Fastvideo

Email: info@fastcompression.com
Web: https://www.fastcompression.com

Introduction

We have done testing for our SDK to demonstrate the latest performance results on NVIDIA server, 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-10 (64-bit)
- Linux (64-bit)
- Linux4Tegra (Ubuntu 18.04)
- NVIDIA GPU: Server (Tesla, Quadro), Desktop (GeForce GTX/GT), Laptop (GeForce GT)
- NVIDIA Jetson: Nano, TX2, AGX Xavier
- CUDA-10.2 (64-bit)

Benchmarks for Fastvideo Image & Video Processing SDK (ms)

	GeForce 1080	*Quadro P6000*	*Jetson Nano / TX2 / Xavier*
JPEG Encoder			
2K gray (8-bit, q=90%)	0.216	0.11	2.9 / 1.2 / 0.42
2K (24-bit, q=90%, 4:2:0)	0.36	0.17	4.3 / 1.7 / 0.62
2K (24-bit, q=90%, 4:4:4)	0.40	0.21	6.8 / 2.6 / 0.75
4K gray (8-bit, q=90%)	0.55	0.35	11.3 / 4.2 / 1.23
4K (24-bit, q=90%, 4:2:0)	0.78	0.51	17.1 / 6.3 / 1.83
4K (24-bit, q=90%, 4:4:4)	1.12	0.74	27.3 / 9.9 / 2.67
4K gray (12-bit, q=90%)	0.83	0.54	19.3 / 7.2 / 2.07
4K (36-bit, q=90%, 4:2:0)	1.22	0.82	26.7 / 11.0 / 3.1
4K (36-bit, q=90%, 4:4:4)	1.90	1.32	50.5 / 18.4 / 5.0
JPEG Decoder (restart interval 1)			
2K gray (8-bit, q = 90%)	0.55	0.40	5.4 / 2.9 / 0.86
2K (24-bit, q = 90%, 4:2:0)	1.36	1.20	9.1 / 4.9 / 1.35
2K (24-bit, q = 90%, 4:4:4)	1.02	0.73	11.1 / 4.9 / 1.37
4K gray (8-bit, q = 90%)	1.52	1.28	20.9 / 8.7 / 2.13
4K (24-bit, q = 90%, 4:2:0)	2.61	2.12	39.8 / 15.8 / 4.0
4K (24-bit, q = 90%, 4:4:4)	2.78	2.28	45.3 / 17.3 / 4.15

Resizer (Lanczos3 algorithm)			
2K (color, 24-bit, downscale = 2.0)	0.38	0.35	10.0 / 4.3 / 1.48
2K (color, 24-bit, downscale to 1919x1079)	0.66	0.60	19.8 / 8.2 / 2.34
4K (color, 24-bit, downscale = 2.0)	1.21	1.01	39.4 / 16.7 / 5.45
4K (color, 24-bit, downscale to 3839x2159)	2.34	1.93	78 / 31.8 / 8.6
Demosaic HQLI			
2K (8-bit, RGGB)	0.065	0.04	1.82 / 0.47 / 0.36
2K (16-bit, RGGB)	0.13	0.06	1.21 / 0.41 / 0.30
4K (8-bit, RGGB)	0.23	0.15	4.64 / 1.71 / 0.53
4K (16-bit, RGGB)	0.46	0.20	7.1 / 3.1 / 0.93
Demosaic DFPD			
2K (8-bit, RGGB)	0.17	0.13	4.68 / 1.96 / 0.45
2K (16-bit, RGGB)	0.24	0.13	4.68 / 2.06 / 0.95
4K (8-bit, RGGB)	0.61	0.45	18.7 / 8.24 / 1.43
4K (16-bit, RGGB)	0.81	0.45	18.2 / 7.03 / 2.18
Demosaic MG			
2K (16-bit, RGGB)	0.65	0.47	12.7 / 5.9 / 2.23
4K (16-bit, RGGB)	2.04	1.38	50.3 / 20.0 / 5.77
Denoiser with CDF 9/7 wavelet			
2K (gray, 8-bit)	0.61	0.37	10.2 / 4.6 / 1.6
2K (color, 24-bit)	1.78	1.07	26.2 / 12.2 / 4.4
4K (gray, 8-bit)	1.96	1.21	37.4 / 15.5 / 4.6
4K (color, 24-bit)	5.85	3.47	97 / 42 / 13
JPEG2000 Encoder (single image mode, sampling 4:4:4)			
2K (24-bit, lossy, cb 32x32, cr = 12)	7.0	6.8	81 / 63 / 11.1
2K (24-bit, lossless, cb 32x32)	10.2	10.3	190 / 163 / 23.3
4K (24-bit, lossy, cb 32x32, cr = 12)	19.2	17.45	309 / 230 / 42
4K (24-bit, lossless, cb 32x32)	34.9	30.7	620 / 490 / 92
JPEG2000 Encoder (multithreaded-batch mode, sampling 4:4:4)			
2K (24-bit, lossy, cb 32x32, cr = 12)	3.3	2.84	71 / 37 / 10.5
4K (24-bit, lossy, cb 32x32, cr = 12)	12.0	10.3	257 / 132 / 39

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). Here we have presented timings for computations on GPU only in multithreaded mode (-thread 4 -async). 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 (kernel time), assuming that initial and final images reside in GPU memory.

Fastvideo SDK modules for CUDA image processing (ver. 0.17.5.0)

- 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
- Bad Pixel Correction
- 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), L7 (8/16-bit), DFPD (8/16-bit), MG (16-bit), BinningDebayer
- Denoiser for processed data
- Color Correction with matrix profile
- Color Transforms: RGB-YCbCr-RGB, RGB-HSV-RGB, RGB-to-Lab, etc.
- Composite or per-color 8/10/12/14/16-bit 1D LUTs for tone mapping in RGB, HSV, Lab
- Rec.601, Rec.709 (FR and LR), Rec.2020 support
- 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 Codec
- 12-bit JPEG Encoder
- Raw Bayer Codec (lossy compression and decompression)
- JPEG2000 Codec (8-16 bits per channel, tile support, window mode)
- Stream-per-thread option to overlap copy and computations
- Other: trace, multiplexer, time measurements, HD-SDI support, multiple camera

Demo software for Image & Video Processing on CUDA

One can download demo applications for JPEG Codec, JPEG2000 Codec, Debayer and Resizer from https://www.fastcompression.com/download/download.htm. 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 release of Fastvideo SDK is available upon request.

Roadmap 2022

- New GPU Memory Manager
- Server version of Fast CinemaDNG Processor software
- HDR processing on GPU
- Image processing for automotive image sensors