



Study on Video Compression and Reconstruction using Downsampling and Upsampling

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ABSTRACT :

Compression of video is an important application in the area of video processing as it is suitable for proper utilization of storage space and sharing over internet with minimum bandwidth utilization. This communication presents a new method for compressing video using downsampling and then reconstructs it using up sampling. Downsampling and upsampling are widely used in video display and compression. The selected video is first divided into multiple frames and then down sampling has been applied on each image. As a result, size of each frame has been reduced. In the next stage, the down sampled frames are added together to reconstruct the video. The compressed video is transmitted over a long distance. At the receiving end, the compressed video is again divided into frames. These frames have been up sampled again to maintain the same size. However, to get a reasonably good output, more down sampling should be avoided. . In this way, we can compress a large size video to a smaller one. This method is worked in spatial domain and a very fast process.

Keywords: Video, Compression, Down sampling, Up sampling

1. INTRODUCTION :

Downsampling of video is a process employed in order to reduce the resolution of input video. This is most helpful for reducing the storage size of videos. Downsampling is the reduction in spatial resolution while keeping the same two-dimensional (2D) representation. It is typically used to reduce the storage and/or transmission requirements of video. Upsampling is the reverse process of the former. In general, 0 is added as dummy pixel during this process. It consists of obtaining an output video of a higher resolution than that of the input. A lot of techniques have been used for video as well as image compression for last few decades. Balakrishnan et. al. compressed the images based on block truncation coding. In their research paper, they have first converted RGB image into HSV planes. [1] Sahnoun used image compression method based on evidence theory and k-Nearest Neighbor (KNN) algorithm.

However main drawback of this compression technique was too much information loss[2] To improve 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 used 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] Hacıhalilgluhas used conventional Discrete Cosine Transform system for lossless image compression. [8]APatra 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, selected video is first divided into multiple frames. Each frame is down sampled in the next process. As a result, size of each frame has been reduced. The video is reconstructed using this compressed images or frames. As a result, the size of the reconstructed video has been reduced. At the receiving end, the transmitted video is again divided into frames. The divided frames are upsampled for enhancement in zooming. Further using these upsampled frames, the video is again reconstructed. Image of down sampling and up sampling is displayed in the Figure 1.

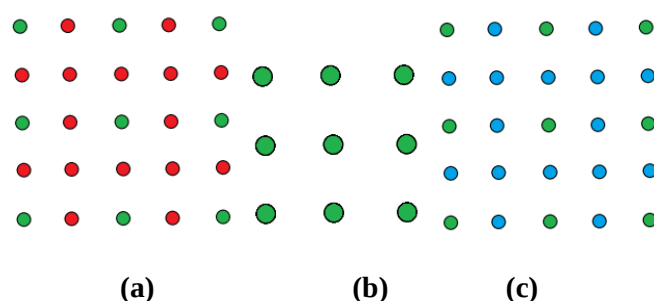


Figure 1 (a – c) – Main Image ; Down sampled Image ; Up sampled Image

2. METHODOLOGY :

Let us assume selected video is represented as $v_x(x, y)$. The video is divided into frames numbered $vf_1(x, y)$ to $vf_n(x, y)$ [where n is the frame no.]

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

$$vf_i(x, y) \downarrow_2 = vdf_i(x, y) \quad [\text{where } i = \text{frame no.}] \quad \text{-----} \quad (1)$$

So, down sampled frames are represented as $vdf_1(x, y)$ to $vdf_n(x, y)$

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

Video $vd_x(x, y)$ is further divided into frames $vdd_1(x, y)$ to $vdd_n(x, y)$

Let the frames have been up sampled by 2. [zero has been added in between two pixels ; row as well as columnwise]

$$vuf_i(x, y) \uparrow_2 = vuf_i(x, y) \quad [\text{where } i = \text{frame no.}] \quad \text{-----} \quad (2)$$

So, up sampled frames are represented as $vuf_1(x, y)$ to $vuf_n(x, y)$

Reconstructed up sampled video is represented as $vu_x(x, y)$

Size of all videos are calculated

3. RESULT :

We have worked in MATLAB 2014 software.

