PERFORMANCE ANALYSIS OF DISCRETE ANAMORPHIC STRETCH TRANSFORM IN IMAGE COMPRESSION SYSTEM

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Abstract - *To compact with the exponential increase of digital data, new compression technologies are needed for more efficient information. This paper introduces a physics-based transform that enables image compression by increasing the spatial coherency.In this paper, performance analysis of discrete anamorphic stretch transform in image compression system is presented and the analysis is done for parameters. The proposed method also presents the Stretched Modulation Distribution with a new density function in image compression. Experimental results show encrytion and decryption using the proposed method improved the performance of JPEG 2000 format.*

Key Words: **Anamorphic transform, spatial coherency, image compression, physics based data compression, warped stretch transform,encryption, decryption.**

1.INTRODUCTION

Image compression leading to efficient representation of information for dealing with the storage and transmission of high resolution images that dominate. JPEG [1] and JPEG 2000 [2] are the most commonly used methods for image compression. To reduce the data size, JPEG and JPEG 2000 use frequency decomposition via the discrete cosine transform (DCT) [1] or wavelet transform [2] as well as the frequency dependence of the human psychovisual perception. DAST is a physics-inspired transformation that emulates diffraction of the image through a physical medium with specific nonlinear dispersive property. By performing space-bandwidth compression, it reduces the data size required to represent DAST is a nonlinear transform, both in terms of amplitude and in terms of the phase operation the image for a given image quality.DAST can use both the JPEG and JPEG 2000 formats to reduce its data size and also spatial bandwidth.

1.1 Need for image compression:

The need for image compression becomes apparent when number of bits per image are computed resulting from typical sampling rates and quantization methods.For example, the amount of storage required for given images is (i) a low resolution, TV quality, color video image which has 512 x 512 pixels/color,8 bits/pixel, and 3 colors approximately consists of 6 x 10^6 bits;(ii) a 24 x 36 mm negative photograph scanned at 12 x 10^{-6}mm:3000 x 2000 pixels/color, 8 bits/pixel, and 3 colors nearly contains 144 x 10^6 bits; (3) a 14 x 17 inch radiograph scanned at 70 x 10^{-6}mm: 5000 x 6000 pixels, 12 bits/pixel nearly contains 360 x 10^6bits.Thus storage of even a few images could cause a problem. As another example of the need for image compression ,consider the transmission of low resolution 512 x 512 x 8 bits/pixel x 3-color video image over telephone lines. Using a 96000 bauds(bits/sec) modem, the transmission would take approximately 11 minutes for just a single image, which is unacceptable for most applications.

2. REVIEW OF PREVIOUS METHOD:DISCRETE ANAMORPHIC STRETCH TRANSFORM

To compress the image using DAST, it is first passed through the DAST and then is uniformly re-sampled (down-sampled) at a rate below the Nyquist rate of original image. To recover the original image form the compressed one, the compressed image is first up-sampled and then inverse DAST is applied to recover the original image.DAST warps the image such that the intensity bandwidth is reduced without proportional increase the image spatial size.

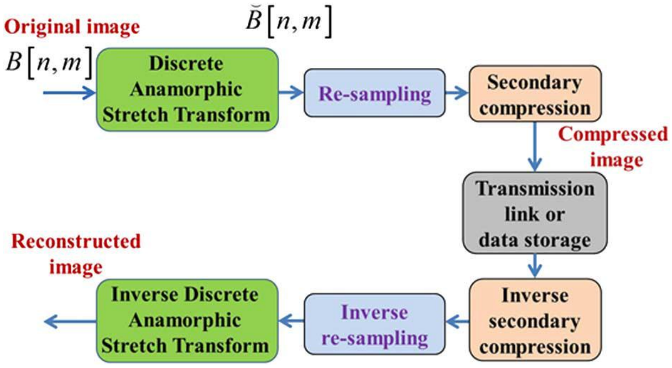

Fig 1:DAST Block Diagram

DAST is defined as

$$\breve{B}[n,m]=\left|\sum_{k_1,k_2=-\infty}^{\infty} K[n-k_1,m-k_2].B[k_1,k_2]\right|^N$$

where is || the absolute operator. For DAST operation, the original image is convolved with DAST Kernel , and then the N-th power magnitude of the result is computed.The Kernel is described by a nonlinear phase operation,To compress the image, the nonlinear phase profile should be chosen such that DAST applies a spatial warp to the image with a particular profile. To describe the applied warp, we define the DAST Local Frequency (LF) profile as the 2D spatial gradient (derivative) of the DAST Kernel phase function. LF is the equivalent of time domain instantaneous frequency but in 2D spatial domain.

