HEVC FEI Encoding Sample

Overview

HEVC FEI Encoding Sample works with **Intel® Media Server Studio 2018 R2 – SDK for Linux* Server**.

It demonstrates usage of **Media Server Studio – SDK** (hereinafter referred to as "**SDK**") API for creation of a simple console application that performs encoding of an uncompressed or compressed video streams according to a H.265 video compression standard. The sample uses SDK FEI API (Flexible Encoder Interface) and provides capability to stream internal encoder information during encoding process to specified output.

- ENCODE FEI H.265. This is extension of conventional encoding functionality described in *SDK API Reference Manual*. It covers all stages of encoding and produces encoded bitstream from original raw frames. It is performed by ENCODE class of functions.
- PREENC FEI H.264. PreENC – pre encoding. As follow from the name it is preliminary step to gather MB level statistics, that later may be used for optimal encode configuration. This step may be used on its own for different kind of video processing, but usually it is followed by ENCODE step. This is exactly the same interface as in AVC FEI sample.

Features

HEVC FEI Encoding Sample supports the following video formats:

input (uncompressed/compressed)	YUV420, NV12, H.264 (AVC), H.265 (HEVC), MPEG2, VC1
output (compressed)	H.265 (HEVC)

Note: For format YUV420, the **HEVC FEI Encoding Sample** assumes the order Y, U, V in the input file.

Software Requirements

See `<install-folder>/Media_Samples_Guide.pdf`.

How to Build the Application

See `<install-folder>/Media_Samples_Guide.pdf`.

Running the Software

The executable file `sample_hevc_fei` requires the following command-line switches to function properly:

`-i <InputFile>`	Input (uncompressed) video file, name and path.
`-o <OutputFile>`	Output (compressed) video file, name and path
`-w <width>`	Width of input video frame
`-h <height>`	Height of input video frame

One of the following FEI interfaces should be selected:

`-preenc <ds_strength(optional)>`	Introduce extended FEI interface PREENC to pipeline. If ds_strength parameter is missed or less than 2, PREENC is used on the full resolution, otherwise PREENC is used on downscaled (by VPP resize in ds_strength times) surfaces. Also forces Encoded Order processing.
`-encode`	Introduce extended FEI interface ENCODE to pipeline (RC is forced to constant QP).

The following command-line switches are optional:

`-i::h264|h265|mpeg2|vc1 <InputFile>`	Set input encoded video file name, path and decoder type.
`-nv12`	Signals that input is in NV12 color format, if not specified YUV420 is expected.
`-tff|bff`	Signals that input stream is interlaced (top/bottom field first). If not specified progressive is assumed. Valid only for yuv input.
`-fieldSplitting`	Use VPP field splitting (works with interlaced input).
`-bref`	

	Arrange B frames in B pyramid reference structure (by default the decision is made by library).
-nobref	Do not use B-pyramid (by default the decision is made by library).
-ppyr:<on,off>	Enables P-pyramid (default is off).
-gpb:<on,off>	Make HEVC encoder use regular P frames (off), or general-purpose B (on). The default is on.
-idr_interval <size>	IDR interval size in number of GOPs term, default 0 means every I is an IDR, 1 means every other I frame is an IDR and etc.
-f <framerate>	Video frame rate (frames per second).
-n <number>	Number of frames to process.
-timeout <seconds>	Set timeout to run processing in seconds.
-r (-GopRefDist) <distance>	Distance between I- or P- key frames (1 means no B-frames) (default is 0 (I frames only)).
-g <size>	Set GOP size (1(default) means I-frames only).
-l <numSlices>	Set number of slices.
-num_ref (-NumRefFrame) <numRefs>	Number of reference frames (number of DPB frame slots).
-qp <value>	Set QP value for frames.
-DisableQPOffset	Disable QP offset per-pyramid
-NumRefActiveP <numRefs>	Set number of maximum allowed references for P frames (up to 4(default)).
-NumRefActiveBL0 <numRefs>	Set number of maximum allowed backward references for B frames (up to 4(default)).
-NumRefActiveBL1 <numRefs>	Set number of maximum allowed forward references for B frames (up to 2(default) for interlaced, 1(default) for progressive).
-gop_opt <closed|strict>	Set GOP optimization flags (can be used together): closed – references to other GOPs

