Lossless Color Image Compression Basedon Folding Technique

ضغط الصورة الملونة بدون فقدان البيانات اعتمادا على تقنية الطي

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Abstract

Image compression assumes a fundamental part in picture handling field particularly when we need to send the compression through a system. While imaging methods produce restrictive measures of information and preparing expansive information is computationally costly, information compression is crucial instrument for capacity and correspondence purposes. Numerous present compression strategies give a high pressure rates however with impressive loss of image quality. This paper displays a methodology for Image compression in spatial space utilizing an idea of data folding. data folding procedure has been connected on shading pictures with various size. A column folding is connected on the RGB image grid took after by a column folding iteratively till the image size diminishes to predefined esteem as indicated by the levels of folding and unfolding cycle) recreation the first image) . While Data unfolding process connected in adores mode. The proposed Method is tried on a few standard test image and found that the nature of reproduced image and compression proportion are improved

الخلاصة

ضغط الصور يلعب دورا حيويا في مجال معالجة الصور خصوصا عندما نريد إرسال صورة عن طريق الشبكة.حيث ان تقنيات التصوير تنتج كميات باهظة للبيانات ومعالجة البيانات الكبيرة مكلفة حسابيا، ضغط البيانات هو أداة أساسية لأغراض التخزين والاتصالات. العديد من أساليب الضغط الحالية توفر معدلات ضغط عالية جدا لكن مع خسائر كبيرة في جودة الصورة. تقدم هذه الورقة طريقة لضغط الصور في المجال المكاني باستخدام مفهوم طي البيانات. وقد تم تطبيق تقنية البيانات القابلة للطي على الصور الملونة مع أحجام مختلفة. تم تطبيق طي العمود على مصفوفة صورة **RGB** متبوعا بطي الصف على التوالي بشكل متكرر حتى حجم الصورة يقل عن القيمة المحددة مسبقا وفقا لمستويات الطي وتكرارات فك الطي (أعادة بناء الصورة الأصلية) . بينما عملية فك الطي للبيانات طبقت بصورة عكسية . تم اختبار الطريقة المقترحة على عدة صور قياسية للاختبار و وجددنا أن نوعية الصورة المعاد بناؤها ونسبة الضغط محسنة..

1. Introduction

Image compression has an essential part in the area of transmission and capacity. It think about as a key in data innovation. The diminishment of redundancies in information representation keeping in mind the end goal to reduction information stockpiling necessity is characterized as information pressure which accomplishes a given need Information hypothesis is portrayed as the examination of powerful coding[**1].**Data compression is predicting so as to make a record littler the most continuous bytes and putting away them in less space**[2].**it might be seen as a branch of Information hypothesis in which the fundamental target is to minimize the measure of data to be transmitted. Information compression has a basic part in the scope of transmission and putting away. It expect a key part in information development. The decreasing of redundancies in data representation in order to decay data putting away essential is described as information compression**[3].** It used less utilization of advantages, for instance, memory space or transmission limit. Information compression is named lossless and lossy compression. Lossless compression is used for substance and lossy compression for image**[4].**The rule of Image compression calculations is to change paired digits into another that contains the same information yet with less digits, so the record can be as meager as would be reasonable, in this way it imperative in image improvement **[5].** Any lossless coding structure on a very basic level includes three stages. Change, information to-image mapping and lossless image coding. Change changes over the picture data into a shape that can be compacted more capably by further stages. Lossless image doling so as to code delivers a parallel piece stream out twofold code words to the information image **[8].** We suggest an optimal technique to compression the image by using a concept of data folding.

2. Related Works

In [7] the proposed technique introduces a methodology for lossless Image compression in spatial area for constant tone images utilizing a novel idea of image folding followed by Huffman encoding. The proposed technique utilizes the property of contiguous neighbor excess for expectation. The closeness between this strategy and our proposition technique in relative execution compression.

In [6] the proposed strategy introduces a methodology for lossless and lossy Image compression of image folding followed by Huffman and arithmetic encoding. The outcomes demonstrates that lossless compression is accomplished just at the locale of hobby and it is for the most part suitable for medicinal images.

Methodology and Proposed Method

As mentioned in a previously, our work is based on data folding algorithm followed by unfolding technique in order to extract the original image .according to following steps we implement data folding :

1. Input a color image.
2. In this step we apply column folding followed by row folding *without convert the image into gray scale.*
3. Save the compressed image in file and compute the compression ratio.
4. Apply data unfolding algorithm on the resultant image to obtain the reconstructed image.

