Title: Independent intra-period coding in HEVC

Status: Input Document

Purpose: Proposal

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1 Introduction

This document presents a proposal for enhancement of HEVC codec as well as the related HEVC encoder software (Test Model) modification. Some interesting benefits which can be acquired for the group are: parallel intra-periods coding and fast debugging functionality. No normative change to the prospective standard is imposed.

Such proposed approach has been originally invented by Poznan University of Technology as a tool for 3D video coding CfP proposal [2] and proposed as a tool [4] for 3D-HTM software currently under development by JCT-3V group.

It can be noted, that practically the same proposal with experimental results for HEVC has been later submitted by Tsinghua University in [5].

2 The idea

The idea consists in parallelization of the codec (Fig. 1) that has been implemented by Poznań University of Technology in software.

![Diagram](image)

Fig. 1. Single-pass versus proposed parallel Intra Period encoding.

The encoder software is enhanced with an additional configuration setting that allows selection of a single Intra Period (e.g. #0, #10). The setting is then used to select a desired frame range that need to be encoded and frame range than need to be outputted to the bitstream.

Each intra period frame range starts with an IDR/CDR frame and ends with another IDR/CDR frame. All of frames in this range are encoded, but the ending IDR/CDR frame is not outputted to the bitstream. It is only used as a source for prediction in coded B frame (Fig. 2).
Fig 2. Additional redundant encoding of CDR frame (POC 8) is required in order to produce bitstream for selected intra period.

Our idea allows attaining the following benefits:

1. **Allow parallelization of video sequence encoding by splitting into multiple runs, each for different Intra Period.** Each Intra Period would be encoded independently (in parallel) and then the resultant bitstreams would be merged into a single concatenated bitstream. The resultant concatenated bitstream should be binary identical to the one produced with a single-pass of the encoder (without parallelization).

2. **Provide an approach for verification of deterministic operation of the encoder.** If after future integration of some new tool, there is a mismatch between single-pass encoding and parallel encoding, there might be an issue with deterministic operation of the software.

3. **Allow stand-alone encoding of a selected Intra Period for debugging.** Currently, if an error occurs in e.g. 249th frame, the whole sequence has to be traced in order to find an exact location of the bug in the source code. More feasible way would be to encode only the last Intra Period in which the error occurs.

Such idea has been successfully implemented and exploited in Poznan University of Technology proposal for the CfP [2] (“EncodeSelectedGOP”) [3] and proved its usefulness.

3 **Summary and recommendations.**

Proposed encoder modification involves no normative change to the future standard. Independent intra-period coding eases debugging and parallel computing. We recommend to:

- adopt independent intra-period coding in HEVC.
4 Patent rights declaration(s)

Poznan University of Technology does not have current or pending patent rights related to the technology described in this contribution.

5 References


