H.264/AVC analysis of quality in wireless channel

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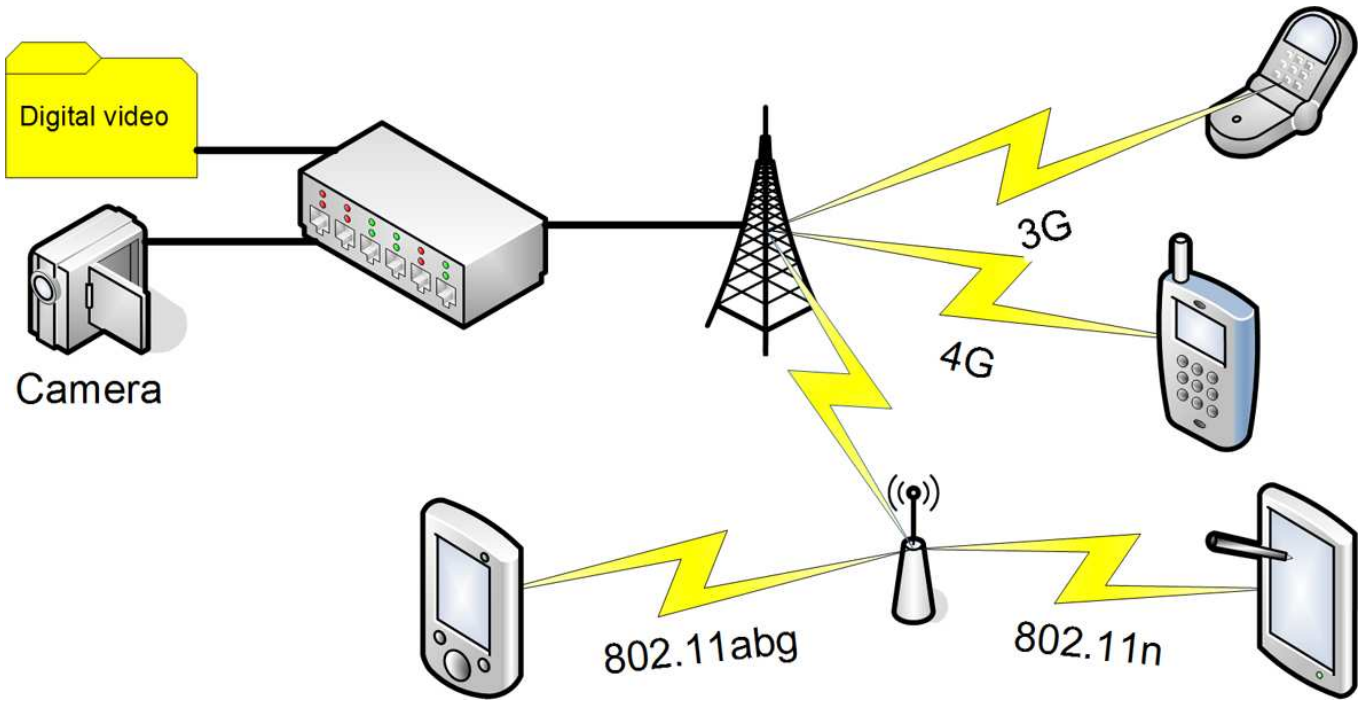
Outline

Video transmission schema



- Transmitters and receivers
- Wire and wireless channels

Outline

Error protection for video

- Error protection for stream
  - Effective
  - No priority

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- Error protection during video encoding (e.g. RVLC)
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  - Compatibility loosing
- Idea! Error protection for separated substream $\Rightarrow$ Protection depends on substream significance

Outline

Model of channel

- Video encoder and decoder

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- Model of channel to produce errors with known distribution

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- Statistics acquisition software

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$\Rightarrow$ Not useful

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Improved model for simulation

- Join channel model and decoder
  - The encoder's source is not change (+compatibility, +performance)

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Improved model for simulation

- Join channel model and decoder
  - The encoder's source is not change (+compatibility, +performance)
  - Only one copy of compressed video-sequence is required for all experiments (+performance)
  - Decoding is more faster than encoder (+performance)
- **Limitation**: The error positions are vary (*easy to avoid*)

Outline

Methods

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- The objective metrics
  - **PSNR** (Peak Signal-to-Noise Ratio)
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- The objective metrics
  - **PSNR** (Peak Signal-to-Noise Ratio)
  - SSIM (structural similarity)
- Video sequences
  - Claire (slow motion)
  - Trueman (fast motion)