In the proposed technique the compression thought depends on spatial determination for lossless Image compression called information folding[6][7]. The thought is to subtract even pixels from odd pixels and store the distinction information in a support called difference matrix. In this Image compression strategy first column folding is applied followed by the row folding in repeating method until the image size become less than previous value. The pixel redundancies are revamped in a tile organization .The objective is to lessen image measure iteratively regarding measurements - lines or sections by 2. At the decoder, information developing is connected which is like information folding[6].

4. Encoder

4.1 Column and Row Folding

In this work, we are used squared image that has a total equaled size as shown in Fig.1. We are applying the folding algorithm on the original color image. Data folding is an iterative procedure, column folding followed by row folding, that is iterate at each picture level. Original image (input image) must be square.

Define a buffer „F (also called image matrix) whose size is equivalent to that of unique image. Unique image is considered as data image for the primary emphasis. At first, the support „F‟ is empty. In column folding, odd segments of the data picture are subtracted from its privilege nearby even segments and put away in first half segments of the unfilled part of the cradle „F‟. Odd segments are put away in an alternate cradle Odd which is taken as input image to row folding. Following equations depicts column folding technique.**[7].**

$$F(X+i, Y+j) = RGB(i, 2j-1) – RGB (i, 2j)$$

$$Odd (i, j) = RGB(i, 2j-1)$$

$$i \in [1, W] \text{ and } j \in [1, W/2]$$

Where, RGB = input image. W = width of input image, Odd = odd row or column of input image, X = starting x-coordinate of empty portion of matrix F, Y = starting y-coordinate of empty portion F.

Row folding is like column folding. In row folding, odd lines are subtracted from its contiguous even lines and put away in first half lines of of empty portion of F, Odd lines are put away in an alternate matrix Odd which is taken as an input to next step. Watch that, input image to column folding is always square whereas it is rectangular to row folding**[7].**The flow charts of data folding as shown in Fig.2, Fig3and Fig4

