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 (32/64), Linux (32/64), Linux4Tegra
- NVIDIA GPU: Server (Tesla, Quadro), Desktop (GeForce GTX/GT), Laptop (GeForce GT), Mobile (Tegra K1/X1)
- CUDA-7.0 or 7.5 (64-bit)

Benchmarks for Fastvideo Image & Video Processing SDK (ms)

Fastvideo SDK Module / NVIDIA GPU	*GeForce 1080*	*GeForce 980*	*Tegra X1*
JPEG Encoder			
2K gray (8-bit, q=90%)	0.216	0.436	1.8
2K (8-bit, q=90%, 4:2:0)	0.356	0.470	2.7
2K (8-bit, q=90%, 4:4:4)	0.395	0.647	4.2
4K gray (8-bit, q=90%)	0.543	0.909	6.9
4K (8-bit, q=90%, 4:2:0)	0.778	1.290	10.3
4K (8-bit, q=90%, 4:4:4)	1.121	1.887	15.9
4K gray (12-bit, q=90%)	0.825	1.463	11.2
4K (12-bit, q=90%, 4:2:0)	1.223	2.107	17.9
4K (12-bit, q=90%, 4:4:4)	1.900	3.363	28.6
JPEG Decoder			
2K gray (8-bit, q=90%)	0.548	0.870	3.5
2K (8-bit, q=90%, 4:2:0)	1.360	1.965	6.5
2K (8-bit, q=90%, 4:4:4)	1.022	1.414	8.1
4K gray (8-bit, q=90%)	1.523	2.359	11.2
4K (8-bit, q=90%, 4:2:0)	2.611	3.676	28
4K (8-bit, q=90%, 4:4:4)	2.784	4.063	29.9

Resizer			
2K (color, 24-bit, downscale=2.0)	0.381	0.664	4.4
2K (color, 24-bit, downscale to 1919x1079)	0.659	1.151	8.5
4K (color, 24-bit, downscale=2.0)	1.210	2.249	16.9
4K (color, 24-bit, downscale to 3839x2159)	2.336	4.225	33.8
Demosaic HQLI			
2K (8-bit, RGGB)	0.065	0.094	1.0
2K (12-bit, RGGB)	0.128	0.186	1.6
4K (8-bit, RGGB)	0.228	0.324	3.6
4K (12-bit, RGGB)	0.458	0.649	6.3
Demosaic DFPD			
2K (8-bit, RGGB)	0.165	0.304	2.9
2K (12-bit, RGGB)	0.241	0.405	2.9
4K (8-bit, RGGB)	0.605	1.109	11.3
4K (12-bit, RGGB)	0.81	1.341	11.3
Denoiser			
2K (gray, 8-bit, CDF 5/3 wavelet)	0.518	0.763	5.5
2K (gray, 8-bit, CDF 9/7 wavelet)	0.605	0.836	6.3
2K (color, 24-bit, CDF 5/3 wavelet)	1.528	2.193	15.9
2K (color, 24-bit, CDF 9/7 wavelet)	1.78	2.426	17.9
4K (gray, 8-bit, CDF 5/3 wavelet)	1.785	2.660	22.4
4K (gray, 8-bit, CDF 9/7 wavelet)	1.955	2.746	24.1
4K (color, 24-bit, CDF 5/3 wavelet)	5.309	7.710	63.9
4K (color, 24-bit, CDF 9/7 wavelet)	5.844	8.020	69.3
JPEG2000 Encoder (single image mode)			
2K (24-bit, 4:4:4, lossy, cb 32x32, cr = 12)	6.3	9.5	-
2K (24-bit, 4:4:4, lossless, cb 32x32)	9.3	15.8	-
4K (24-bit, 4:4:4, lossy, cb 32x32, cr = 12)	16.9	27.9	-
4K (24-bit, 4:4:4, lossless, cb 32x32)	31.2	45.9	-
JPEG2000 Encoder (batch mode)			
2K (24-bit, 4:4:4, lossy, cb 32x32, cr = 12)	3.6	-	-
4K (24-bit, 4:4:4, lossy, cb 32x32, cr = 12)	14.3	-	-

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. 0.10.9.2)

- 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 Denoiser
- Debayer: HQLI (8/16-bit), DFPD (8/16-bit)
- Denoiser for processed data
- Color Correction with matrix profile
- Color Transforms: RGB-YCbCr-RGB, RGB-HSV-RGB, etc.
- Composite or per-color component 8/10/12/14/16-bit LUTs for tone mapping in RGB or HSV
- Gamma transform (composite or per-color component)
- Histograms for RAW and processed data
- RGB Parade (waveform monitor)
- Crop
- Rotation (90/180/270 degrees) and flip/flop
- Resize (downsampling and upsampling)
- Sharp
- 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
- Other: trace, multiplexer, time measurements, HD-SDI support

Demo software for GPU image & video processing

One can download demo applications for JPEG Codec, 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 image and video processing SDK. Other sample applications could be found in the SDK.

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

The latest demo of Fastvideo SDK is available upon request.

Fastvideo Roadmap 2016

- High quality 16-bit MG Debayer (40.7 dB for Kodak data set)
- Fast 12-bit JPEG Decoder
- JPEG2000 Decoder
- 3D LUT
- Defringe for CA correction
- OpenGL output to 10-bit monitor
- FastCinemaDNG software (standalone or plug-in for Adobe Premiere Pro)

