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Subjective quality of SVC-coded videos with different error-patterns concealed using spatial scalability

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Network impairments and video transmission

- Network impairment
  - Packet loss
  - Reordering
  - Corruption
  - Delay

- Missing or corrupted data during decoding
- Error Propagation

- Visual distortions

How to minimize visual distortions?
  - Stream protection
  - Error-concealment
SVC-based error-concealment

- 2 SVC spatial layers
  - BL : 320x240
  - EL : 640x480

- Loss only in EL

- Hypothesis
  - No loss in base layer (base layer protection)

Principle of SVC error-concealment
Snapshot examples

upscaled base layer  enhancement layer
Factors having an impact on perceived quality

Length of impairment

Number of impairments

Interval between impairments

Base Layer Quality
Experimental setup

• Content generation :
  • 9 video contents
    12 sec, 30 fps
  • 26 impairment patterns
    + 1 reference
  • SVC reference encoder
    JSVM v9.18
  • Lanczos upscaler
    QVGA → VGA
  • Impairment simulated on
    the decoded videos (YUV)
  • first and last second not
    impaired

• Test conditions :
  • ACR 5-levels scale
    (ITU-T P.910)
  • Standard viewing conditions
    (ITU-R BT.500)
  • 42” reference screen
  • 28 naïve viewers
  • 2 sessions of 45min with
    5 min break after 20 min
Impairment patterns

• Systematic approach:
  Several conditions for each influence factor

• Considered values for each influence factor:
  • Length : {2,8,16,32,64,128}
  • Number : {1,2,3,4}
  • Interval : {8,16,32,64,128}
  • BL Quality : QP = {38,44}
Experimental results

- Wide and balanced range of qualities
- Statistical significance analysis:
  - Student-t test
  - 95% intervals of confidence (displayed on next slides)
Impact of base layer quality

- Significant impact of base layer QP
- Stronger impact for long impairments
Impact of length of impairments

- Significant impact
- Linear decrease of quality / exp. increase of duration
- Slope of the decrease depends on base layer QP
Impact of number of impairments

- Significant but limited impact
- Depends on base layer QP
Impact of interval between impairments

- No significant impact!
Conclusion

• Ordering the influence on quality of the 4 factors:
  1. quality of the base layer > 2. length of impairments
  3. number of impairments > 4. interval between impairments

• Modeling the influence of the parameters
  – Linear decrease with the length of impairments
  – Significant dependence on the base layer coding quality
  – Joint impact of factors

• To be investigated:
  – Influence of the source content
  – Bit-rate constraints

• Publication of video database
Thank you for your attention
Questions?
Impact of impairments on perceived quality

Our goal: *Study the factors that influence visual quality in this context*

4 factors:

• Impairments distribution:
  – Length of impairments (cumulated)
  – Number of impairments
  – Interval between impairments

• SVC error concealment:
  – Quality of the base layer (QP)