	are forbidden; strict – no GOP optimization from MSDK.
`-profile <decimal>`	Set HEVC profile.
`-level <decimal>`	Set HEVC level.
`-EncodedOrder`	Force ENCODE to use internal logic for reordering (default is display; ENCODE only).
`-mvpin <file>`	Use this input to set MV predictor for FEI ENCODE (EncodedOrder will be enabled automatically).
`-mvpin::format <file>`	Use this input to set MV predictor arranged in internal format for FEI ENCODE (EncodedOrder will be enabled automatically).
`-mvout <file>`	Output MV predictors from PreENC to this file.
`-mvout::format <file>`	Output MV predictors from PreENC to this file in internal format (Down Sampling is not supported along with this option).
`-mbstat <file>`	Output per-MB distortion from PreENC to file.
`-qrep`	Repack predictors in quality mode
`-SearchWindow <value>`	Specifies one of the predefined search path and window size. In range [1, 5] (5 is default). If non-zero value specified: -RefWidth / RefHeight, -LenSp, -SearchPath are ignored.
`-RefWidth <width>`	Set width of search region (should be multiple of 4), maximum allowed is 64 for one direction search and 32 for bidirectional. At the same time search window w*h is 2048 for one direction and 1024 for bidirectional search.
`-RefHeight <height>`	Set width of search region (should be multiple of 4), maximum allowed is 64 for one direction search and 32 for bidirectional. At the same time search window w*h is 2048 for one direction and 1024 for bidirectional search
`-LenSP <length>`	Defines number of search units in search path. In range [1, 63].
`-SearchPath <value>`	Defines shape of search path. 0,2 - full, 1-diamond.
`-AdaptiveSearch`	Enables adaptive search.

-MultiPredL0 <type>	Use internal MV L0 predictors for FEI ENCODE, 0 – off, 1 – spatial.
-MultiPredL1 <type>	Use internal MV L1 predictors for FEI ENCODE, 0 – off, 1 – spatial.
-NumPredictorsL0	Number of maximum L0 predictors for FEI ENCODE (default – derive from frame type).
-NumPredictorsL1	Number of maximum L1 predictors for FEI ENCODE (default – derive from frame type).
-MVPBlockSize <size>	External MV predictors block size, 0 – no MVP, 1 – MVP per-16x16 block, 2 – MVP per-32x32 block, 7 – derive on per-MVPs basis, use when reading MVPs from file.
-ForceCtuSplit	Force splitting CTUs into CUs at least once.
-NumFramePartitions <num>	Number of partitions in frame that encoder processes concurrently (1,2,4,8 or 16).
-dstw <width>	Set destination picture width, invokes VPP resizing.
-dsth <height>	Set destination picture height, invokes VPP resizing.
?	Print help.

Below are examples of command-lines that can be used to execute **HEVC FEI Encoding Sample**:

DECODE + ENCODE (in loop for 7200 sec (2 hours))

```
sample_hevc_fei -encode -i::h264 input_1920x1080i_30fps.h264 -o
output.265 -w 1920 -h 1080 -tff -f 30 -qp 32 -g 32 -GopRefDist 4 -
NumRefFrame 4 -bref -NumRefActiveP 3 -NumRefActiveBL0 3 -
NumRefActiveBL1 1 -NumFramePartitions 4 -timeout 7200
```

PREENC

```
sample_hevc_fei -i input_352x288p_300frm.yuv -w 352 -h 288 -qp 24 -g 30
-GopRefDist 4 -NumRefFrame 4 -NumRefActiveP 3 –NumRefActiveBL0 2 –
NumRefActiveBL1 1 -preenc -mvout::format mvout.bin
```

DECODE + VPP + PREENC (with 4x DownSampling) + ENCODE (process only 30 first frames)

```
Sample_hevc_fei -i::h265 input_1920x1080_300frm.h265 -o output.h265 -w
1920 -h 1080 -n 30 -f 30 -qp 27 -l 1 -NumRefFrame 4 -g 32 -GopRefDist 4
-bref -preenc 4 -encode -dstw 720 -dsth 480
```

Tip:

To achieve better performance, use input streams in NV12 color format. If the input stream is in YUV420 format, each frame is converted to NV12 which reduces overall performance.

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