Outline

PSNR vs. SSIM

PSNR	**SSIM**
MSE based	**Compares intensity group of pixels**
Compares pixels	**Uses window** (size $M \times M$) for compare
Low complexity $\Theta(w \times h)$ and low memory usage (some cells)	High complexity $5O(M \times w \times h) + 17\Theta(w \times h)$ and high memory usage $\approx 7 \times w \times h$ cells
The high bound is undefined $(+\infty)$	**Normalized** from 0 (worst) to 1 (best)
Same behavior for high bitrates	
Prefer for high bitrates usage	**Large proportional range for low bitrates**

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Video encoder

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Video encoder

- H.264/AVC (ITU-T H.264 and ISO/IEC 14496 (MPEG-4) Part 10) reference version
- Profiles from cellular up to home theater
- Simulation options
  - VLC instead CABAC
  - RTP (RFC1889) encapsulation

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Results & bits classification

- H.264 has not error protection

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Results & bits classification

- H.264 has not error protection
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$\Rightarrow$ The quantity of fatal bits determine the significance of the substream

$\Rightarrow$ Code protection options depend on significance of the substream

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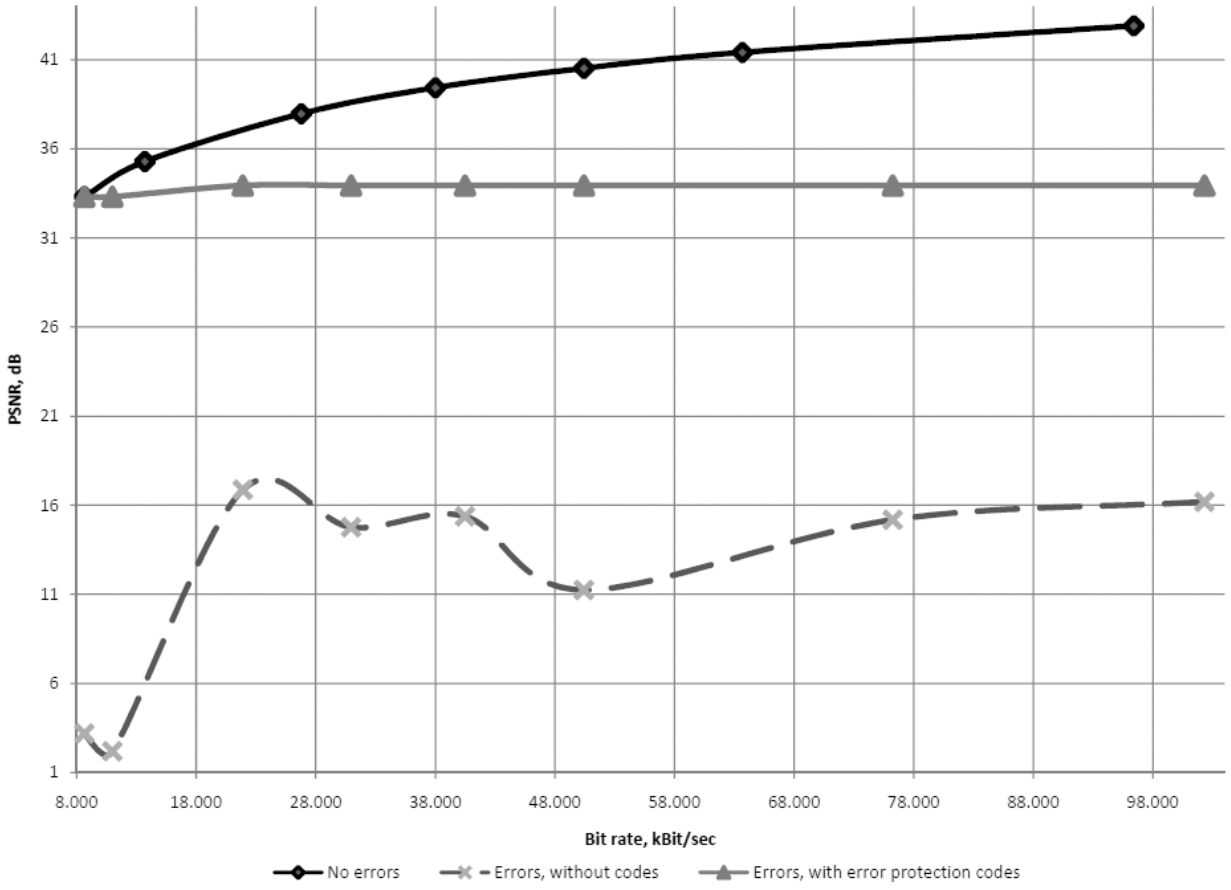
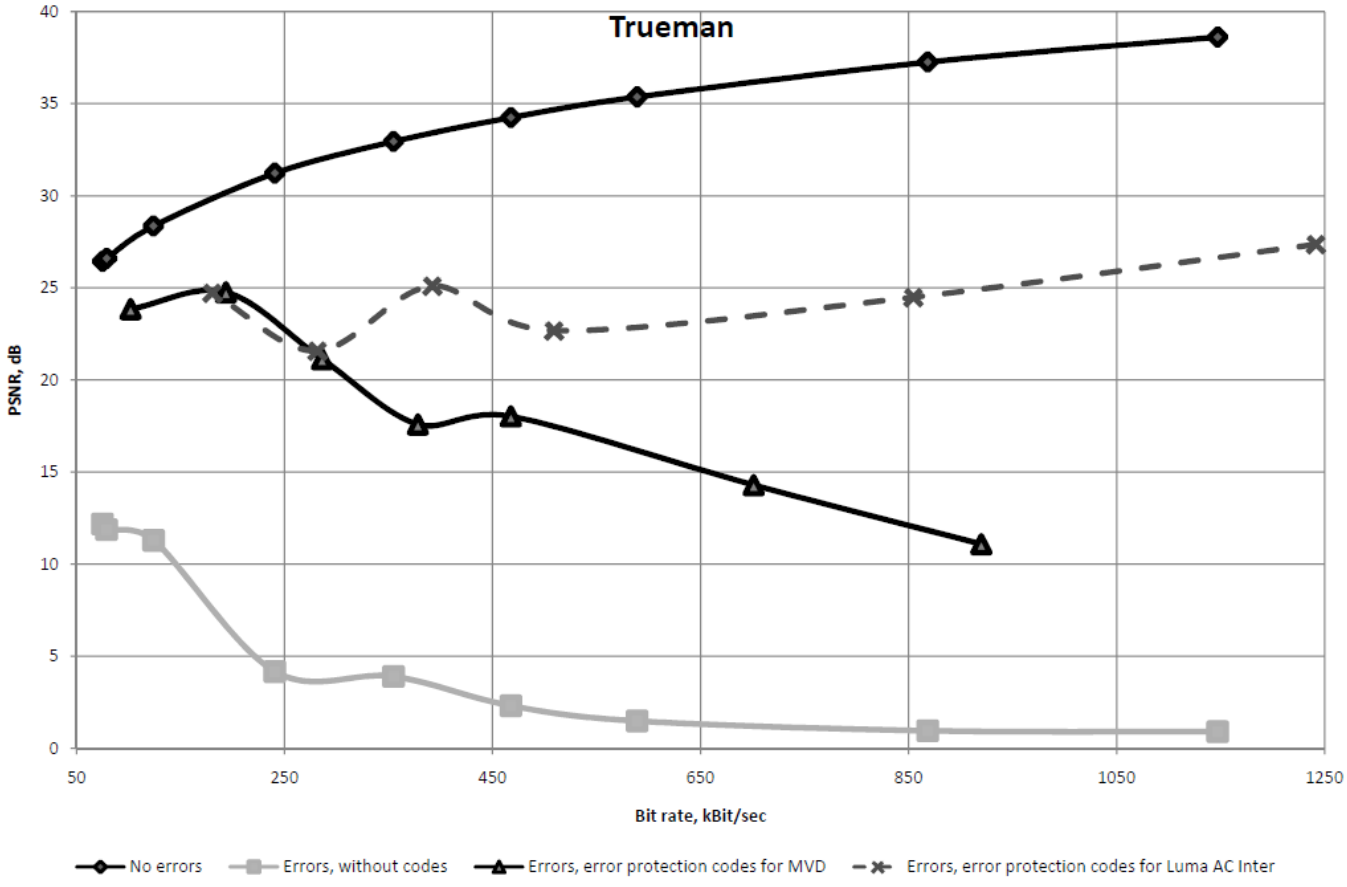
RD, Claire


41
36
31
26
21
16
11
6
1
PSNR, dB
8.000
18.000
28.000
38.000
48.000
58.000
68.000
78.000
88.000
98.000
Bit rate, kBit/sec
No errors
Errors, without codes
Errors, with error protection codes

Outline

RD, Trueman


Trueman
PSNR, dB
40
35
30
25
20
15
10
5
0
50
250
450
650
850
1050
1250
Bit rate, kBit/sec
No errors
Errors, without codes
Errors, error protection codes for MVD
Errors, error protection codes for Luma AC Inter

Thanks

- Any questions?