Parametric Comparison of H.264 with Existing Video Standards

Sumit Bhardwaj
Department of Electronics and Communication Engineering
Amity School of Engineering, Noida, Uttar Pradesh,INDIA

Jyoti Bhardwaj
Department of Physics and Astronomical Sciences
School of Physical and Material Sciences
Central University of Himachal Pradesh
Dharamshala,INDIA

Dr.Vinod Shokeen
Department of Electronics and Communication Engineering
Amity School of Engineering, Noida, Uttar Pradesh,INDIA

Abstract- The H.264 is a dominant video coding standard in transmission and storage of video data. The new H.264 video standard has achieved significant improvements in terms of compression over existing standards despite of the fact having same basic coding framework similar to existing standards, but H.264 introduces many new features. In this paper we compare H.264 standard with previous existing standards like MPEG 4 and MPEG 2 in terms of PSNR, NOISE ESTIMATION, BLURRING and MSE.

Keywords- PSNR, Noise Estimation, Blurring And MSE.

I. INTRODUCTION

H.264 is an emerging video coding standard designed video communication of low bit rate applications such as video conferencing in 3g networks on mobile phones.H.264 is also known as MPEG-4 part 10 Advanced Video Coding (AVC) of ISO/IEC [1]. It is extension of previous video standards MPEG-2, MPEG-4 Visual or part 2 showing quality and efficiency progress in video coding standards. The H.264 expands very effectively the use of reference frames by allowing one reference frame to be used by many future and past frames and by allowing any frame to act as reference frame. Multimedia applications including such as entertainment, communication, surveillance etc requires high noise immunity and high compression ratio so that maximum data can be send and H.264 fulfils all these requirements effectively, eliminating flaws of previous video standards. The detail description of H.264 is given in [2]. As stated in [3], different frames from a video can be assessed for different parameters n order to judge for quality in compression. In this paper we will compare four different parameter of three video standards, i.e. H.264, MPEG2 and MPEG4 and will find out how H.264 is ahead of existing video standards.

II. TEST ENVIRONMENT

In this test we took 10 frames of a video and then compared these 10 frames for different parameters for H.264, MPEG 4 and MPEG 2. These sequences are in CCIR- 601 format (720 x 480) at 30 fps frame rate. The H.264 encoder was configured to have five frames for inter motion search, motion vector resolution, context-based adaptive binary coding (CABAC) for symbol coding, and rate-distortion optimized mode decision. For MPEG-2, the bit rates were chosen such that the encoded video qualities (PSNR values) are close to the corresponding H.264 video streams. MPEG-2 sequences were generated in constant bit-rate (CBR) mode.

III. COMPARISION OF H.264, MPEG 4 and MPEG 2

A. PSNR

This metric is called the peak signal-to noise ratio or PSNR and is the ratio between maximum signal power and that of affecting noise. It is given by

$$\mathrm{PSNR} = 10\log_{10}\left(\frac{\mathrm{MAX}_I^2}{\mathrm{MSE}}\right)$$

$$\mathrm{PSNR} = 20\log_{10}\left(\frac{\mathrm{MAX}}{\sqrt{\mathrm{MSE}}}\right)$$

Where MAX_I represents the maximum possible pixel value of the image However value of PSNR for video compression and lossy images lies between 30 to 50 dB, higher the value more it is good. While compression codecs comparison, it gives approximation of reconstruction quality to human perception, thus higher PSNR will indicate that reconstruction is of higher quality. Figure 1 represents the comparison of PSNR for MPEG-2, MPEG-4 and H.264