Frames of the selected video is shown in the Figure 2 .

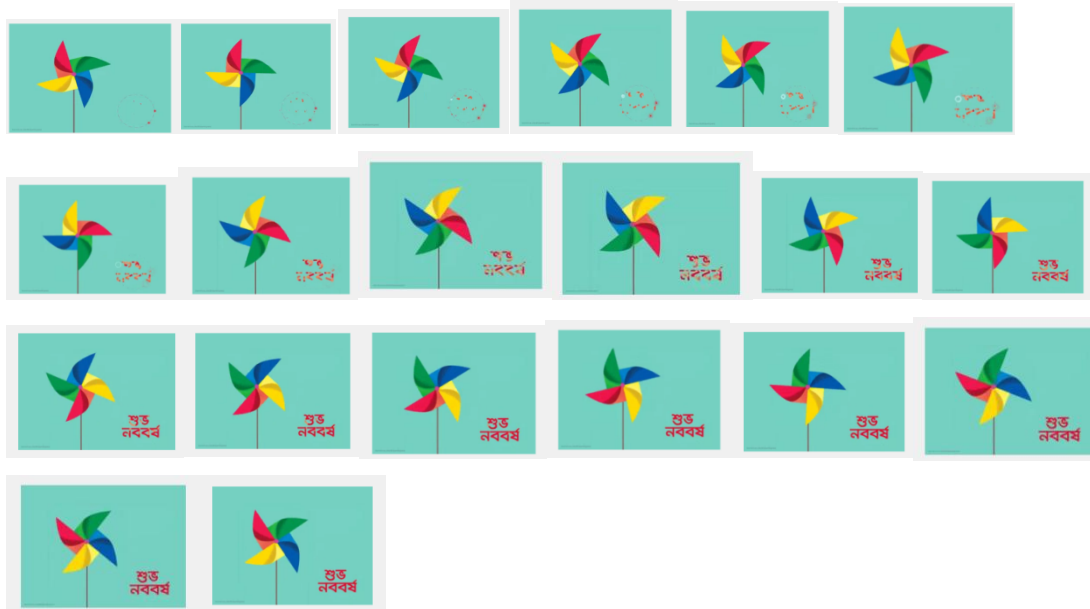


Figure 2



Down sampled frames of the selected video is shown in the Figure 3 .