Fig.1 original image

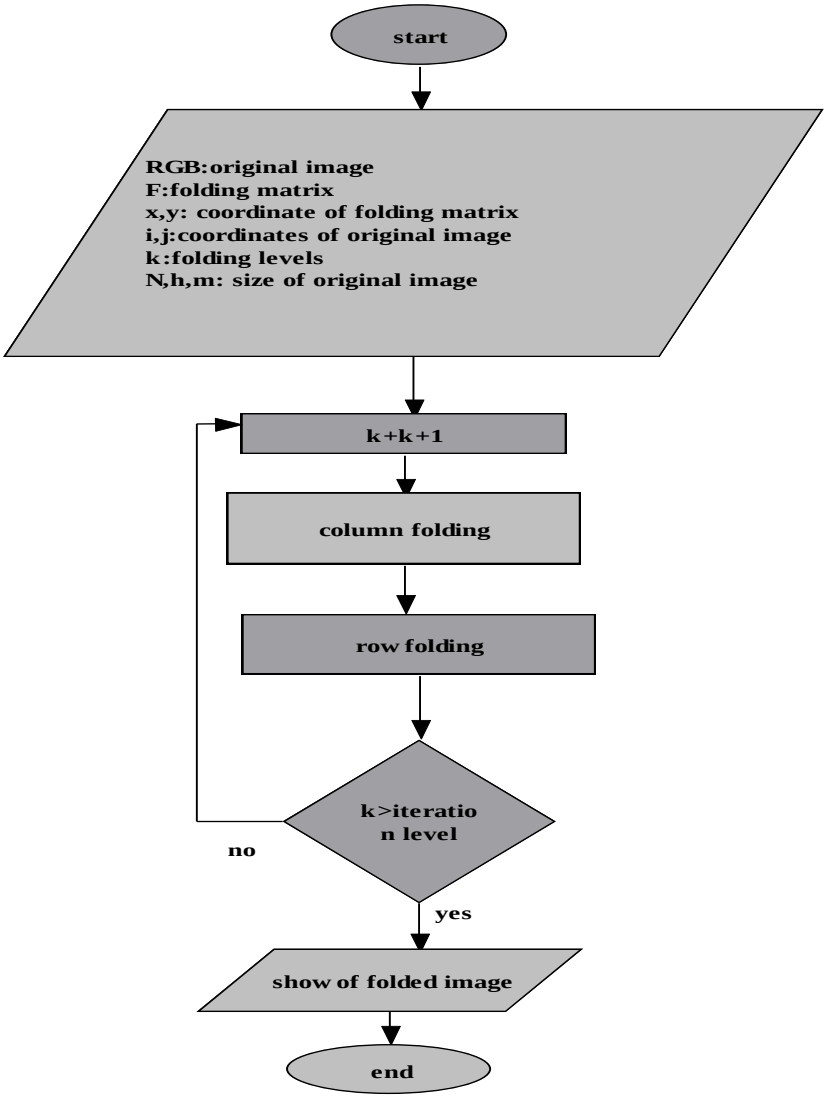


Fig.2 flowchart of folding algorithm

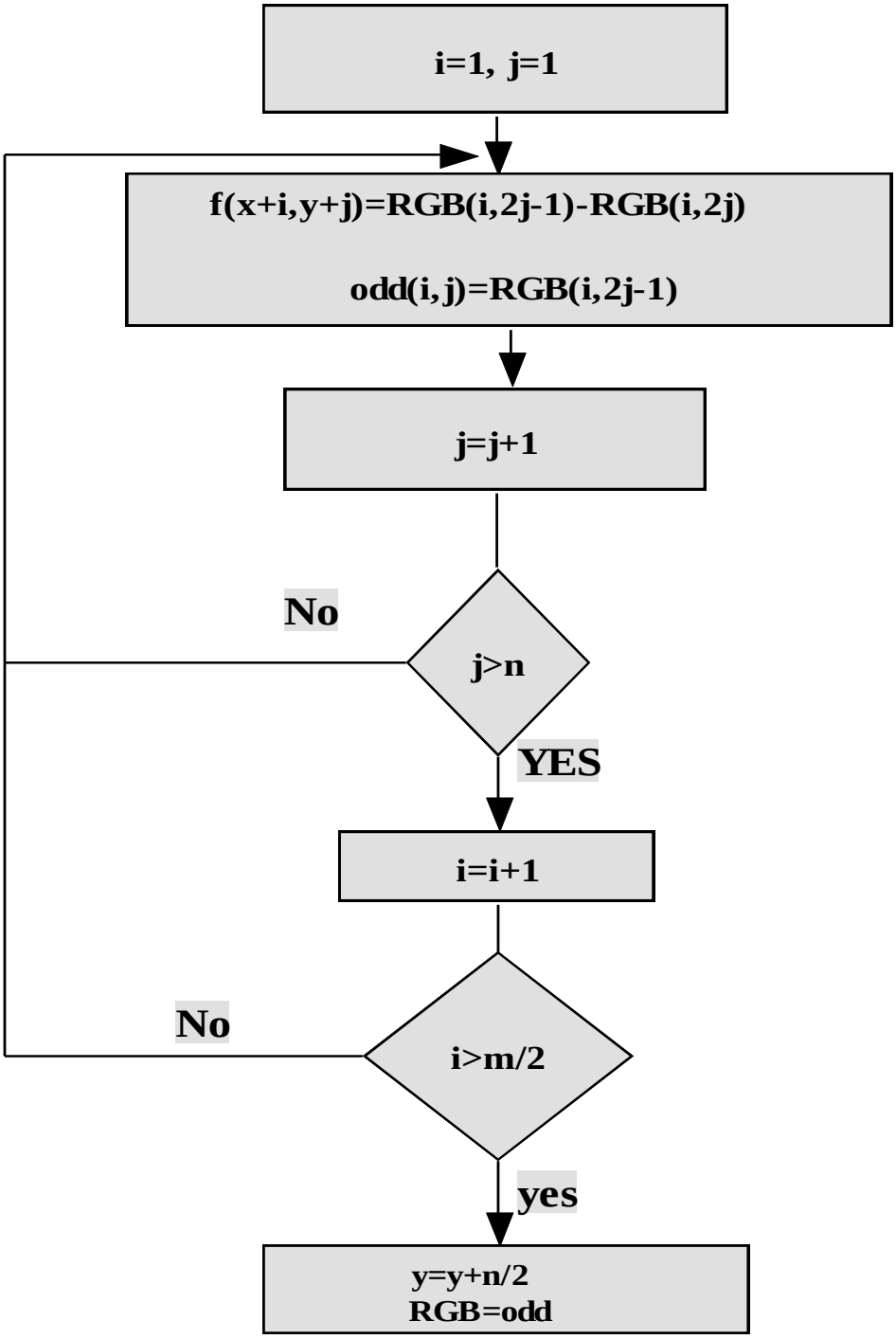


Fig 3.flowchart of Column Folding

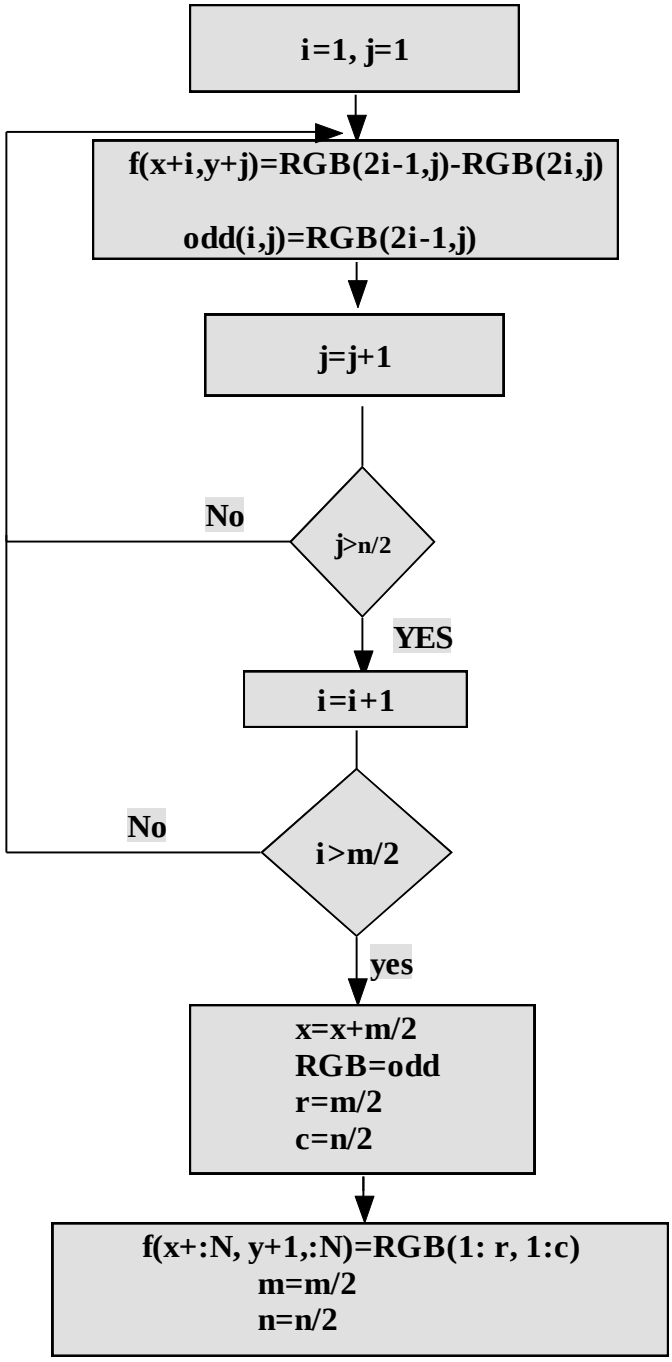


Fig .4 flowchart of Row Folding

4.2 Image Unfolding Algorithm

The flowchart of unfolding algorithm as shown in Fig.5

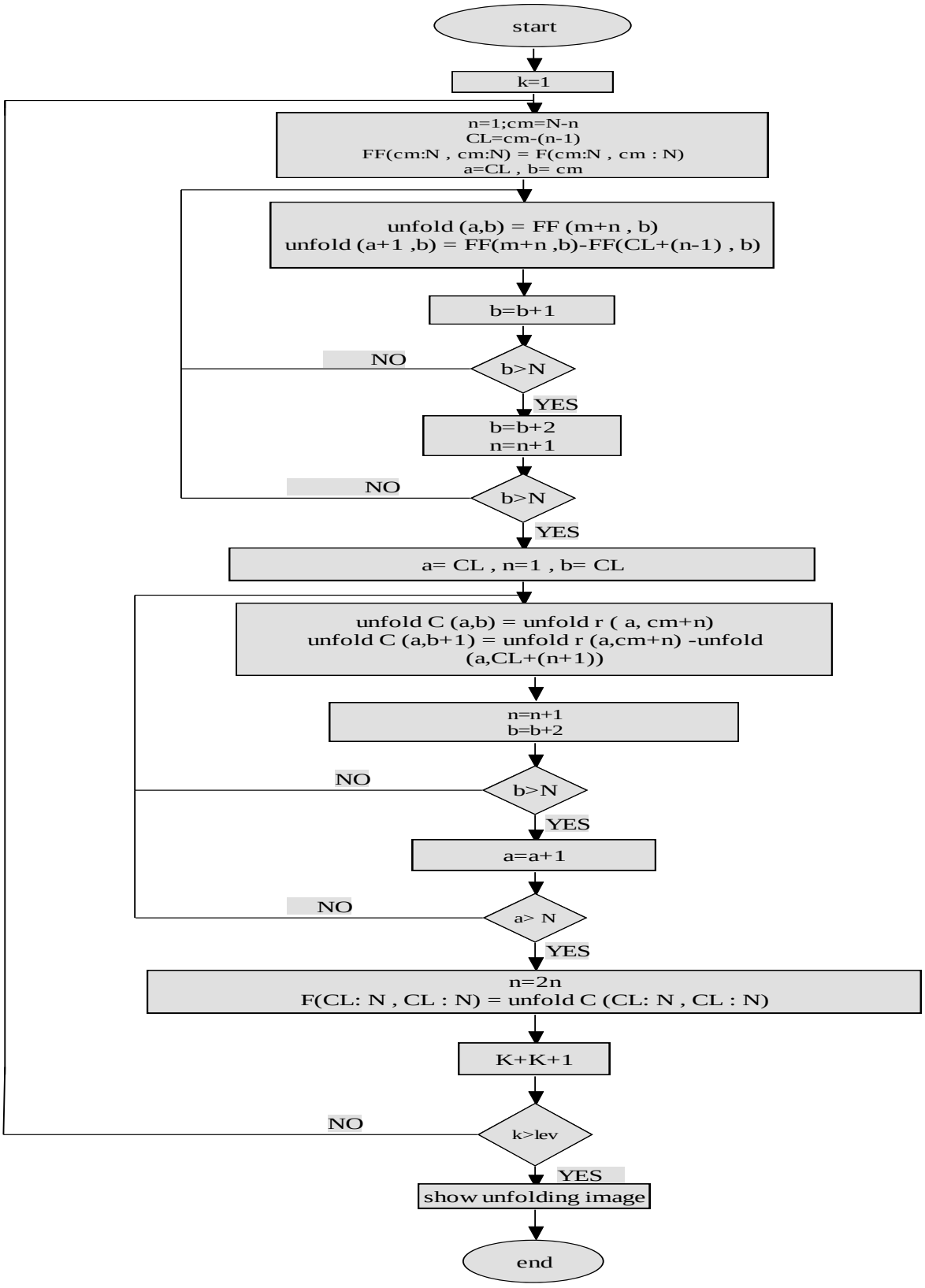


