

Effective Storage and Transmission of Satellite and Medical Images using Optical Information Processing

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Abstract: Image Compression is a completely critical device for today's tremendous escalating generation. As it paperwork the premise for garage compatibility and cost-efficiency. Image compression, i.e., discount within the byte length of pics immensely facilitates in clean and higher evaluation of items just like the humongous moon. In the far flung sensing and scientific industry, photo evaluation has a main function in element fine evaluation and different analytical purposes. In general, those pics eat plenty of area for this reason it's far a difficult assignment to well keep them. Researchers have used plenty of photo compression algorithms for lots years. However, a main disadvantage of them is that, because of the excessive compression ratio, an excessive amount of statistics loss is there. Therefore, it isn't appropriate for an in-depth evaluation of far flung sensing and scientific properties. In this communication, we have proposed a image compression technique using sinusoidal amplitude grating. For better quality of the images, we have maintained a low compression ratio. PSNR value of the output images proved the better-quality indication of our method.

INTRODUCTION:

Image Compression is instead turning into very essential in our everyday lives. Compression of photos additionally aids in green sharing ensuing in notable clean information transmission. For the previous couple of decades, researchers have defined many techniques for photograph compression. The use of SCIKIT- photograph in photograph processing offers excessive first-rate well-documented and clean-to-use implementations of not unusual place photograph processing algorithms. The library enables hands-on enjoy via way of means of adjusting parameters and enhancing code. Though big overhead for numerical loops and the issue in effectively the usage of codes of different languages like C and Fortran for this library caused numerous different explorations.[1]

For the previous couple of decades, quite a few strategies had been proposed through researchers for the compression of various kinds of images. All those techniques are labeled as optical and non-optical techniques. In the optical process, these days sinusoidal grating (each sinusoidal and phase) is used for compression of far off sensing and scientific images. [2,3] This technique gives a higher output and garage efficiency. In a non-optical system, researchers Integer shape of Wavelet Regression to compress satellite tv for pc images. Here, a higher compression ratio is carried out through change of the temporal correlation value. [4] Image compression is executed through noise bit elimination the usage of discrete wavelet transforms. [5] Evidence concept at the side of the k-Nearest Neighbor (KNN) set of rules is likewise used for photo compression. [6] To keep away from facts loss, a few researchers have proposed a photo compression set of rules primarily based totally on Fourier Transform and Huffman Coding. [7] Discrete Wavelet Transform (DWT) is a not unusual place device this is used for photo compression. In some recent work, researchers have worked on image compression in pharmaceutical images and satellite images using MATLAB and Python platform. [8 - 12]

Sinusoidal grating is used for multiplexing, encryption in addition to compression of virtual pix for the previous couple of years. In those works, distinct form of decided on virtual pix is modulated the usage of segment and amplitude grating to generate spectra of the pix. [13-15] Out of more than one generated spectrum, handiest 3 of them are seen. Among those 3 seen spectra, middle one is the Fourier Transform of the chosen photo while others are the sidebands of the pix. The sidebands are not anything however a reproduction of every other. Inverse Fourier Transform is implemented to extract the records from someone of the sideband spectra.

In our proposed method, image is first modulated via way of means of sinusoidal amplitude grating with excessive spatial frequency having constant orientation alongside x-axis, i.e, $\theta = 0^\circ$. Due to modulation alongside x- axis, 3 brilliant spots are generated horizontally at the spectrum aircraft at specific spatial positions. The intense spots are genuinely because

of the 2 facet bands produced. From the spectrum aircraft, filtering any person spot from the spectrum, the unique photograph is extracted via way of means of local inverse Fourier transform. We have decided on the higher facet band for filtering purpose. PSNR and correlation coefficients are used to check the quality of the extracted images.

METHODOLOGY:

Let us assume that selected images are represented by $f_1(x, y)$, $f_2(x, y)$, $f_3(x, y)$ and $f_4(x, y)$ respectively. The selected images $f_1(x, y)$ to $f_4(x, y)$ is modulated by sinusoidal amplitude grating whose equation is given by

$$G_1(x) = \frac{1}{2}(1 + \cos 2\pi u_0 x) \quad (1)$$

Where $u_0 = 1200$

This equation can be represented as

$$s_1(x, y) = \frac{1}{2}f_1(x, y) \cdot (1 + \cos 2\pi u_0 x) \quad (2)$$

Its Fourier Transform is given by

$$S_1(u, v) = \frac{1}{2}[F_1(u, v)] + \frac{1}{4}[F_1(u - u_0, v)] + \frac{1}{4}[F_1(u + u_0, v)] \quad (3)$$

Equation (3) represents that, three spectra is generated due to modulation.

