Fastvideo

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Introduction

We have done testing for our SDK to demonstrate current performance results on NVIDIA desktop and mobile GPUs for frequently used algorithms, image resolutions 2K/4K and bit depths.

Hardware and Software requirements (OS, PC, GPU, etc.)

- OS: Windows-7/8/10 (64-bit), Linux (64-bit), Linux4Tegra
- NVIDIA GPU: Server (Tesla, Quadro), Desktop (GeForce GTX/GT), Laptop (GeForce GT), Mobile (Tegra K1/X1/X2)
- CUDA-8.0 (64-bit)

Benchmarks for Fastvideo Image & Video Processing SDK (ms)

Fastvideo SDK / NVIDIA GPU	GeForce 1080	Quadro P6000	Tegra X1	Tegra X2
JPEG Encoder				
2K gray (8-bit, q=90%)	0.216	0.11	1.5	1.2
2K (8-bit, q=90%, 4:2:0)	0.36	0.17	2.4	2.0
2K (8-bit, q=90%, 4:4:4)	0.40	0.21	3.7	3.1
4K gray (8-bit, q=90%)	0.55	0.35	6.3	5.0
4K (8-bit, q=90%, 4:2:0)	0.78	0.51	9.4	7.9
4K (8-bit, q=90%, 4:4:4)	1.12	0.74	14.9	12.5
4K gray (12-bit, q=90%)	0.83	0.54	11.2	8.5
4K (12-bit, q=90%, 4:2:0)	1.22	0.82	17.9	13.4
4K (12-bit, q=90%, 4:4:4)	1.90	1.32	28.6	22.4
JPEG Decoder				
2K gray (8-bit, q = 90%)	0.55	0.40	3.1	2.5
2K (8-bit, q = 90%, 4:2:0)	1.36	1.20	6.2	5.3
2K (8-bit, q = 90%, 4:4:4)	1.02	0.73	8.3	6.1
4K gray (8-bit, q = 90%)	1.52	1.28	11.9	9.1
4K (8-bit, q = 90%, 4:2:0)	2.61	2.12	27.1	19.5
4K (8-bit, q = 90%, 4:4:4)	2.78	2.28	32.6	21.4

Resizer (Lanczos3 algorithm)				
2K (color, 24-bit, downscale = 2.0)	0.38	0.35	5.6	4.9
2K (color, 24-bit, downscale to 1919x1079)	0.66	0.60	10.6	9.9
4K (color, 24-bit, downscale = 2.0)	1.21	1.01	20.4	17.7
4K (color, 24-bit, downscale to 3839x2159)	2.34	1.93	39.5	35.6
Demosaic HQLI				
2K (8-bit, RGGB)	0.065	0.04	0.7	0.56
2K (16-bit, RGGB)	0.13	0.06	1.0	0.66
4K (8-bit, RGGB)	0.23	0.15	2.7	2.15
4K (16-bit, RGGB)	0.46	0.20	3.9	2.6
Demosaic DFPD				
2K (8-bit, RGGB)	0.17	0.13	2.7	2.3
2K (16-bit, RGGB)	0.24	0.13	2.5	1.9
4K (8-bit, RGGB)	0.61	0.45	11.1	9.6
4K (16-bit, RGGB)	0.81	0.45	9.6	7.5
Demosaic MG without/with Enhance option				
2K (16-bit, RGGB)	0.52 / 0.52	0.38 / 0.40	7.8	6.1 / 8.6
4K (16-bit, RGGB)	1.9 / 2.03	1.29 / 1.35	32	25 / 34
Denoiser with CDF 9/7 wavelet				
2K (gray, 8-bit)	0.61	0.37	5.5	4.4
2K (color, 24-bit)	1.78	1.07	15.2	11.3
4K (gray, 8-bit)	1.96	1.21	21	16.7
4K (color, 24-bit)	5.85	3.47	59	43
JPEG2000 Encoder (single image mode, sampling 4:4:4)				
2K (24-bit, lossy, cb 32x32, cr = 12)	7.0	6.8	70	57
2K (24-bit, lossless, cb 32x32)	10.2	10.3	180	118
4K (24-bit, lossy, cb 32x32, cr = 12)	19.2	17.45	-	184
4K (24-bit, lossless, cb 32x32)	34.9	30.7	-	442
JPEG2000 Encoder (multithread-batch mode, sampling 4:4:4)				
2K (24-bit, lossy, cb 32x32, cr = 12)	3.3	2.84	-	54
4K (24-bit, lossy, cb 32x32, cr = 12)	12.0	10.3	-	179

Time and performance measurements for Fastvideo SDK modules on NVIDIA GPUs for grayscale and color images don't take into account host I/O latency (image loading to RAM from HDD/SSD and saving back). We have presented timings for computations on GPU only. As soon as any image processing pipeline consists of series of such algorithms (SDK modules), it's a reasonable approach to measure only computation time, assuming that initial and final images reside in GPU memory.

Fastvideo SDK modules for CUDA image processing (ver. 0.12.6.0)

- Image acquisition (from HDD/SSD/RAM, camera, grabber, byte array in CPU/GPU memory, OpenGL texture, PBO, etc.)
- Unpacking module for specific formats of RAW data
- Dark Frame Subtraction
- Shading Correction
- White balance (R, G1, G2, B)
- Exposure correction with LUT (Raw Curves and Levels for each channel)
- Raw Denoiser
- Debayer: HQLI (8/16-bit), DFPD (8/16-bit), MG (16-bit), Enhance option
- Denoiser for processed data
- Color Correction with matrix profile
- Color Transforms: RGB-YCbCr-RGB, RGB-HSV-RGB, etc.
- Composite or per-color 8/10/12/14/16-bit 1D LUTs for tone mapping in RGB or HSV
- Gamma transform (composite or per-color component)
- 3D LUTs for RGB or HSV, DCP profile support
- Histograms for RAW and processed data
- RGB Parade (waveform monitor)
- Rotation (90/180/270 degrees), flip/flop, arbitrary angle
- Resize (downsampling and upsampling)
- Remap (shift, resize, rotate, perspective, undistortion, projections, etc.)
- LCP support
- Unsharp Mask
- Realtime output via OpenGL
- JPEG Codec (Baseline JPEG only: 8/24-bit, Huffman encoding/decoding)
- MJPEG input or output
- 12-bit JPEG Encoder
- Raw Bayer Codec (lossy compression and decompression)
- JPEG2000 Encoder (8-16 bits per channel)
- Stream-per-thread option to overlap copy and computations
- Other: trace, multiplexor, time measurements, HD-SDI support, multiple camera

Demo software for Image & Video Processing on CUDA

One can download demo applications for JPEG Codec, JPEG2000 Encoder, Debayer and Resizer from our site (download section at www.fastcompression.com). These are high performance applications with command line interface to evaluate both performance and quality of GPU-based Image & Video Processing SDK. Other sample applications could be found in the SDK.

The latest version of **Fast CinemaDNG Processor** is available from www.fastcinemadng.com

The latest release of Fastvideo SDK is available upon request.

Fastvideo Roadmap 2017

- Fast 12-bit JPEG Decoder
- JPEG2000 Decoder
- Defringe for CA correction
- OpenGL output to 10-bit monitor
- Final release of Fast CinemaDNG Processor software