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Video Compression based on Visual Perception of Human Eye

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Abstract: ***Video compression plays an important role in cable TV distribution, interactive communications (video phone, video conferencing, video tags), Digital Storage Media (CD-ROM, CD-V, digital VTR), network database services, video library, broadcasting and video surveillance that require large amount of storage space and transmission bandwidth.Presently, many compression techniques are in existence. All those techniques areusuallybased on two methods (i.e) either Lossy Compression or Lossless Compression. The existing approach is that one of the compression techniques is been applied to the entire video or to the entire frame. Here, a method has been proposed in order to use both Lossy and Lossless compression to every single frame of the video. For an example, when we watch a dancing video of a person with a sea shorebackground, our eyes will pay much attention on the dancer's movements rather thanthe sea or sea shore. Substantially, a human eye visualizes only a particular portion in the video which either has the high lighting effects or the area where the camera focuses. Based on this idea, the proposed method divides the single frame into two and it applies the lossless compression to human eye focused area and lossy compression on the remaining area of the frame.***

Keywords: High illumination pixel Area Detection (HIPD), Partitioning the frame, HEVP (Human Eye Vision Perception) Algorithm

I. INTRODUCTION

Videos require a large transmission bandwidth and vast amount of storage space sincethey are found to be in high definition or high qualities. There are various strategies to reduce the redundant data in video that compresses the information without affecting the quality of the frames negatively. Lossy and lossless are two methods widely used. In lossless, there will be no losses in data whereas in lossy the information is thrown way which can't be retrieved. The proposed method mainly focuses on commercial videos like movies, album songs, advertisements, etc. Basically, the objective of the commercial video is to focus on primary element in a single frame. To illustrate the above idea, let us consider the following instance.An advertisement focuses keenly on the product under the action of promoting it. Similarly, a song focuses the primary artist of the video. The illumination on that particular portion must be increased in order to gain focus. Generally People's brain fairly instructs the eyes to look on the primary theme on the frame. One of the fascinating experiments is, In Michael Jackson`s album, human`s eye and brain will be concentrating only on him excluding the background stage or other scenarios. Therefore, it is justifiable that human`s eye will not be able to see all the objects that exist in the frame. Then, what is the wider scope to do lossless compression in all the parts of the frame? So, the human eye focused area has to be detected and lossless compression is applied to it. In the excluded area, the lossy compression is used to compress video. Depending on the human`s psychology, we have proposed a new algorithm named "Human Eye Vision Perception (HEVP)".

II. HIGH ILLUMINATION PIXEL'S AREA DETECTION

Generally, Commercial videos give much importance to lightings that pinpoints the area to be focused. So that,the illumination on the particular portion will be increased automatically.The pixels must be detected foremost. To do that, the coloursin the frameare transformed from RGB to LAB. By doing this, the high illuminated pixels will be highlighted. The maximum illumination value can be calculated and once after the calculation, a new image frame has to be created and it will be filled by 0's.

In order to detect the high illumination patch, the I-space value is been checked whether it's near to the maximum I-Space value of the frame. When it satisfies, it is put into the high illumination pixel patch. Eventually, the group of pixels which has the maximum illumination will be gotten in the pixel's patch whereas the remaining group is found which does not have high illumination which we call as non high illumination patch.

III. LOSSY AND LOSSLESS COMPRESSION IN SINGLE FRAME

Obviously, we can understand that the high illumination patch is the human's eye focusing patch and the non high illumination patch is not the human's eye focusing patch. Once we get two patches, the lossy compression is applied to the non high illumination patch. The Byte Pair Encoding algorithm is used for lossy compression which will give the same resolution. In the same way, the lossless compression is applied to the High illumination patch. For lossless compression, haar algorithm is used. So inside a single frame, both the lossy compression and the lossless compression can be performed according to the proposed method.

IV. HUMAN EYE VISUAL PERCEPTION ALGORITHM

```
//The proposed algorithm for Video Compression
N = no of frames
For k = 1 to n
L_space = Convert frame rgb to lab
Maxvalue = max(l_space)
For i = 1 to width-1
For j = 1 to height – 1
Converted_img(i,j) = 0
if (l_space(i,j) >= (maxvalue-150)) then      Converted_img(i,j) = 1
End
End
End
Areasize = math.round(h/2)
For m = 1 to areasize
For n = 1 to areasize
patch = (converted_img (m:m+areasize-1, n:n+areasize-1,1:3)
if(all(patch)) then
apply  lossless compression algorithm
else
applylossy compression  algorithm
end
end
end
end
```

V. EXPERIMENTAL RESULTS AND DISCUSSIONS

The presented method HEVP algorithm has been tested for two video sequences. The performance of the proposed method is measured in terms of the PSNR and percentage of saving number f computations of video compression. To test the efficiency of the proposed algorithm with the existing method, the algorithms are executed in single machine. The performance of HEVP algorithm is compared with lossy compression and lossless compression. The existing method of lossless compression and lossy compression applied on the entire frame and the results are presents in Table 1.

