text article text article text article text article text article text article text article text text article text article text article text article text article text article text article text article text article text article text article text article [3-5]. The text of the article the text of the article the text of the article the text of the article the text of the article the text of the article the text of the article the text of the article the text of the article the text of the article the text of the article the text of the article the text of the article. (applied style text of article)

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| --- | --- | --- |
|  |  |  |
| *а* | *b* | *c* |

Figure 1. Representation of image scanning methods: *а* – raster scan;
*b* – spiral scan; *c* – Block partitioning (applied style caption line)

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Figure 2. Digital signal processing (applied style caption line)

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1. Beginning of the cycle of searching for local single-pixel extrema.

1.1. Searching for local single-pixel maxima. The matrix of maxima values partitioning is generated  by using the expression

, (1)

(for a formula applied style equation)

where 

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Table 1. Search result of extremums of images with size 512512
(applied style table head, the word "Table 1." is NOT highlighted in bold)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Methods (table style applied) | Picture | Number of extrema | Time, с | Number of comparisons | Memory |
| Amount | Search | Error |
| Straightforward | Lena | 33078 | 23404 | 0 | 0,241 | 9,66 |  |
| Barbara | 32322 | 26233 | 0 | 0,240 | 9,81 |
| Airfield | 47414 | 33876 | 0 | 0,235 | 9,86 |
| Forstner [10] | Lena | 33078 | 23404 | 0 | 0,107 | 4,47 |  |
| Barbara | 32322 | 26233 | 0 | 0,117 | 4,63 |
| Airfield | 47414 | 33876 | 0 | 0,116 | 4,85 |
| Neubeck [9] | Lena | 33078 | 26395 | 1799 | 1,420 | 3,22 |  |
| Barbara | 32322 | 27709 | 1141 | 1,441 | 3,26 |
| Airfield | 47414 | 35097 | 977 | 1,415 | 3,45 |
| Scanline3x3 [13] | Lena | 33078 | 25401 | 602 | 1,043 | <4 |  |
| Barbara | 32322 | 27626 | 548 | 0,993 | <4 |
| Airfield | 47414 | 34573 | 318 | 1,113 | <4 |

# Conclusion (applied style subtitle)

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# References (applied style subtitle)

1. Rosenfeld A., Kak A. Digital Picture Processing. Academic Press, 1976. (applied style book, numbering entered manually)

2. Kitchen L., Rosenfeld A. // Pattern Recognition Letters. 1982. Vol. 1. P. 92–102.

3. Harris C., Stephens M. // Proc. of the Fourth Alvey Vision Conference. 1988. P. 147–151.

4. Lowe D. // IJCV. 2004. Vol. 60. P. 91–110.

5. Mikolajczyk K., Schmid C. // IJCV. 2004. Vol. 60. P. 63–86.

6. Van Herk M. // Pattern Recognition Letters. 1992. Vol. 13. P. 517–521.

7. Gil J., Werman M. // IEEE Trans. on PAMI. 1993. Vol. 15. P. 504–507.

8. Coltuc D., Bolon P. // Proc. Of EUSIPCO. 2000. P. 2425–2428.

9. Neubeck A., Van Gool L. // Proc. of ICPR. 2006. Vol. 3. P. 850–855.

10. Forstner W., Gulch E. // Proc. of Intercommission Conf. on Fast Processing of Photogrammetric Data. 1987. P. 281–305.

11. Soille P. / Morphological Image Analysis: Principles and Applications. Springer. 2006.

12. Гонсалес Р., Вудс Р. Цифровая обработка изображений. М., 2005.

13. Tuan Q. Pham // [Advanced Concepts for Intelligent Vision Systems](https://link.springer.com/book/10.1007/978-3-642-17688-3) (ACIVS). 2010. Vol. 12. P. 438–451.

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**СВЕДЕНИЯ ОБ АВТОРАХ (in Russian!)**

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