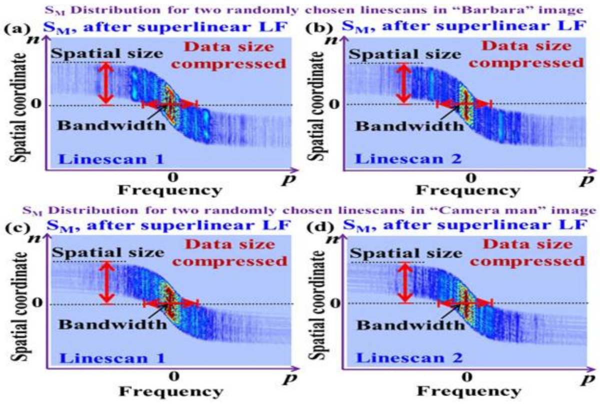

Fig2 :streched modulation distribution

3.PROPOSED METHOD

Different steps for implementation of DAST for application to image compression are shown in Fig. 1. To encrypt and compress the image using our method, it is first passed through the DAST and then encryption is done . after the encryption, the encrypted image is comprssed.

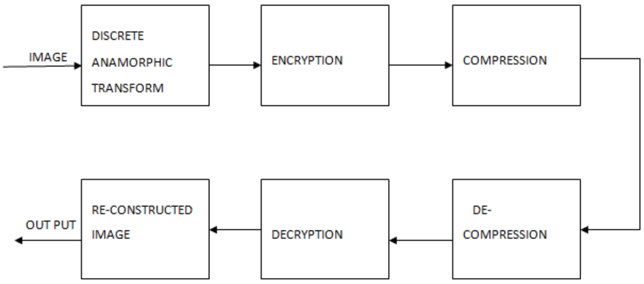

Fig3:block diagram of proposed method.

To recover the original image from the compressed one, the compressed image is decompressed and the decompressed image is decrypted .and then inverse DAST is applied to recover the original image. DAST warps the image such that the intensity bandwidth is reduced without proportional increase the image spatial size. This increases the spatial coherence and reduces the amount of data needed to represent the image.

An example of the phase function is shown in Fig. 3. The slope of the LF profile at the origin (related to and) determines the amount of intensity bandwidth compression. After the proper choice of and , the resulting spatial image size is related to the warping strength (related to and). After the anamorphic transform with proper phase profile the brightness bandwidth is compressed (the coherence increased). The transformed image can now be re-sampled at a lower rate without losing information given by the amount of brightness bandwidth compression after DAST. The compressed image including the re-sampled transformed image and its filtered one using the discriminator kernel (described below) along with the data , and re-sampling factor is sent to the transmission channel or storage device. We note that only five parameters (real numbers) are required for reconstruction, resulting in negligible data overhead. The algorithm can also be combined with vector quantization [19] and entropy encoding to further reduce the image data size. Also, the re-sampled image can be compressed further by a secondary compression, e.g. JPEG or JPEG 2000. For application to color images the DAST image compression is applied to each of the constituent color components.

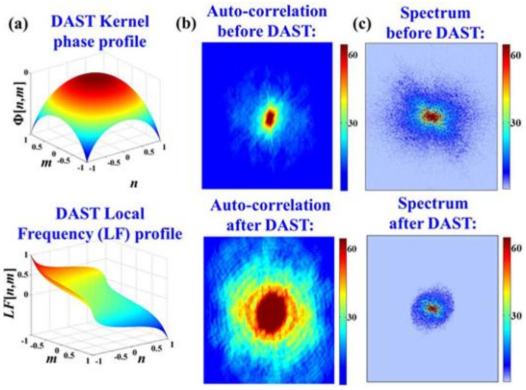

Fig. 4:Analysis of Discrete Anamorphic Stretch Transform (DAST) effect onLena image.

4.FLOWCHART FOR PROPOSED METHOD

Flowchart shows that how DAST with encryption and decryption can change the values of parameters Mean square error, peak to signal ratio, normalized cross correlation, average difference, structural content, maximum difference, normalized absolute error.

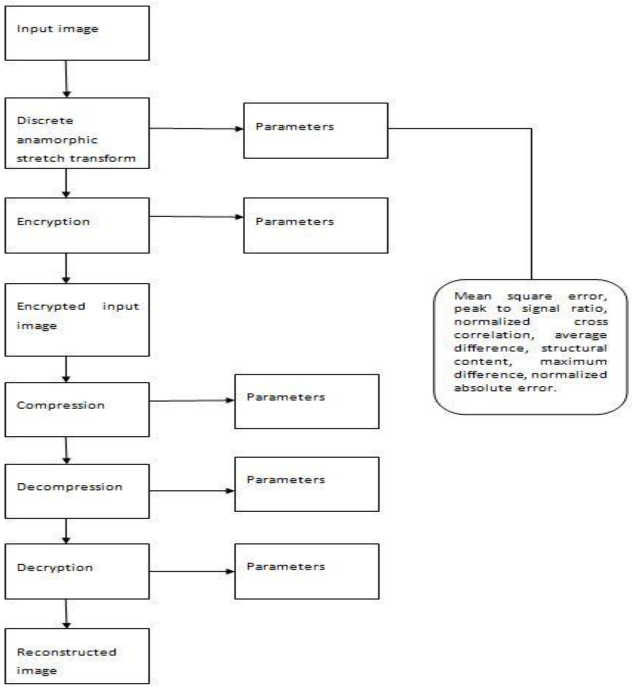

Fig 5:flowchart of propsed model

5.EXPERIMENTAL RESULTS

In this section, we study an example to show the effect of DAST on images. We also examine the proposed image compression method and compare it to JPEG 2000 image compression format. The phase and Local Frequency (LF) profiles of the DAST Kernel for the examples presented are shown in Fig. 6(a).