TABLE I
PSNR Gain Ratioby HEVP algorithm over Existing Methods

Sequence	Lossy	Lossless	HEVP
Video 1	10.53447	36.3929	41.90408
Video 2	12.29932	38.20399	40.73889

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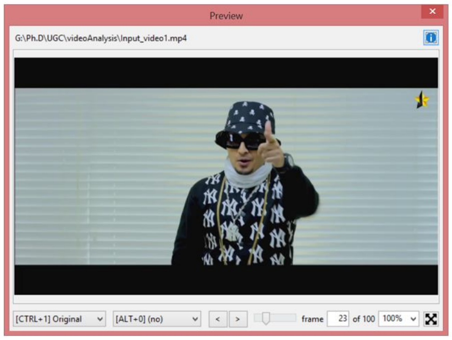
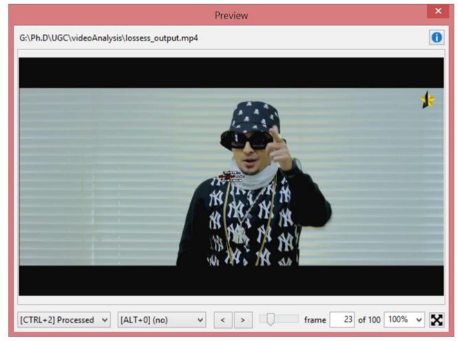
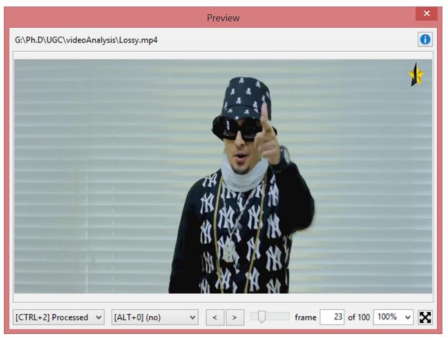


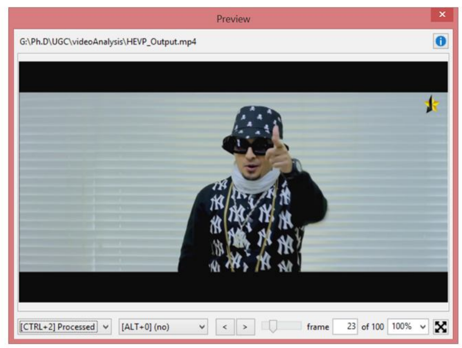
a) input frame



b) lossless compression



c) lossycompression



d) HEVP Compression

Fig: 1 sample output frame for comparing compression algorithm with HEVP Algorithm

The figure 2 and figure 3 shows the comparison of PSNR with other existing methods for two video sequences respectively and figure 4 shows the comparison of PSNR with the proposed method.