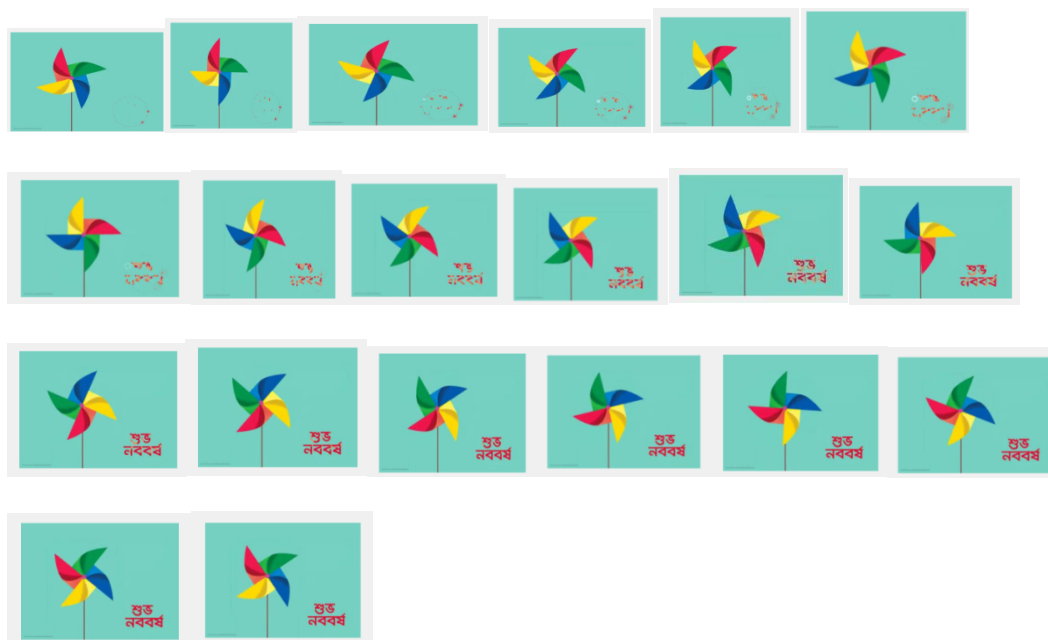


Figure 3

Up sampled frames are shown in Figure 4.

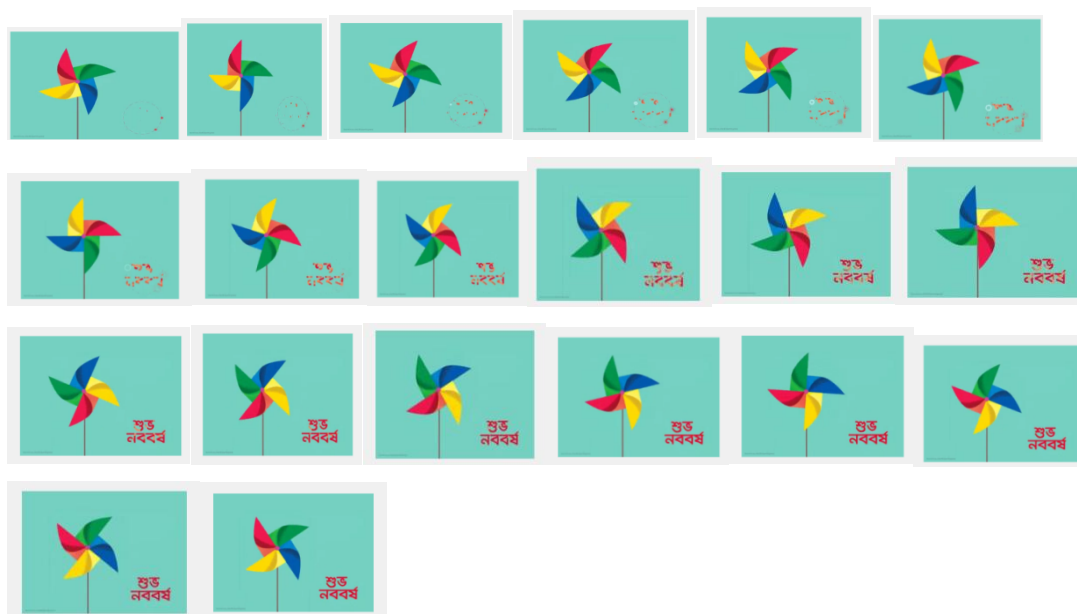


Figure 4



Main Video File Size = 62 Kb

Downsampled Video File Size = 44 Kb

Compression Ratio = $44/62 = 0.71$

4. CONCLUSION :

We have proposed a very simple method of video compression in spatial domain using down sampling and up sampling. In our research work, we have done down sampling only by 2. More down sampling is also possible depending on quality of the input image. As our selected video is not HD quality, therefore more down sampling results more information loss. As a result, video would be blurred. Our proposed technique is simple and moreover this technique has potential to compress HD video too.