Fig.5 Flowchart of Row Unfolding Algorithm

5. Results

The proposed compression method is tested on several standard test images such as lena.png, mandril.tif, coloredchips.tif, with diverse sizes such as 256 X 256, 512 X 512, 1024 X 1024, 2048 X 2048. For each image we make it as a square image matrix by changed its spatial coordinates then the number of bits required to store the digitized input image is calculated depended on its spatial resolution, so for a typical 512 X 512 image with 256 levels we need 2,097,152 bits or 262,144 bytes. Then we apply column folding followed by row folding for different levels. Figure (6) depicted the results of applying image folding algorithm for 4 levels

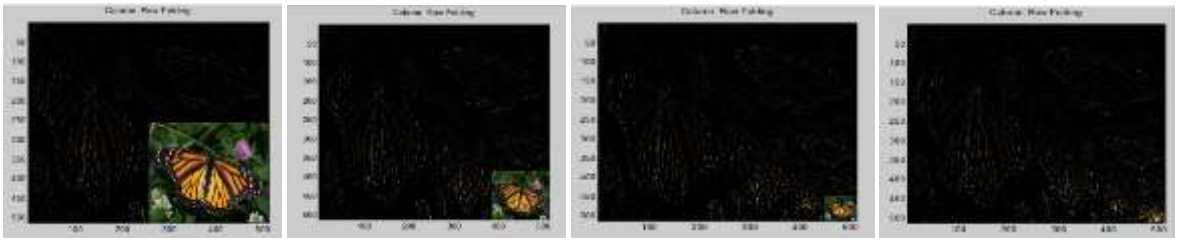
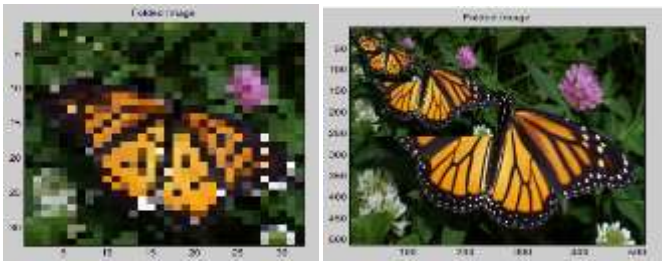


