QUALITY ASSESSMENT OF MPEG-4 AVC/H.264 AND HEVC COMPRESSED VIDEO IN A TELEMEDICINE CONTEXT

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General context

Ex. Nancy University Hospital: **55 *Tbytes*** in 2015**!!!**

→ **Data Compression**

Storage

Local Network

Medical image

Medical video

Medical consultation

Network

Transmission

Remote consultation

Celtic Plus European project *HIPERMED* (***H*igh *PER*formance tele*MED*ecine platform) 2010-2013

→ ***Best European project 2014***

http://hipermed.eu/

New Celtic Plus European project *E3* (***E*-health services *E*verywhere and for *E*verybody) 2015-2018

→ **Mobility for high and low bitrate networks**

Solutions:

✓ Compress more the medical videos by using the new video encoding standard HEVC.

✓ Evaluate the quality of medical compressed data with respect to their usage

== > **The best quality for a given constrained bandwidth.**

Material & Methods

Original ENT endoscopic video sequences FHD (1920x1080) – 60 fps – uyvy422 (Original bitrate : 1.99 Gbits/s)

Goal

Compare performance between AVC/H.264 (x264) and HEVC (x265)

Subjective test environment

✓ Living-lab PROMETEE (http://prometee.telecomnancy.eu/)

✓ ITU-BT.500-13 protocol

✓ Double Stimulus Continus Quality Scale (DSCQS)

✓ FHD 42" screen

✓ Duration: 2x24minutes

Subjective tests procedure

✓ 5 different AVC/HEVC compression ratios

✓ FHD vs SD resolutions

✓ Mean Opinion Score (MOS)

✓ 16 observers (5 womens and 11 men

Years of experience	[1; 5]	[6; 10]	[11; 25]
Number of observers	7	4	5

Experimental Results

FHD encoding: x264 vs x265 quality performance

✓ Evolution of the MOS score with respect to the AVC/HEVC compression bit-rate

✓ "pchip" function

✓ Threshold of quality: MOSmin=+0.1

→**HEVC offers 50% of bit-rate save with respect to AVC!!**

Sequence	1	2	3	4
HEVC thresholds (Mbits/s)	4.19	6.53	5	3
AVC thresholds (Mbits/s	5.15	7.49	7.3	6.5

SD vs FullHD quality behavior

→ **SD resolution ≈ FHD at low bit-rate (<096 Mbits/s)!!**

Objective metrics

✓ 16 objective metrics

✓ Pearson correlation assessment coefficient: Linear Correlation Coefficient (LCC).

✓ LCC → 1 → the best correlation between subjective and objective marks.

LCC	Avg(AVC)	Rk(AVC)	Avg(HEVC)	Rk(HEVC)
SSIM	0.9236	5	0.9065	4
MSE	0.9757	2	0.9580	1
MSSIM	0.9282	6	0.9126	3
NIQE	0.9855	1	0.8004	15
NQM	0.9499	3	0.9513	2
BRISQUE	0.9437	4	0.8263	13

➢ **MSE:** ENT surgeons seem to rather focus on the global video quality during the surgery.

➢ **NQM:** Human vision is sensitive to the variation of both luminance and contrast.

➢ **SSIM/MSSIM:** Structural approach.

➢ **NIQE/BRISQUE:** Effectiveness of the deblo-cking filter used by HEVC.

Conclusion & Perspectives

✓ HEVC (x265) is more efficient than AVC/H.264 (x264).

✓ Fixing MOS=+0.1, the gain at compression bit-rate ranges between 13% and 54% with respect to x264.

✓ We can switch from FHD to SD resolution at low bit-rates (<1Mbits/s).

Future work: to generalize these results to other types of medical video