

A Comparison of Four Video Multiple Description Coding Schemes

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Outline

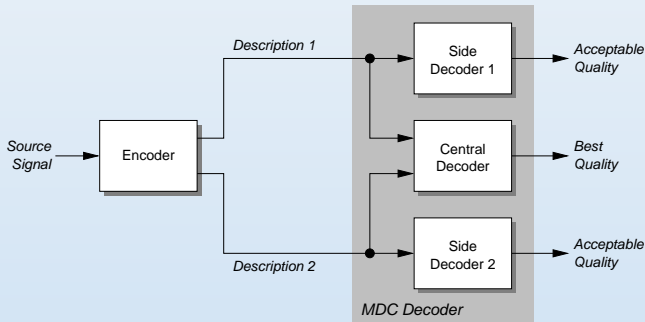
- 1 Introduction
- 2 Temporal multiple description coding schemes
- 3 Simulation results
- 4 Conclusion

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Multiple description coding

Generic MDC scheme with two descriptions:



- ① Decompose the source into two correlated bitstreams
- ② Send each bitstream across a different channel
- ③ Quality remains acceptable and improves with the number of bitstreams received

Multiple description coding

Many techniques exist to introduce the redundancy:

- Information splitting
- Multiple Description Scalar Quantization (MDSQ)
- Transform coding
- ...

Motivations for using MDC:

- Introduce redundancy at the source coder to combat transmission failures (joint source and channel coding)
- MDC has advantages over other resilient coding techniques (classical FEC) when the network is very lossy (no cliff effect)

Objectives

Objectives:

- Introduce source redundancy in the temporal domain using motion-compensated temporal filtering (MCTF)
- Different ways of constructing the temporal descriptions with various impacts in terms of:
 - flexibility to tune the redundancy
 - temporal error propagation

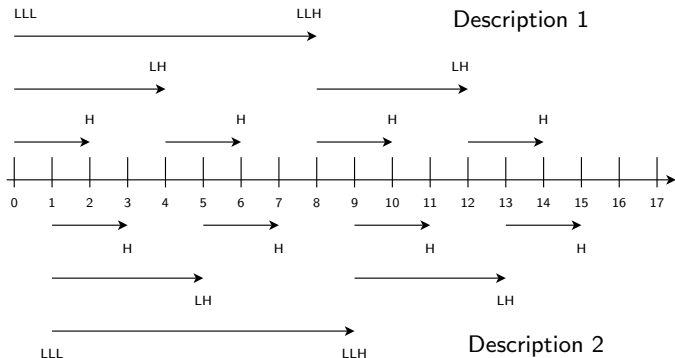
4 MDC schemes:

- Based either on two-band Haar MCTF or three-band MCTF
- By separating the odd/even frames or separating groups of frames according to the MCTF GOP size

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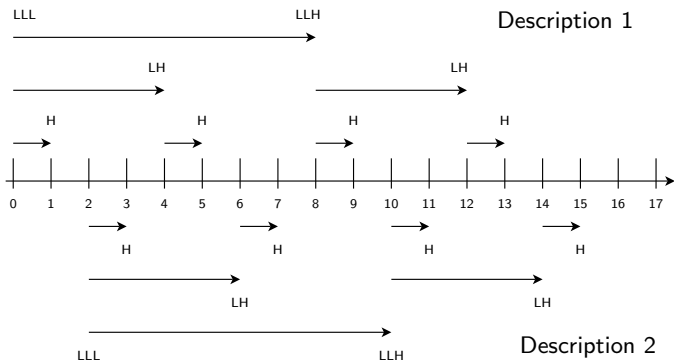
Scheme 1



- Odd/even temporal splitting and two-band Haar MCTF
- Three temporal levels of decomposition