Fig6(a):original image

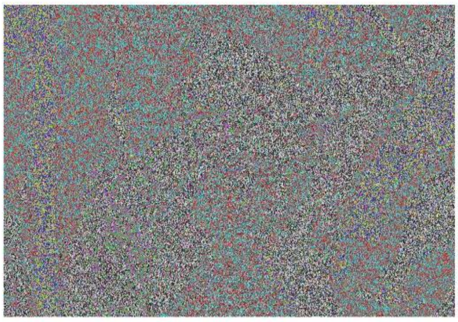

Fig6(b):encrypted image

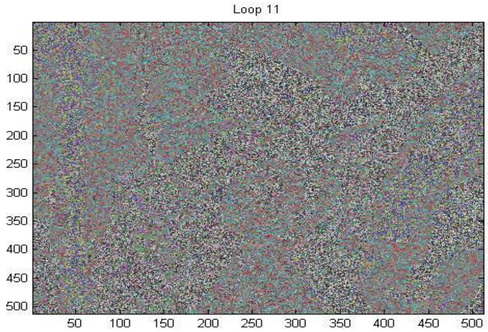

Fig6(c):compression after encryption

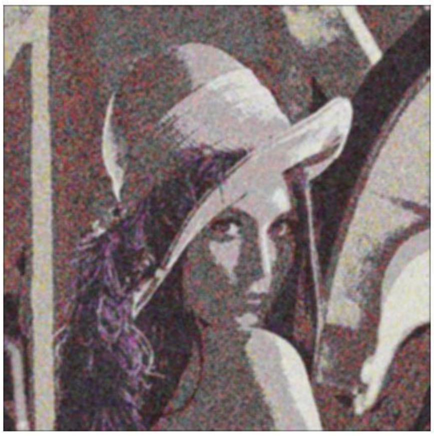

Fig6(d): decrypted image

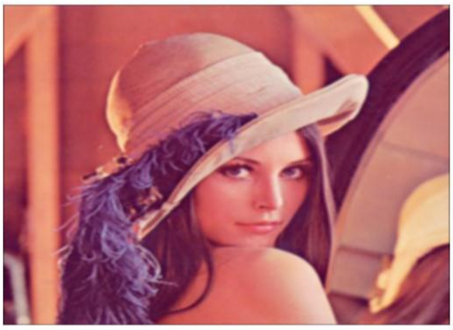

Fig6(e): reconstructed image

The parameters in these plots are normalized to the dimensions of the image in each case. We first study the effect of DAST on gray-scale Lena image512X512 with pixels with 8 bits/pixel accuracy in TIF format.To understand how the image data is compressed, in Fig. 6(b) we compare the auto-correlation of the original image with the transformed image. As it can be seen, the autocorrelation is broadened leading to increased spatial coherence andreduced spatial intensity bandwidth (Fig. 6(c)). This is done without an image spatial size increase, i.e. the original and transformed images have the same 512X512 pixels with 8 bits/pixel accuracy. The reduced spatial bandwidth (increased coherence) allows one to re-sample the transformed image at the lower rate,to achieve compression. However, it should be noted that compression is not merely obtained from the re-sampling, but ratherfrom the increase in correlation caused by the reshaping.

6. Analysis Of Different Parameters In DAST

Table 1:analysis of parameters

Parameters	Encryption	Compressed	Decompressed	Decryption
Mean square error	4.1720	6.9038	5.3782	1.6941
Peak signal to noise ratio	18.4312	16.4333	17.4346	21.7084
Normalized cross correlation	0.7370	0.6229	0.6864	0.8273
Average difference	31.9798	39.6369	32.4349	19.4540
Structural content	2.3263	2.6746	2.4293	2.2610
Maximum difference	184	203	208	172
Normalized absolute error	0.4408	0.5183	0.4891	0.3231

7. CONCLUSIONS

In this project, it is shown that how DAST pre-encryption and compression can improve the performance of JPEG for high compression factor and high PSNR. And also shown how image compression is done using DAST pre- encryption and compression followed by JPEG.The DAST method can be to extend to digital compression for Big Data as Big Data can present big problems, especially in fields where the events being studied happen at rates that are too fast to be sampled and converted into digital data in real time.

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