Video Quality Evaluation of MPEG-4 Using (MOS) Mean Opinion Score in NS-2

Younis Rasool Wani, Dr.Swati Sharma,Sanjeev Chopra

Reaseach Scholar,Electronics and Communication Engineering,UGI college Lalru,Punajb,India

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Abstract- Recently visibly a lot of telecommunication systems are supporting various types of real-time transmission and video transmission being one most important application. Today's studies reveal that around 60 % of the data on social media and other internet applications use video transmission. So the growing demands for telecom operators needs much sophisticated methods and procedures to provide high quality real-time video streaming in limited bandwidth paradigm. Some scholars have marginally done a good job to improve the characteristics of video transmission such as packet loss rate, packet delay or packet jittering. However the above quality parameters cannot be easily and uniquely transformed into high quality video transmission. The drawback of these parameters is that their transformations will be different for every coding scheme, loss concealment and jitter handling. The tools available in market for video quality evaluation often assume synchronized frames at both sender and receiver side. However this assumed synchronization of frames cannot be applied in case of frame drops and frame decoding errors. JNDmetrix-IQ software and the AQUAVIT are the publically available tools in today's market but they can't evaluate incomplete received videos at the receiver side. These are applicable to video frame which can be decoded at the receiver side without any jittering and delay loss.

In this paper

Keywords– MPEG, NS-2, Adhoc Networks, PSNR,MOS.

1.INTRODUCTION:-

Peak signal-to- noise ratio, abbreviated as PSNR, is an engineering term for the fraction between the highest doable power of a signal and the power of corrupting noise that affect the reliability of its representation. Because several signals have incredibly wide dynamic range, PSNR is typically uttered in provisions of the logarithmic decibel scale for measurement. PSNR is generally used to determine the quality of restoration of lossy compression codec's (for instance, for image compression). The signal is our scenario is the data signal in original form and the noise considered is the error that occurs by compression. When we compare compression codecs, PSNR is an rough calculation to human observation of rebuilding original signal with same quality. Even though a upper PSNR generally indicate that the reconstruction is of superior quality, in some cases it could not. One have to be tremendously cautious with the range of power of this metric; it is decisively valid only when it is used to compare results from the similar codec and similar content.

PSNR is mainly defined via the mean squared error also known as *MSE*.

In a noise-free $m \times n$ monochrome image I and its noisy

approximation K, *MSE* is defined as:

The PSNR (in dB) is defined as:

$$\mathrm{PSNR} = 10 \times \lg\left(\frac{255^2}{\mathrm{MSE}}\right)$$

$$\mathrm{MSE} = \frac{1}{M \times N} \sum_{i=1}^{N} \sum_{j=1}^{M} \left[I(i,j) - I'(i,j) \right]^2$$

Typical values for the PSNR in lossy image and video compression are between 30 and 50 dB, provide the bit depth is 8 bits, which should be higer always . For 16-bit data typical values for the PSNR are between 60 and 80 dB. Acceptable values for wireless communication quality loss are considered to be about 20 dB to 25 dB.

The PSNR block compute the peak signal-to-noise ratio(PSNR), in decibels, among two images. This ratio is regularly used as a quality amount between the original image signal and a compressed image signal. The higher the PSNR of a image signal, better is the quality of the compressed, or reconstructed image signal.

There are two types of error metrics used for quality of image compression one is known as the Mean Square Error (MSE) and other is the Peak Signal to Noise Ratio (PSNR. The MSE always represents the cumulative squared error among the compressed image signal and the original image signal, whereas PSNR represents a measure of the peak error.Also we can say that lower the value of MSE signal lower is probability of error in the image signal.

To calculate the PSNR, the initial block primarily calculates the mean-squared error using the below equation:

$$\mathrm{PSNR} = 10 \times \lg\left(\frac{255^2}{\mathrm{MSE}}\right)$$

$$\mathrm{MSE} = \frac{1}{M \times N}\sum_{i=1}^{N}\sum_{j=1}^{M}\left[I(i,j) - I'(i,j)\right]^2$$

MSE and PSNR are the algorithms adopted in image processing for evaluating the performance of the codec of interest; they are closely linked to and borrowed from other contexts of signal processing. Even though easy for implementation and calculation purposes, they show the side in different situations, so the findings cannot be considered always reliable. Nevertheless, their use continues to be predominant in the performance evaluation of any video coding system.

PSNR is one of the most widespread objective metrics to assess the application-level QoS of video transmissions. The below equation shows the definition of the PSNR between the luminance component Y of source image S and destination image D:
PSNR(n)dB = 20

$$\left(\frac{V_{peak}}{\sqrt{\frac{1}{N_{col}N_{row}}\sum_{i=0}^{N_{col}}\sum_{j=0}^{N_{row}}[Y_S(n,i,j) - Y_D(n,i,j)]^2}}\right)$$

where Vpeak = 2k-1 and k = number of bits per pixel also known as luminance component. PSNR calculates the error between a reconstructed image signal and the original image signal. Prior to transmission, one may then compute a reference PSNR value sequence on the reconstruction of the encoded video as compared to the original raw video. After transmission, the PSNR is computed at the receiver for the reconstructed video of the possibly corrupted video sequence received. The individual PSNR values at the source end or receiver end do not mean much, but the dissimilarity between the quality of the encoded video signal at the source and the received one can be used as an objective QoS metric to review the transmission impact on video quality at the application level.

