



The following benchmarks provide a performance overview for a range of imaging operations running on different platforms. A brief description of all functions, parameters and images used are included. Note that the benchmarks assume full processor and memory bandwidth (i.e., no other system activity), and include command overheads.

Note: Operations executed on 512 x 512 images¹.

Image Processing

	Odyssey XA / XCL 1 GHz MPC7447A 133 MHz MPX 133 MHz PA DDR266 SDRAM	Odyssey Xpro 1.3 GHz MPC7457 133 MHz MPX 133 MHz PA DDR266 SDRAM	3.6 GHz Xeon™ 533 MHz FSB DDR266 SDRAM
Point-to-point Add two 8-bit images and store results in an 8-bit destination image.	0.28 ms	0.26 ms	0.05 ms
Edge Detection (sobel) Perform an edge detection (sobel) on an 8-bit source image and store results in an 8-bit destination image.	0.23 ms	0.21 ms	0.74 ms
Convolution (3 x 3) Perform a general 3 x 3 convolution with arbitrary coefficients on an 8-bit source image and store results in an 8-bit destination image. Results are saturated.	0.21 ms	0.19 ms	0.54 ms
Convolution (5 x 5) Same as above except with a 5 x 5 kernel.	0.27 ms	0.25 ms	1.5 ms
Convolution (11 x 11) Same as above except with a 11 x 11 kernel.	1.0 ms	1.0 ms	5.8 ms
Erosion/Dilation (3 x 3, predefined, binary) Perform a binary erosion/dilation on a 1-bit source image using a predefined 3 x 3 structuring element and store results in a 1-bit destination image.	0.14 ms	0.12 ms	0.04 ms
Erosion/Dilation (3 x 3, predefined, grayscale) Same as above except perform a grayscale operation.	0.21 ms	0.19 ms	0.16 ms
Erosion/Dilation (3 x 3, user-defined, binary) Perform a binary erosion/dilation on a 1-bit source image using an arbitrary 3 x 3 structuring element and store results in a 1-bit destination image.	0.15 ms	0.13 ms	0.14 ms
Erosion/Dilation (3 x 3, user-defined, grayscale) Same as above except perform a grayscale erosion/dilation operation.	0.21 ms	0.19 ms	0.51 ms
Erosion/Dilation (5 x 5, user-defined, binary) Perform a binary erosion/dilation on a 1-bit source image using an arbitrary 5 x 5 structuring element and store results in a 1-bit destination image.	0.15 ms	0.13 ms	0.55 ms
Erosion/Dilation (5 x 5, user-defined, grayscale) Same as above except perform a grayscale erosion/dilation.	0.28 ms	0.26 ms	1.1 ms
Histogram Calculate the histogram of an 8-bit source image and store result in a 32-bit buffer.	1.4 ms	1.1 ms	0.24 ms
LUT map Perform a point-to-point LUT mapping operation for an 8-bit source image and store results in an 8-bit destination image.	0.33 ms	0.31 ms	0.31 ms
Lossless JPEG Compression (monochrome) Perform lossless JPEG compression on an 8-bit source image and store results in an 8-bit destination image.	8.3 ms	7.1 ms	1.5 ms
Lossy JPEG Compression (monochrome) Same as above except perform lossy JPEG compression.	4.4 ms	3.6 ms	2.3 ms
Rotate (30°) Rotate by 30° an 8-bit source image and store results in 8-bit destination image.	3.3 ms	2.6 ms	0.69 ms
Warp Polynomial Warping using a first-order polynomial mapping with nearest neighbor interpolation on an 8-bit source image and store results in an 8-bit destination image.	3.2 ms	2.5 ms	0.69 ms



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Geometric Model Finder ^{2, 3}