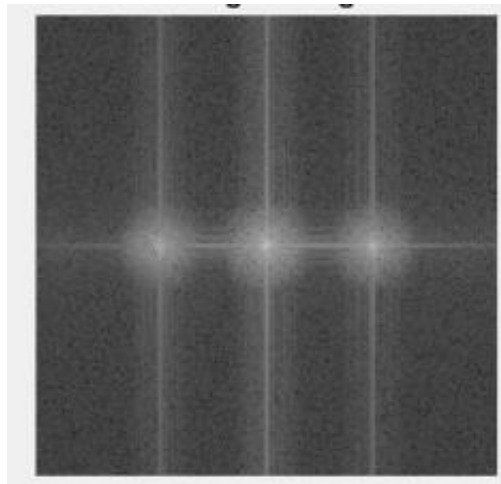
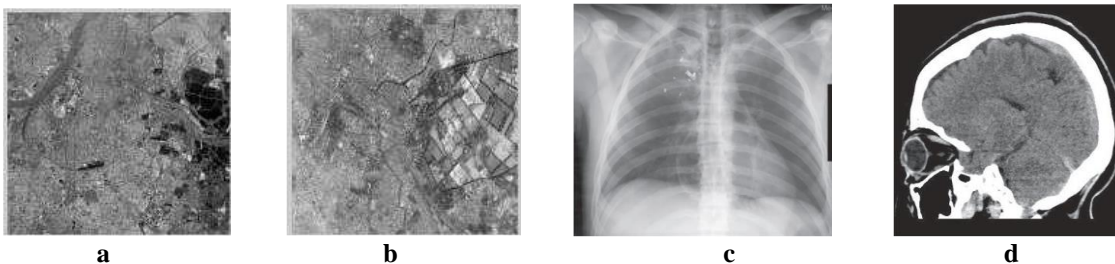


Figure 1 – Generated Spectra

Out of three spectra, we have selected only one.

RESULT AND DISCUSSION:

Pixel decision length of the chosen pictures, which might be displayed withinside the Figure 2 (a-d) are 512 x 512. Entire work is accomplished in MATLAB 2014 simulation software program the use of Intel core i5 processor and sixteen GB RAM. Retrieved pictures are proven withinside the Figure 3 (a- d).



Four Selected Images (Courtesy: MedPix: ISRO Kolkata)

Figure 2

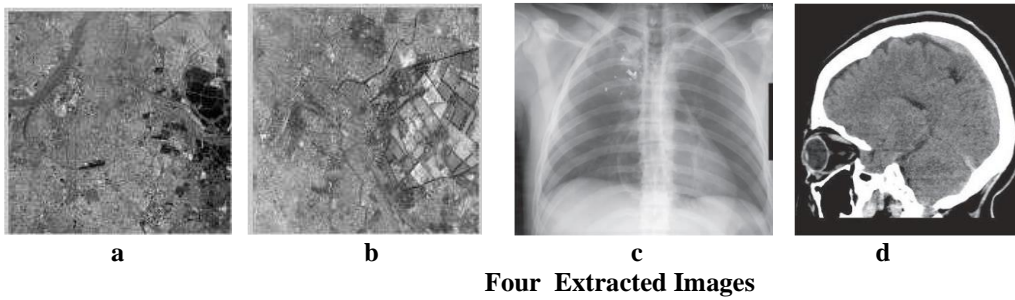


Figure 3

**Table 1
Compression Ratio and PSNR**

Image	Original Image Size (kB)	Compression Ratio (Compressed Image/ Original Image)	PSNR
$f_1(x, y)$	236	0.89	33.4
$f_2(x, y)$	242	0.9	32.8
$f_3(x, y)$	240	0.89	32.5
$f_4(x, y)$	242	0.87	32.1

ADVANTAGES OF THE SYSTEM:

In a few preceding methods, compression is utilized in low-decision snap shots while our device is relevant for high-decision snap shots. Moreover, the fine of the output snap shots is degraded after compression while, in our device, fine isn't always degraded.

CONCLUSION:

Table 1 represents compression ration as well as PSNR values of the selected images. In this work, satellite and medical images are compressed using amplitude grating. PSNR value indicates the good quality of the extracted images.

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