Analysis of content impact on subjective quality assessment of 3D video affected by bit-rate reduction

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Ph.D. Thesis – Abstract

One of the fundamental problems in subjective Quality of Experience (QoE) assessment experiments design is source material selection which subsequently forms a basis for stimuli generation. Obviously, subjective experiments rely on human subjects, who cannot be treated only as quality degradation level detectors. A specificity of such experiments requires putting under investigation the source material which is as similar as possible to the video provided in real-life services. Some suggestions on source material selection issues can be found in related recommendations, and these seems not to have been proved scientifically – so broader research needs to be conducted. However, unfortunately, video sequences used in subjective experiments are substantially different from content widely available to users in Video-on-Demand repositories.

The dissertation deals with the problem of video content impact on subjective quality assessment scores. Video content features are operationalised by three cognitive attributes: level of interestingness, level of visual attractiveness and 3D effect experience (depth experience). Gradation of video quality is introduced by streaming on four bitrate levels.

The first stage of research is devoted to the design of an authorial database – a collection of video shots from commercially available feature films and documentaries. Sequences are selected considering not only objective metrics – temporal activity (that generally indicates the amount of temporal changes of a video sequence) and spatial activity (that generally indicates the amount of spatial detail of a picture), but also results of a subjective experiment.

In the main stage of the research, the authorial database is compared with a commonly used database, designed for research purposes. In order to include a subjective assessment of cognitive attributes, keeping in mind state-of-the-art on factors influencing subjective quality assessment,

an innovative experimental scenario is proposed. Additionally, this scenario enables a proper comparisons between both databases considering cognitive attributes of video content.

Statistical analysis of the collected results using a stochastic dominance analysis adjusted to a 5-point Likert scale makes it possible to prove the thesis:

It is possible to assess the impact of cognitive attributes of video content on perceptual quality of video affected by artifacts related to bitrate reduction, using a relevant experimental scenario.

The obtained results show that quality assessment scores depend on intensity of content cognitive attributes. Moreover, it is proved that test material commonly used in research is assessed higher for lower bitrates.