Original Research Paper

Volume - 12 | Issue - 12 | December - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Statistics

REDUCED REFERENCE VIDEO QUALITY ASSESSMENT BASED ON HYPOTHETICAL METRICS

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ABSTRACT Out of all existing methods, Reduced-Reference Video Quality Assessment is the one which is most needed in situations where the handiness of reference video is not available. Our challenge lies in formulating and melding effective features into one model based on human visualizing characteristics. Our research work explores the trade-offs between quality prediction and video compression. Therefore, we implemented inbuilt RR- based Video Quality Metric (VQM) and it has been concluded that in our past research work the issue was raised on quality of video(compression) not assessment, it happened due to spatial and temporal perceptual information, i.e, instead of coding of spatial within chrominance and temporal information within luminance plane according to H.264 standards mentioned by ITU only for video quality assessment, spatial and temporal information within test sequences were encoded in luminance plane itself.

KEYWORDS : VQM, RR-VQM, ITU, MOS

INTRODUCTION

In recent times, due to increase in neediness of technology towards modernization and digital transmission, out of existing methods, four of which were considered in our research work, and they are acquisition, compression, transmission and reconstruction. In our scenario, channel, acquisition refers to generation of source video towards compression within limited band width in a compression block. At encoder in a channel compressed information is referred as lossy compression and the data which is transmitted to decoder towards reconstruction based on Spatial and temporal information can be altered. Quality degradation due to compression of video can be categorized into two types spatial and temporal.

In other scenario, transmission impairments of video through error prone channels or network may cause packet loss, band width fluctuation, jitter and delay etc due to low internet speed data is degraded and, in this scenario, transmitted information within network is referred as bit stream data and at decoder side decoded information is referred to distorted sequence of video and this concept is related to lossless compression.

In a quality estimation point of view, it is very important to judge the efficiency of transmission system. This help monitoring the digital video transmission system to maintain quality levels during display. There are many factors that affect the video quality and many research works are done exploring these factors and methods to assess the video quality.

Survey Related Works

The feature extraction process for H.264 coded bitstream data was performed in two main steps. First the encoded video bitstreams were decoded using a modified version of JM reference software 16.1 in order to generate an XML file of coding parameters for each video sequence. These XML files contained video information at macroblock level such as quantization parameters, absolute and difference motion vectors, and the type of macroblocks.

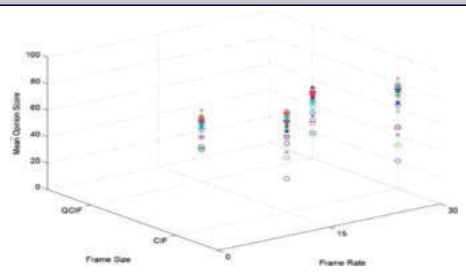

Figure 1 Projection of both spatial and temporal information within 3-dimensional space of luminance plane

In the next step a Java program was developed to analyse and process the large XML data in order to extract 18 selected features of the coded videos at frame level. These features which are expected to have high correlation with the perceptual quality of the videos

Problem Statement towards Issue Raised:

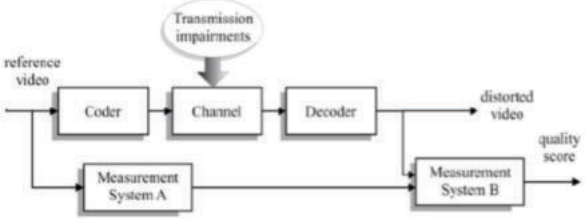

Figure 2 Proposed Reduced Reference Model

With the Introduction of quality metrics at network level distortions, need of features extraction out of bitstream parameters towards calculating quality estimation of video sequence at frame level is mandatory but not required to decode the video at any level and is suitable for situations where encoded video is encrypted. Based on our observation, the error concealment is less effective in case of high motion intensity in frames of video sequence and in order to evaluate the effectiveness of error concealment, a strategy is based on new feature is developed out of DCT coefficients such as estimation of motion dynamics of target video based on reference video is required. Motion Intensity (I) defined by:

$$\sum_{i=1}^{N} \sqrt{MVX_i^2 + MVY_i^2}$$

where N is the total number of macroblocks in each frame and MVX(i) and MVY(i) are the absolute motion vector values of the ith macroblock in X and Y directions respectively.

Motion Intensity (II) defined by:

$$\sqrt{MVX^2 + MVY^2}$$

where MVX and MVY are the average of absolute motion vectors in each frame in X and Y directions respectively. Percentage of Intra coded macroblocks of size 4x4 in I frames. Percentage of Intra coded macroblocks in P frames.

Assumptions based on statement

Based on Assumptions, if B frame size is less than predetermined threshold then we must not consider motion intensity, so it is an algorithm based decision-making technique (estimation of motion dynamics) which decides to consider or not motion intensity feature based on conditional acceptance. The effectiveness of error concealment is refined by adjustment of values in accordance with the significance of the region in which the error has occurred within each of frame of video sequence. To quantify motion dynamics, a new algorithm based on decision making is developed towards understanding the mechanism of this algorithm and identification of the error occurred due to delay in signal within channel is based on motion intensity of intra prediction (spatial) and inter prediction (temporal).

Validation based on analysis

After investigation of unidentified error at decoder side, we understood that its motion vectors which are missing in reconstructed frames of video because of coding or compression technique not due to delay. The modelling of our proposed metric identifies the tradeoff between video compression and quality estimation. The errors within compressed video sequences at frame level were proliferated due to loss of encoded macroblocks during coding and the channel induced degradation due to specific coding the estimation of motion intensity techniques like intra-macroblock prediction and deblocking filters. The calculations of the quality degradation within reconstructed frames of video sequence are evaluated at macroblock level. It has been observed that the proposed method generates results which holds good correlation with reduced reference method.

Problem Solution

The scientific process of evaluation of video quality by humans is called subjective quality assessment. However, subjective evaluation is often too inconvenient, time-consuming, expensive and it must be done by following special recommendations in order to produce reproducible and standard results. These reasons give rise to the need of some intelligent ways of automatically predicting the perceived quality that can be performed swiftly and economically [1].

Implementation and Testing Results

To further validation based on selection of features, we ran several regression tests where prediction ability of the parameters for subjective MOS was investigated. We used the professional IBM SPSS (originally, Statistical Package for the Social Sciences) release 20 for this purpose. Particularly, the test employed was a regression analysis. Table 1 presents a summary of the model with 3 different sets of the features included in the test. The analysis of variance (ANOVA) table showed all these models are statistically significant. Moreover, we noticed that in our model the R values were quite high.

Table 1: Statistical Analysis of ANOVA model

Model	R	R Square	Adjusted R SQUARE
1	0.940	0.883	0.868
2	0.940	0.883	0.868
3	0.939	0.883	0.868

CONCLUSIONS

We concluded that based on our results in above section, R values of proposed model was quite high even after dimensionality reduction and the reason is quite simple, proposed metric cannot validate quality assessment based on video compression unlike subjective assessment which are judged as true values and it was traced out because of motion dynamics.

REFERENCES:

[1] Subjective video quality assessment methods for multimedia applications, ITU-T, Recommendation ITU-R P910, September 1999.