Fig.6 Image Folding Algorithm for 4 Levels

While figure (7) shows the final folded image for four levels and without buffer matrix



(a) (b)

Fig.7 (a,b) final folded image

In data unfolding of figure (8) showed only row unfolding scheme for four levels without any loss of image quality.

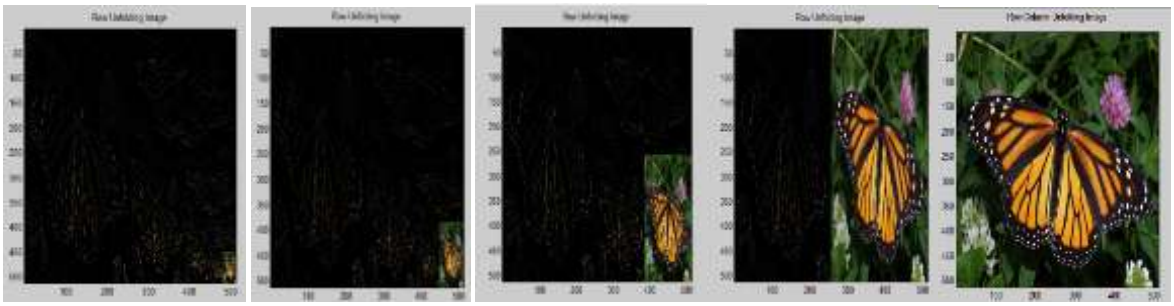


Fig.8 Row Unfolding Image with decompressed image

From the table (1) we notice the variety of file sizes effect the amount of data to be compressed. Also effect on the compression Ratio. and in decompressed part the file

size has changed also. Because in compressed part a lot of information added, header data.

Table(1) show the compression ratio for different size of tested images

Image name	Image size	Level (K)	Compression ratio
Union	1024X1024	Level 2	6.1133
Flower	512X512	Level 3	9.8600
Purble	256X256	Level 3	17.9427
Peppers	1024X1024	Level 2	7.0562
Peppers	1024X1024	Level 3	17.6745
Peppers	1024X1024	Level 4	40.5250
Peppers	1024X1024	Level 5	71.7574
Lena	1280X1280	Level 5	89.0126
Coloredchips	1280X1280	Level 6	114.9769

6.Conclusion

The execution of the proposed work in matlab, its worldwide programming language. Where it properties of interfaces backing and be agreeable and well known to the client. The outcomes demonstrated that Data folding is a basic and speedier strategy for pressure, and an extremely valuable for security since all the delicate data will be spared in the last pixel of folded image, where the protection of the proposed compression technique depending on folded image, which contain the distinctions of odd positions. It works similarly better for smooth pictures, in this manner it is more suitable for medicinal pictures.

References

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Supplementary Material

Suppose we are working on the following matrix(image) for one level of folding algorithm:

1	**2**	**3**	**4**		**-1**	**-1**
5	**7**	**6**	**2**	**column folding**	**-2**	**4**
10	**12**	**3**	**1**		**-2**	**2**
9	**5**	**7**	**8**		**4**	**-1**

1	**2**	**3**	**4**	**rowfolding**	**-4**	**-3**
5	**7**	**6**	**2**		**1**	**-4**
10	**12**	**3**	**1**			
9	**5**	**7**	**8**			

Then the result of folded image as following:

-1	**-1**	**-4**	**-3**
-2	**4**	**1**	**-4**
-2	**2**	**1**	**3**
4	**-1**	**10**	**3**

Now in the case of applying unfolding algorithm the results is as following:

-4	**-3**		**row unfolding**		**1**	**3**
1	**-4**				**5**	**6**
1	**3**				**10**	**3**
10	**3**				**9**	**7**

-1	**-1**	**1**	**3**	**column unfolding**	**1**	**2**	**3**	**4**
-2	**4**	**5**	**6**		**5**	**7**	**6**	**2**
-2	**2**	**10**	**3**		**10**	**12**	**3**	**1**
4	**-1**	**9**	**7**		**9**	**5**	**7**	**8**