Reference :

- [1] BBalakrishnan, S. H. Darsanal, J Mathews, M S. Nair ; “Aerial Image Compression Using Adaptive Block Truncation Coding Technique”; Journal of Indian Society of Remote Sensing, July 2018
- [2] K Sahnoun, N Benabadji ; “ Image Compression Technique Based On The Evidence Theory” ; Advanced Computing: An International Journal (ACIJ), Vol.5, No.1, January 2014
- [3] K Sahnoun, N Benabadji ; “ Image Compression Algorithm Based On The FFT” ; The International Journal of Multimedia & Its Applications (IJMA) Vol.6, No.1, February 2014
- [4] Md. Al Mamun and Md. Ali Hossain ; “ Image Compression Using Integer Wavelet Regression” ; International Conference on Electrical, Computer and Communication Engineering (ECCE) ; 2017
- [5] K Sahnoun, N Benabadji ; “ Image Compression Technique Using Noise Bit Removal and Discrete Wavelet Transform”; International Journal of Imaging and Robotics; Volume 15, Issue Number 3 , 2015
- [6] R.M. Susilo , T.R. Bretschneider; “On the realtime image compression of X-Sat” ; Fourth International Conference on Information, Communications and Signal Processing, 2003
- [7] T Memane and S D Ruikar ; “Selection Of Wavelet For Image Compression Using Picture Quality Measures”; International Conference on Communication and Signal Processing ; 2014
- [8] I. Hacihaliloglu and M. Kartal ; “DCT and Wavelet Based Image Compression in Images”; Recent Advances in Space Technologies, 2003. RAST '03.
- [9] A Patra, D Chakraborty, A Saha, K Bhattacharya; “ Compression of Satellite Images using Sinusoidal Amplitude Grating”; IJEE; Vol – 11, Issue – 1, Jan- Jun 2019



- [10] K Sneha, N Roy, A Patra, ArijitSaha ; “Watermarking in Medical Images Using Alpha Blending” ; IJSART 3 (10), 384-387
- [11] A Patra, D Chakraborty, A Saha, K Bhattacharya ; “Compression of Satellite Images using Sinusoidal Amplitude Grating” ; IJEE 11 (1), 664-667.
- [12] A Patra, A Saha, A K Chakraborty ; “A Simple Approach to Watermarking of Multiple Grayscale Images using Alpha Blending” ; IEEE Xplore; EDCT ; 2018
- [13] A Patra, A Saha, K Bhattacharya ; “Multiplexing and encryption of images using phase grating and random phase mask” ; Optical Engineering 59 (3), 2020
- [14] A Patra, S Bandyopadhyay, D Chakraborty, A Saha ; “A Novel Approach to Compression of Satellite Images Using Butterworth Filtering” ; Information, Photonics and Communication, 179-183 ; LNSS, Vol 79, 2020
- [15] A Patra, K Anubala, M Ghosh,; “Additive Watermarking in Filtered Satellite Images Using Alpha Blending” ; ICNNEE 2019 ;doi : [10.2139/ssrn.3511654](https://doi.org/10.2139/ssrn.3511654)
- [16] S Chakraborty, A Patra ; “Development of UAV Based Glacial Lake Outburst Monitoring System” ; IGARSS 2019; 978-1-5386-9154-0/19, 9372-9375
- [17] A Patra, A Saha, AK Chakraborty, K Bhattacharya ; “A New Approach to Invisible Watermarking of Color Images using Alpha Blending” ;2018 ; doi[10.1109/EDCT.2018.8405083](https://doi.org/10.1109/EDCT.2018.8405083)
- [18] AnirbanPatra; “A Study on Security System of Vehicular AD HOC Network” ; International Journal of Electrical and Electronics Engineers ; Volume – 8 ; Issue – 1; Page no.- 920 – 923
- [19]AnirbanPatra ; “Developing a Low Cost Microcontroller Based Data Acquisition System to Monitor Civil Structure”; International Journal of Advanced Technology in Engineering and Science ; Volume – 2; Issue – 1 ;Pp30 – 34, 2014
- [20] Dr. ArijitSahaAnirbanPatra ; “RFID Based Automated Low Cost Data Acquisition System for Public Transport”; International Journal of Advance Research In Science And Engineering ;Volume – 4 ; Issue -2; Pages- 240-244