Find a Model (1 model, 1 occurrence, very high speed, limited scaling) Find a single 128 x 128 model in an 8-bit image. The whole image is searched for a model rotated within 0-360° and scaled within 90-110% using the highest speed (lowest robustness and accuracy) setting.	12.9 ms	8.4 ms	3.4 ms
Find a Model (1 model, 1 occurrence, medium speed, max. scaling) Find a single 128 x 128 model in an 8-bit image. The whole image is searched for a model rotated within 0-360° and scaled within 50-200% using medium speed setting.	29.3 ms	23.2 ms	8.1 ms
Find a Model (1 model, 1 occurrence, medium speed, limited scaling) Find a single 128 x 128 model in an 8-bit image. The whole image is searched for a model rotated within 0-360° and scaled within 90-110% using medium speed setting.	28.0 ms	22.0 ms	8.5 ms
Find Models (1 model, 4 occurrences, medium speed, limited scaling) Same as above except find four occurrences of a single 128 x 128 model.	40.2 ms	29.9 ms	11.8 ms
Find Models (4 models, 4 occurrences, medium speed, limited scaling) Same as above except find a single occurrence of four 128 x 128 models.	54.2 ms	39.2 ms	14.2 ms

Pattern Matching (Normalized Grayscale Correlation) ^{2, 3}

Find a Model (128 x 128, non-rotated) Find a 128 x 128 model in an 8-bit grayscale image. The whole image is searched for a model that is not rotated.	0.60 ms	0.49 ms	0.19 ms
Find a Model (32 x 32, non-rotated) As above except perform a pattern match of a 32 x 32 model.	1.6 ms	1.3 ms	0.89 ms
Find a Model (128 x 128, -5° to +5°) Find a 128 x 128 model located at 0° in an 8-bit grayscale image. The whole image is searched for a model rotated within +/-5°.	1.8 ms	1.3 ms	0.83 ms
Find a Model (32 x 32, -5° to +5°) As above except perform a pattern match of a 32 x 32 model.	5.0 ms	3.2 ms	1.4 ms

Edge Finder (4000 elementary points or edgels) ³

Extract contours	24.2 ms	23.3 ms	8.0 ms
Extract thin line crests	56.2 ms	44.5 ms	24.8 ms

Blob Analysis (100 blobs that occupy 25% of area) ^{3, 4}

Calculate Area	0.46 ms	0.39 ms	0.12 ms
Calculate Area and Binary Center of Gravity	0.53 ms	0.46 ms	0.15 ms
Calculate Area and Grayscale Center of Gravity	2.2 ms	1.8 ms	0.45 ms

Measurement

Find an Edge Locate an edge in a 16 x 4 measurement region of an 8-bit image.	0.23 ms	0.18 ms	0.07 ms
Find Multiple Stripes Locate 24 stripes in a 128 x 16 measurement region of an 8-bit image.	0.42 ms	0.32 ms	0.09 ms



String Reader

String Reading

Read a 6 character string using a 28 character font within a 512 x 512 image region.

n/a

n/a

25.0 ms

OCR

OCR Reading

Read an unknown string of twelve 33 x 21 characters (no grammar rules) within a 404 x 54 image region.

28.1 ms

20.2 ms

5.8 ms

Verification

Verify that a known string of 12 SEMI font characters (33 x 21) within a 404 x 54 image region can be read properly.

7.7 ms

4.6 ms

0.84 ms

Bar and Matrix Code Recognition

Bar Code Reading

Read a EAN13 bar code (no rotation).

0.83 ms

0.66 ms

0.18 ms

DataMatrix Reading

Read a DataMatrix code.

14.6 ms

8.6 ms

2.2 ms

Odyssey XA / XCL
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ENDNOTES

1. Benchmarks for larger images do not necessarily scale linearly due to CPU cache effects.
2. Faster search speeds can be obtained by reducing accuracy.
3. Search speeds will vary with image content.
4. Blobs in image occupy approximately 25% of area.

Corporate headquarters:

Matrox Electronic Systems Ltd.
1055 St. Regis Blvd.
Dorval, Quebec H9P 2T4
Canada
Tel: +1 (514) 685-2630
Fax: +1 (514) 822-6273

For more information, please call: 1-800-804-6243 (toll free in North America) or (514) 822-6020
or e-mail: imaging.info@matrox.com or <http://www.matrox.com/imaging>

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