Video Bitrate Control by Criteria of Picture Quality

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Abstract – In this paper a rate control method is offered by the criteria of video pictures quality, measuring by means of objective indexes and corresponding to subjective human perception.

Keywords – video stream, bitrate, digital television, control, picture quality.

I. INTRODUCTION

Practical experience in the field of the digital television broadcasting and results of experimental researches give an opportunity to form a task important for providing of delivery of high-quality video content to end-user, which consists in a bitrate control of transport stream (TS) both on the stages of preparation of video content and in the process of transmission (multiplexing) of video programs.

II. BITRATE CONTROL BY VIDEO PICTURE QUALITY

There are a few methods of TS bitrate control, general essence of which is taken to the calculation of necessary bitrate through the known global quantization coefficients of initial and transcoded video streams and mean square difference of error frame after motion cancellation. However these methods don’t allow changing TS bitrate depending on current video picture quality both inside of elementary stream and multiplexing [1].

A TS bitrate control is carried out by means of transcoder. It is offered to apply a closed-loop transcoder for implementation of video picture quality analysis and use of the obtained estimation for adjusting of TS bitrate In this case transcoder fully decodes video data (fig. 1), getting discrete values of samples of brightness signal and color difference signals of every frame of video sequence for further transmission them into the block of quality analysis which determines the objective quality index $Q_i$ for every $i$-th frame of video stream and averages it on some temporal interval.

$$\ln(Q_{av}) = a \cdot \ln(R) + b,$$  (1)

where $a$ and $b$ are the parameters of model.

The type of Eq. (1) is obtained experimentally, coming from the results of the objective and subjective quality measurements of the test sequences compressed in accordance with the MPEG-2 algorithm which is used in the digital television systems [2].

It is offered to use MSSSIM (Multi-Scale Structure Similarity Index Measure) [1] as objective quality index because objective scores given by MSSSIM correspond to subjective human perception in the closest way (shown experimentally).

Test video sequences are nine typical video fragments taken from [2] with duration of approximately 10 sec. that represent wide range of possible scenes which can appear while watching the digital TV programs. These nine video sequences correspond to nine classes of video scenes that are identified definitely by parameters $a$ and $b$ in MSSSIM objective quality index (fig. 2).

Fig. 2. Approximation results for objective quality indexes vs. video bitrate

Using Eq. (1) that links the required video bitrate $R$ with objective quality index $Q_{av}$, which depends on the class of video sequence and its descriptions, it is possible to define the necessary global quantization coefficient to change the bitrate of TS of this class [1].

III. CONCLUSION

Offered approach gives an opportunity to change bitrate for the video of certain classes depending on its objective quality which corresponds to subjective human perception at creation of telecasts or multiplex forming for providers of satellite, cable or IP television.

REFERENCES
