

# Simulation of Robust HEVC Decoding

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# Aim and Context

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- The availability of a free and robust HEVC decoder allows to simulate impairments due to transmission over a packet lossy channel
- Add sequences to a video database with impairments due to data loss
  - E.g., to JEG-Hybrid database (currently 59,520 HEVC-encoded sequences)
  - Free availability of the software reduces the need to redistribute the corrupted video sequences (they can be generated locally by knowing the loss pattern)

# Robust Video Decoding

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- Many video decoding software crash when certain data loss happen in the coded bitstream
  - Especially if losses are consecutive
- Making them robust to any loss pattern requires complex modifications to the source code
- Software with source code availability is often not well written, poor documented, etc.
  
- Radically different approach:

**SIMULATION** of the concealment technique  
that would be used by a robust decoder

# Approach

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- Decode the compressed, uncorrupted, video sequence
- Modify source code so that:
  - Decoding proceeds as for the uncorrupted video
    - Except for the content of the decoded picture buffer (DPB)
  - Every time a new data segment (e.g., HEVC NALU) is encountered, check if it should be lost or not (read a file with a loss pattern)
  - If it is to be lost, immediately after correctly decoding the data segment, change the content of the DPB by overwriting it with the result of the concealment algorithm (e.g., copy of a previous frame or an area of that frame)
  - Resume normal decoding operations

# Advantages and Issues

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## ■ Advantages

- No crashes due to data loss (any loss pattern is supported)
- Different concealment techniques can be easily implemented
- Reasonably realistic simulation of the reconstructed video in case of data loss (realistic impairments)

## ■ Issues

- Not exactly the same output (pixel-by-pixel) of a real robust decoder in case of data loss in very specific cases, e.g., some coding modes which requires the availability of data from previous frames may incorrectly assume the data is available when it is not
  - E.g., forming MV predictors in Direct Mode

# Software

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- Implemented as a modification of the HM 12.1 test model software
  - Current concealment: copy-concealment
  - Support for concealment at the NAL unit level (video NALU only)
- Tested successfully on the whole HEVC database that uses different encoding parameters using random loss patterns (20% loss rate)
  - 59520 compressed sequences
  - [ftp://ftp.ivc.polytech.univ-nantes.fr/VQEG/JEG/HYBRID/hevc\\_database/](ftp://ftp.ivc.polytech.univ-nantes.fr/VQEG/JEG/HYBRID/hevc_database/)