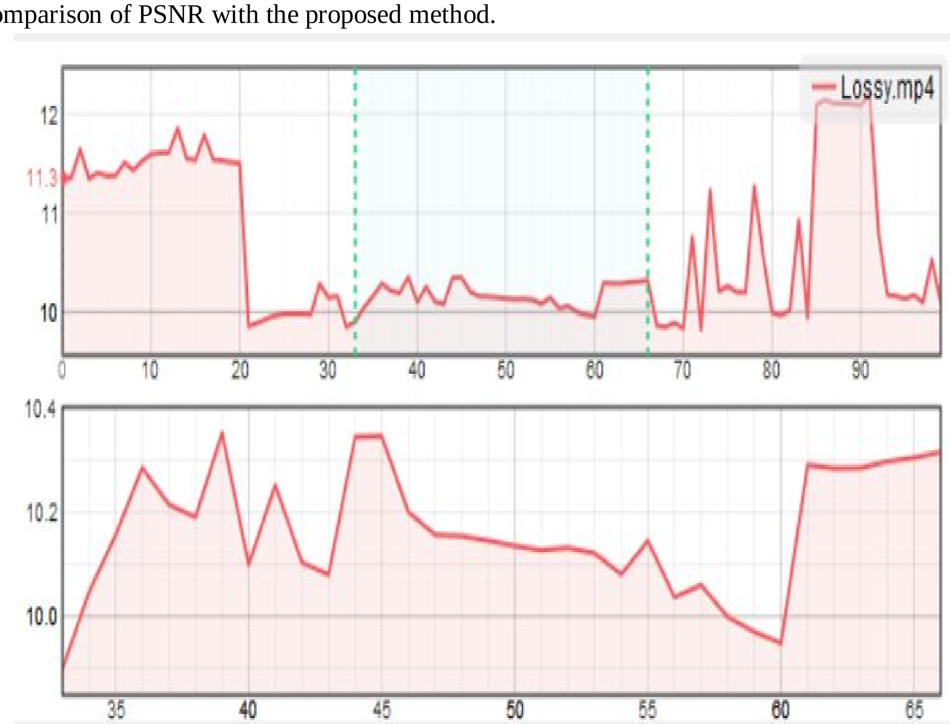


Fig2: Comparison of PSNR for Lossy Compression

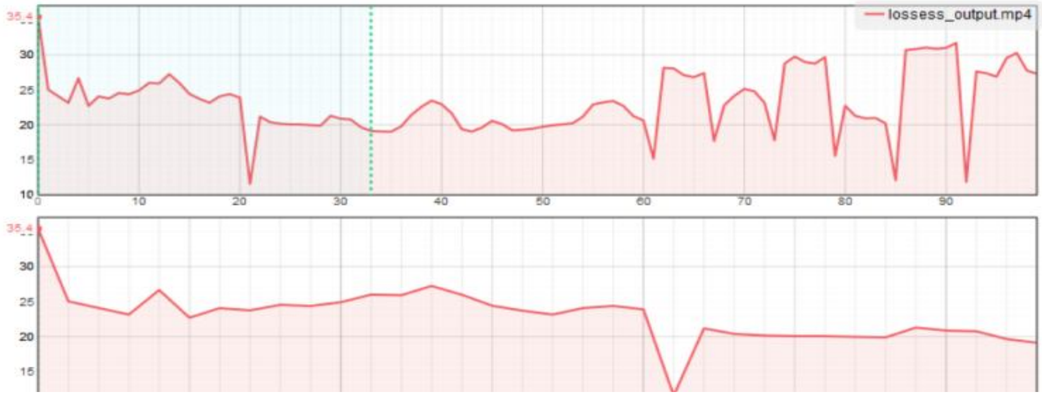


Fig3: Comparison of PSNR for Lossless Compression

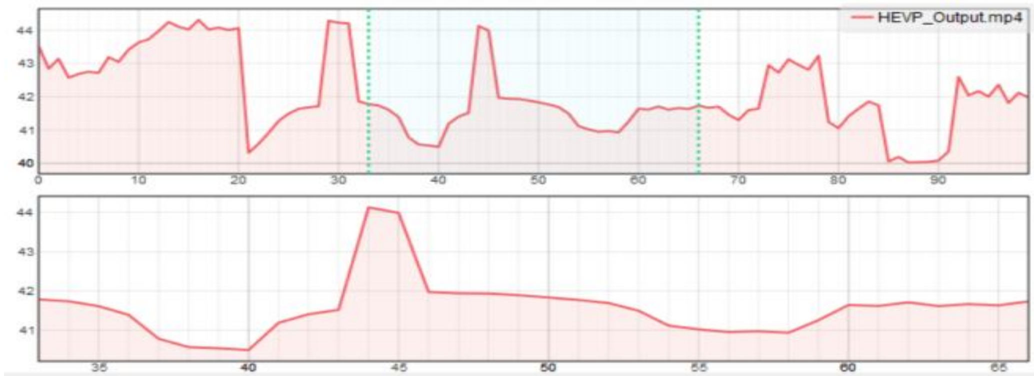


Fig4: Comparison of PSNR for HEVP Compression

VI. CONCLUSION

From the experimental result, it is undoubtedly clear that it is possible to compress video files without compromising the feel of quality of the viewers and the important aspect is that compression could be done in such a manner that it could not be detected by the human eye and every human would get a feel of watching a high quality video. The MSU Video Quality Measurement Tool is used for calculating PSNR value. The quality of the video is good when compared with existing lossy compression and lossless compression. The result shows promising improvement in terms of quality vision for human eye.

“A compressed video could present the impression of a high quality video” is the ultimate concept of this proposal.

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