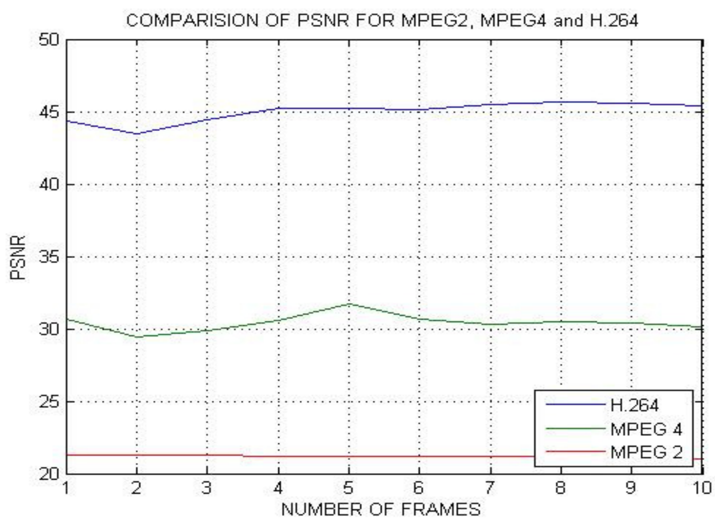

Figure 1 Comparison of PSNR for MPEG2, MPEG4 and H.264

As clear from figure 1 that PSNR value for MPEG2 in around 21, for MPEG4 it is varying in between 29 and 32 and for H.264 it is between 38 and 41. Thus H.264 shows higher PSNR value.

B. Noise Estimation

In image de-noising the noise is assumed to be known as Additive Gaussian White Noise (AWGN) However, in real applications the noise is unknown and non-additive. The standard deviation of noise is a function of image brightness (called Noise Level Function), measurable by fixing the camera and taking multiple shots of a static scene. Thus we defined a Noise Level Function and with the help of which we estimated noise for various frames in different algorithms.

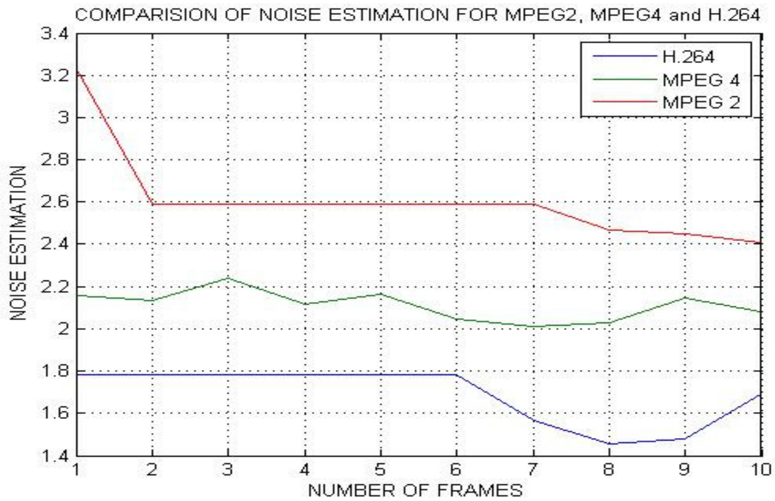

Figure 2 Comparison of Noise Estimation for MPEG2, MPEG4 and H.264

As clear from figure 2, which shows comparison of MPEG2, MPEG4 and H.264 for noise estimation, that when same video passed through same channel, H.264 shows high noise immunity whereas maximum noise was in the oldest standard MPEG2 , and noise level lie for MPEG4 lie in between H.264 and MPEG2.

C. MSE

Mean square error provides the cumulative squared error between the original image and processed (compressed) image. It is given by

$$MSE = \frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

Where I(i,j) is the original image and K(i,j) is the compressed image. It is thus used here for estimating noise level for each video sequence thus giving the average of square of errors The error is the amount by which the value implied by the estimator differs from the quantity to be estimated. The main difference occurs because of randomness or because the estimator doesn't account for information that could produce a more accurate estimate. Figure 3 shows comparison in terms of MSE between three formats. As we can see that highest MSE is for MPEG2, around 500, for MPEG4 it is around 200 and for H.264 it is around 1. Hence H.264 provides minimum MSE as compared to previous standards