Results:

The results are prepared by considering different outcomes of the peak signal to noise ratio (PSNR) MPEG video on different parameters and are viewed separately but the final conclusion is made by comparing the results.

6.1 Effects of bandwidth, fragment size, and CER on PSNR

The peak signal to noise ratio in the multimedia traffic is examined by varying the parameters. First we have varied the fragment size and channel error rate (CER) for different set of bandwidth and PSNR is measured. The following results are observed.

The results are divided with reference to the bandwidth

- **PSNR at 0.5 Mbps bandwidth**

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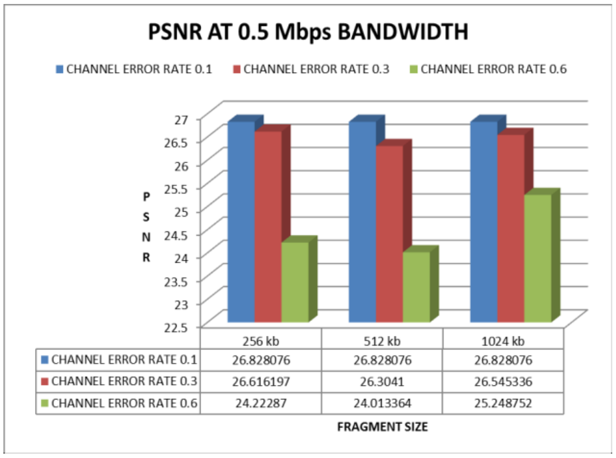


Figure 1.1 : Graph for PSNR at 0.5Mbps

In the above result bandwidth is set at 0.5 Mbps ,the size is increased from 256 Kb to 1024 kb and channel error is varied slightly from 0.1 to 0.6 then peak signal to noise ratio gets improved from initially from 26.828076 to 24.22287 at 256 kb and then from 26.828076 to 25.248752 at 1024 kb. For Example at CER 0.6 size is 256 kb and PSNR is 24.22287 and gets improved to 25.248752 when size is increased to 1024 kb.

- **PSNR at 1.0 Mbps bandwidth**

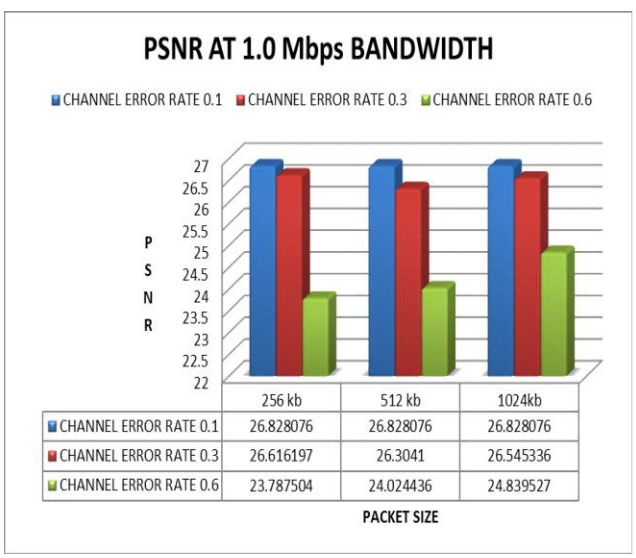
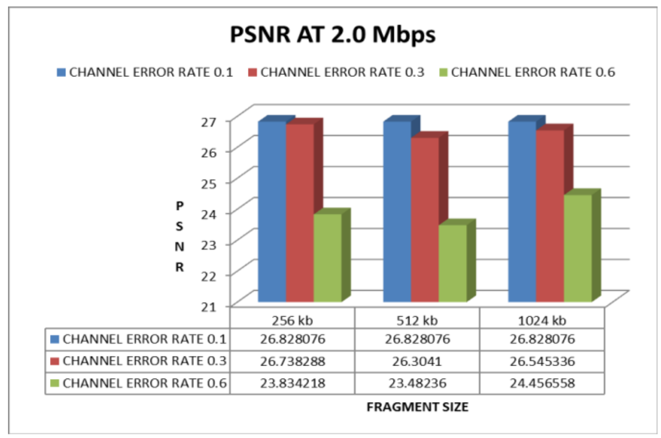


Figure 1.2: Graph of PSNR at 1.0Mbps

The above graph shows PSNR at 1.0 Mbps in which channel error rate is fixed and fragment size is increased. This graph suggests that peak signal to noise ratio (PSNR) at varying channel error rate (CER) and fragment size at three sets of bandwidth reveals that the PSNR improves for higher channel error rate (CER) at higher fragment size**.**



- **PSNR at 2.0 Mbps bandwidth**

Figure 1.3: Graph for PSNR at 2.0Mbps

The analysis of peak signal to noise ratio (PSNR) at varying channel error rate (CER) and fragment size at three sets of bandwidth reveals that the PSNR improves for higher channel error rate (CER) at higher fragment size**.**

CONCLUSION:

In this article, different parameters are changed to increase the peak signal to noise ratio because peak signal to noise ratio is ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation in image compression. In order to improve the peak signal to noise ratio (PSNR) three parameters were varied namely channel error rate (CER) and data size and bandwidth .when these parameters are varied the peak signal to noise ratio is improved drastically as it can been from the results shown in the above figures.

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