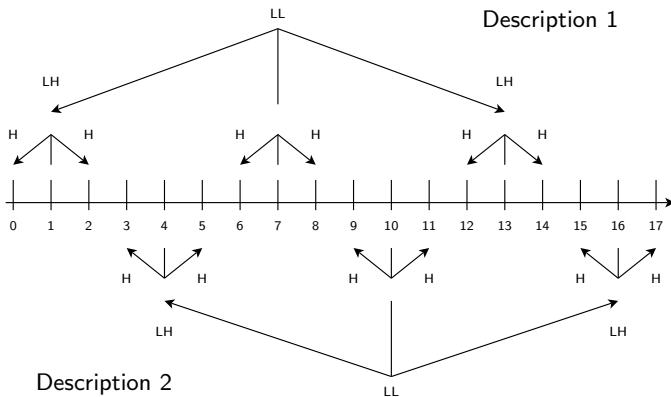
The redundancy comes from the sub-optimality of the original scheme
After concealment we should recover a good quality at the side decoders

Scheme 2



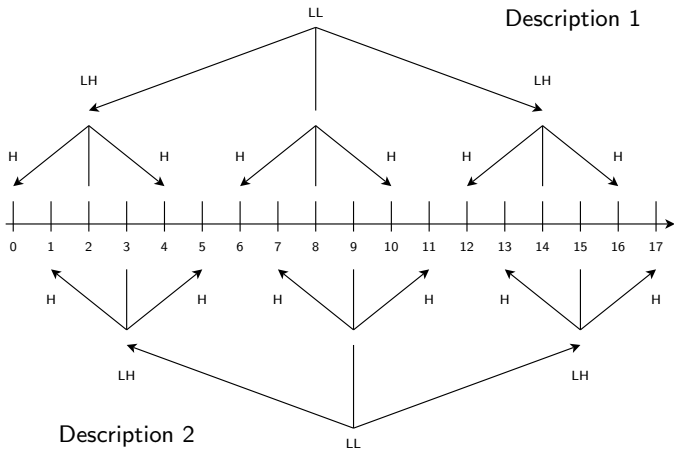
A two-band Haar MCTF is applied to groups of two frames of each description
 More efficient at the central decoder

Scheme 3



- A three-band MCTF is applied to groups of three frames of each description
- Two temporal levels of decomposition

Scheme 4



Odd/even temporal splitting and three-band MCTF

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Test conditions

Motion Compensated Embedded Zero Block Coding (MC-EZBC)

At the side decoders:

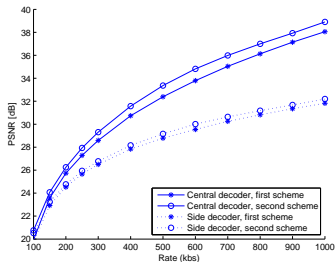
- Interpolation is a simple copy of the closest frame
- If the distance is more than one, the central frame is obtained by averaging the surrounding frames

Two video sequences:

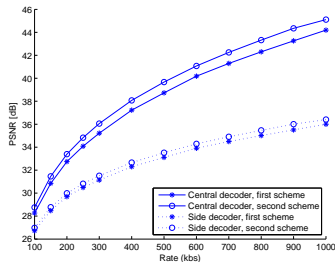
- Mobile (QCIF, 30 Hz)
- Foreman (QCIF, 30 Hz)

Scheme 1 vs Scheme 2

Mobile, QCIF 30 fps



Foreman, QCIF 30 fps

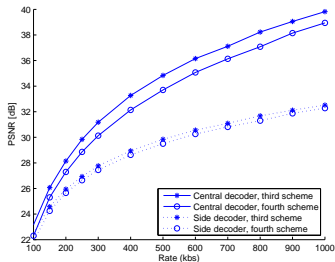


The scheme that separates groups of two consecutive frames performs better:

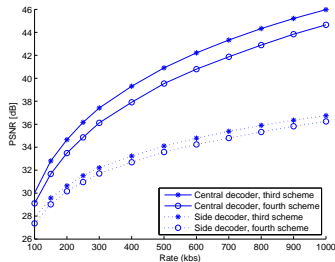
- Central: +1 dB
- Side: +0.5 dB

Scheme 3 vs Scheme 4

Mobile, QCIF 30 fps



Foreman, QCIF 30 fps



The scheme that separates groups of three consecutive frames performs better:

- Central: +2 dB
- Side: +1 dB

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Conclusion

Conclusion:

- Four temporal MDC schemes in the temporal domain
- Grouping consecutive frames before filtering is better when using a simple interpolator
- This effect is more visible when using a three-band MCTF

Future work:

- Use a more complex interpolator
- Use a more classical hybrid video codec

THANK YOU