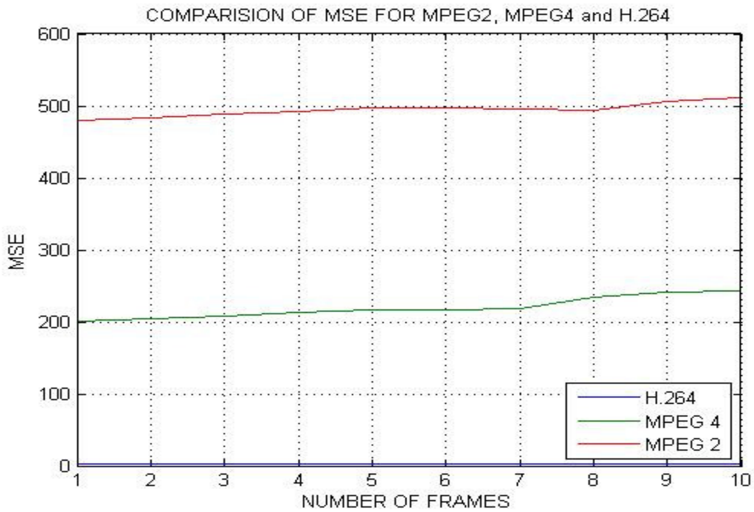

Figure 3 Comparison of MSE for MPEG2, MPEG4 and H.264

D. Blurring

All coding standard techniques based on block based motion compensation become ineffective when blurring takes place in video sequence. Blurring generally takes place in video sequence when relative motion between the captured scenes is faster the exposure time of camera. It also takes place when a object in a video is focused and defocused again and again. Figure 4 shows blurring in three formats.

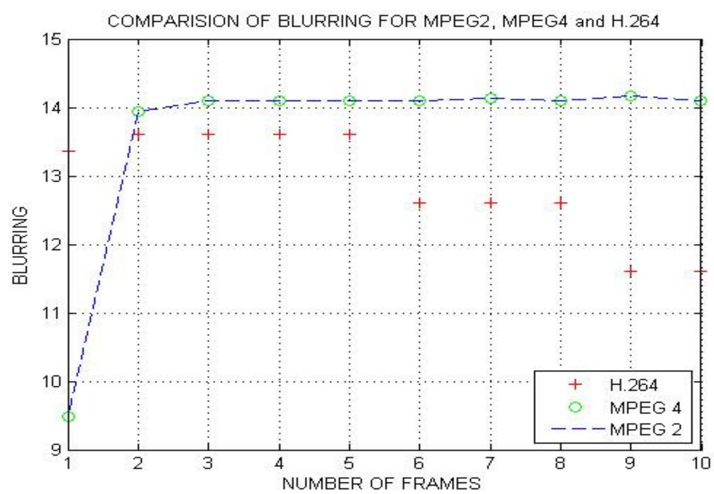

Figure 4 Comparison of Blurring for MPEG2, MPEG4 and H.264

From figure it is clear that blurring in H.264 is less than MPEG2 and MPEG4, depicted by red plus sign.

IV.CONCLUSIONS

In this paper, we presented an evaluation of the new video coding standard H.264 compared to existing video coding standards in terms of PSNR, Noise Estimation, MSE and Blurring. We performed encoding tests at a wide range of rates for both low- and high-latency application and found that H.264 is superior to existing video standards. When coding blurred scenes in video sequences, bit rate reductions of up to 64% were achieved for H.264.

REFRENCES

[1] ISO/IEC 14496–10:2003, “Coding of Audiovisual Objects—Part 10: Advanced Video Coding,” 2003, also ITU-T Recommendation H.264 “Advanced video coding for generic audiovisual services.”

[2] G. S. Greenbaum, “Remarks on the H. 26L project: Streaming video requirements for next generation video compression standards,”, ITU-T SG16/ Q. 15, Q15- G- 11,

[3] Z. Wang, A. C. Bovik, H. R. Sheikh, and E. P. Simoncelli, “Image Quality Assessment: From Error Visibility to Structural Similarity,” IEEE Trans. on Image Processing, vol.13, no.4, pp. 600-612, Apr. 2004.