A Novel Method of CCTV Video Compression using Down Sampling

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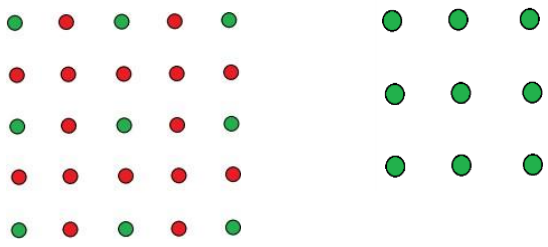
***Abstract*— CCTV monitoring is an important application in the area of video processing as it is suitable for proper monitoring of surveillance. One of the main drawbacks of this process is that it consumes a lot of storage space. This paper presents a novel method for compressing CCTV video using down sampling. Down sampling is a lossy process and widely used in video compression. The selected CCTV footage video is first divided into frames and followed by down sampling applied on each frame. So, size of each frame has been reduced. The compressed CCTV footage video is communicated over a long distance. However, to a get a reasonably good output, high compression ratio of down sampling should be avoided. We have proved that CCTV video can be compressed a large size video to a smaller one. This method is worked in spatial domain and it is not a time-consuming process. At the receiving end, up sampling is applied to reconstruct the video again. We have calculated PSNR and correlation coefficient values in each frame to measure the quality of the reconstructed images..**

Keywords: CCTV Video, Video Compression, Down sampling, Compression Ratio

1. INTRODUCTION

Down sampling of video is a editing process incorporated in order to reduce the size of a video. This is helps to reduce the storage size of videos. Down sampling is the reduction in pixel size resolution while keeping the same two-dimensional (2D) representation. It is typically used to reduce the storage space for transmission of video. A lot of methods have been used for video as well as image compression for last few decades. Balakrishnanet. al. compressed the images based on block truncation coding. In their research paper, they have first converted RGB color image into HSV planes.[1] Sahnoun proposed image compression method based on evidence theory and k-Nearest Neighbor algorithm. However main drawback of this compression technique was high information loss [2] To modify the quality of the output image, Fourier Transform and Huffman Coding was used for modification the previous technique. In both method, visual quality of the original image was poor.[3] Mamun used integer wavelet regression by increasing temporal correlation, which consequently improves the compression gain. [4] Sahnoun discussed an image compression technique using discrete wavelet transform for noise removal to compress images. [5] Susilohas proposed only hardware-based solutions in this lossless compression technique of X-Sat images. [6] Memane used Discrete Wavelet Transform in their image compression work and performance of different wavelets for image compression have been analyzed.[7] Hacihalilgluhas used conventional Discrete Cosine Transform system for lossless image compression. [8] A Patra proposed a research paper on satellite image compression based on sinusoidal grating. [9] He also worked on medical and normal digital images and networking too. [10-20]

In our proposed method, we have selected CCTV video of a particular area. Selected CCTV footage video is first divided into multiple images. Each image (frame) is down sampled by two inthe next process. As a result, size (both pixel resolution and storage) of each frame has been reduced. The series of reduces frames are transmitted to a long distance. At the receiving end, the reduced CCTV footage video frames is joined together to reconstruct the video. As a result, the size (pixel resolution) of the reconstructed CCTV footage video has been reduced. At the receiving end, the transmitted video is again divided into frames. Process of down sampling is displayed in the Figure 1.



1(a) 1(b)

Figure 1 (a –b) – Main Image ;Down sampled Image

Figure 1(a) represents a 5 x 5-pixel size of image whereas figure 1(b) represents a 3 x 3-pixel size of image which is received by down sampling by 2 of image 1(a). It is down sampled by 2. Red pixels of the above image are eliminated whereas green pixels are selected.

II. METHODOLOGY

In the methodology part, we have explained the entire process.

i) Division of video into frames

ii) Application of down sampling in each frame

iii) Transmission of down sampled frames

iv) Reconstruction of down sampled frames by up sampling

v) Addition of up sampled frames to reconstruct video

vi) Calculation of PSNR, correlation coefficient

Let us assume selected video is represented as $g_x\ (x,\ y)$. The video is divided into frames numbered $gf_1\ (x, y)$ $to\ gf_n\ (x, y)$ [where n is the frame no.]

Let the frames have been down sampled by 2. [Alternate pixels have been eliminated from row as well ascolumn]

$gf_i\ (x, y) \downarrow_2 = gdf_i\ (x, y)$ [where i = frame no.]

So, down sampled frames are represented as $gdf_1\ (x,\ y)$ $to\ gdf_n\ (x, y)$

Reconstructed down sampled video frames is represented as $vd_x\ (x, y)$

Pixel Size of all CCTV footage frames are calculated

III. RESULT

We have worked in MATLAB 2015 software, i5 processor, 16 GB RAM to perform this simulation operation.

Frames of the selected video is shown in the Figure 2. Pixel resolution of all frames is 1280 x 720.

Though we have worked with 60 frames, here only frames are displayed.

Figure 2 CCTV footage Video Frames

Figure 3 Downs sampled Video Frames

Down sampled frames of the selected video are shown in the Figure 3. Pixel resolution of all down sampled frames is 640 x 360.

Figure 4 Up sampled Video Frames

Size of Original CCTV footage frame = 560 kB

Size of Down sampled CCTV footage frame = 410 kB

Compression Ratio = 380/560 = 0.73

To maintain better quality of the extracted images, we have maintained low compression ratio.

PSNR and Correlation Coefficient calculation:

PSNR is calculated to measure the quality of the reconstructed images. Correlation coefficient is used to measure the similarity between two images. If it is close to 1, then it is decided that reconstructed image quality is very good. Both values are displayed in the table.

TABLE

Frame no	PSNR	Correlation Coefficient
1	29.4	0.962
2	30.1	0.945
3	29.6	0.91
4	28.9	0.88
5	29.3	0.898
6	30.2	0.912
7	29.8	0.954
8	30.1	0.922

CONCLUSION

In this communication, we have presented a simple method of video compression in spatial domain using down sampling. In this research work, down sampling is done only by 2. More down sampling is also possible but it is depending on quality of the input image. To maintain a good quality, we have not compressed the frames too much. More down sampling results more loss of information of the video. As a result, output video would be degraded and it would be blurred. PSNR value is almost 30 and correlation coefficient is close to one in each case which indicates the better quality of the output images. Our proposed technique is simple and moreover this technique has potential to compress any type of video also.

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