Quality assessment of ultrasound video for medical tele-assistance

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Rationale

In a typical tele-assistance practice, medical video signals are communicated remotely in real time and are therefore vulnerable to distortion due to data compression and transmission. It is highly desirable to understand how tele-assistance practitioners perceive the quality of videos, and consequently to improve the clinical practice.

Methods

A perception experiment was conducted with radiologists assessing quality of various ultrasound videos. Four source videos were extracted from four distinctive ultrasound scans from Angers University Hospital. They were compressed by two different compression schemes (i.e., H.264 and HEVC) at various compression ratios, yielding 32 stimuli including originals. Eight radiologists participated in the experiments, scoring the overall quality of each video.

Results

An ANOVA (Analysis of Variance) was performed by selecting the perceived quality as the dependent variable, the video content and compression as fixed independent variables, and the participants as random independent variable. The results show that there is no significant difference between participants in scoring quality, and that content and compression are statistically significant. For each compression scheme, the perceived quality monotonously increases with the increase of bit rate. Using the same bit rate, HEVC gives better perceived quality than H.264. We also applied two widely recognised objective quality metrics developed for natural images/videos to our new database. The Pearson correlation between the predictions of PSNR and the MOSs is 0.58, and 0.71 in the case of SSIM.

Conclusions

Our results provide insights into how distortion in ultrasound videos affect the quality of experience of radiologists in the practice of tele-assistance. We demonstrate that compression and video content have a significant impact on the perceived quality, and that the objective quality assessment contains plenty of headroom for further improvement.