

Progress on Real-time UHD HEVC Encoder

Li Song, Yanan Zhao, Xiangwen Wang, Zhengyi Luo, Min Chen

<http://medialab.sjtu.edu.cn/>



Abstract

This demo paper presents a fully optimized HEVC encoder. Currently the overall encoder could provide 1920x1080@25fps with only 0.5dB PSNR decrease in a wide bitrate range compared with HM10.0. If low complexity configure is enabled, our encoder can even support 3840x2160@25fps encoding.

Full Optimization for HEVC Encoder

A. Architecture Level

We re-designed the HEVC encoder architecture and key data structures. The new architecture provides significant convenience for encoding control, data flowing, and parallel-friendly optimization. The whole framework was implemented in pure C language.

B. Algorithm Level

We developed many low complexity algorithms (fast RDO for intra and inter coding, fast motion estimation, etc) which suffer little RD performance but dramatic complexity decrease. Furthermore, by carefully evaluating different candidate tools, we integrate those which bring better compression gains without incurring significant complexity.

C. Platform level

- 1) **Task-level parallelism:** We provide WPP, frame and GOP level parallel processing.
- 2) **Data-level parallelism:** SSE, AVX are fully utilized for the optimization of computation-intensive modules, including: DCT/IDCT, Quant/DeQuant, SAD, SSD, SATD, interpolation and Intra prediction.

Our HEVC Encoder Features

A. Specification

- Input: YUV 4:2:0, 8 bit
- Out: UDP/RTP, TS/MP4/FLV
- Profile: HEVC Main Profile, HM10.0
- Performance: 1080p@25fps, < 0.5dB compared to HM10.0
- Platform: HP 620 (Intel Xeon E5-2670 Dual 8core@2.6G)

B. Main Tools

- CTU: 64x64; CU: 64x64-4x4; TU depth: 2
- Parallel processing tools: WPP/Frame/GOP
- Intra prediction: 33 directions + DC + Planar
- ME range +/- 64, MV precision: 1/4, ME alg. HEX/DIA
- Number of Reference Pictures: 1
- Loop filters: Deblocking and SAO
- Advanced Tools: Sign Hide and RDOQ
- Rate Control: CBR and VBR

RD Comparison

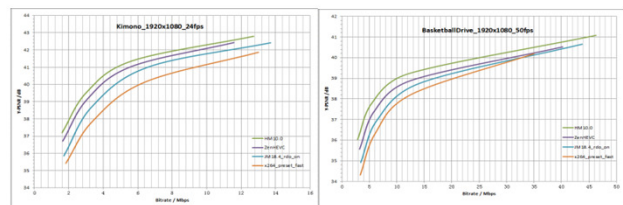


Fig.1 HD(1920x1080p) RD Curve

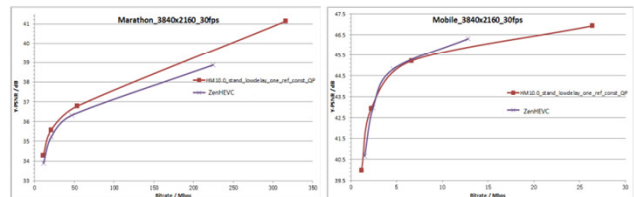
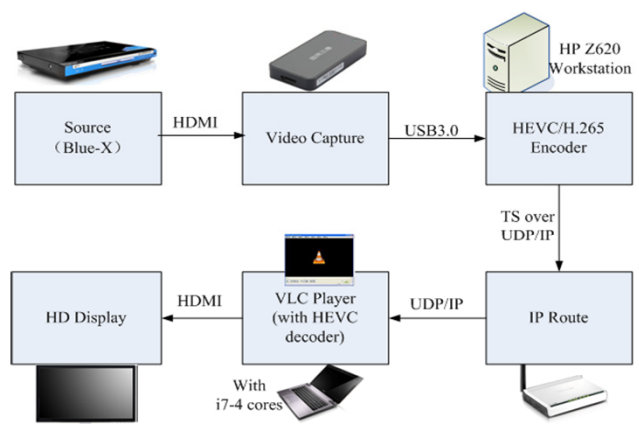


Fig.2 4K(3840x2160p) RD Curve, where *Marathon* is from [1] and *Mobile* is from [2].

Demo System Diagram



Reference

[1] <http://medialab.sjtu.edu.cn/web4k/index.html>
 [2] <http://www.elementaltechnologies.com/resources/>