ISSN: 2716-9227 Algerian Journal of Engineering and Technology 04 (2021) 054–058 e-ISSN: 2716-9278

Algerian Journal of Engineering and Technology

Journal homepage: https://jetjournal.org/index.php/ajet

Original Article

Color Component Based Lossless Compression Method for Satellite Images (CCBLC)

Sanjith S

Department of Computer Science and Engineering, Noorul Islam Centre for Higher Education, Kumarcoil, Kanyakumari District, Tamilnadu, India.
Department of Computer Science, St. Alphonsa College of Arts and Science, Soosaipuram, Karinkal, Kanyakumari District, Tamilnadu – 629157, India

ARTICLE INFO

Article history:
Received 25 October 2020
Revised 20 January 2021
Accepted 08 March 2021

Keywords:
RGB;
Lossless compression;
Color component;
Satellite image;
CCBLC

ABSTRACT

In recent years, the development and demand of remote sensing images are increased rapidly, however the huge volume of satellite images are contributing to inadequate bandwidth of network and storage of memory device. Therefore, the hunt of data compression methods becomes more and more significant to reduce the data redundancy to save more hardware space and transmission bandwidth. This paper introduces a new lossless compression method which reduces the size of the image by performing on blocks that have the comparable color components because the importance of the color varies from block to block depending upon the image. The similar color blocks are identified by the histogram values of each color Red, Green and Blue. A threshold value is fixed and the high order color component blocks will be removed and mentioned in a frequency table. While using this method, we got a comparatively better compression ratio for satellite images than the existing compression methods.

1. Introduction

The technological evaluation in satellite technology brought as to use Remote Sensed Images to monitor earth in various aspects by which we are transmitting more amount of data from satellite to ground station and storing a huge volume of necessary data. Although the volume of Remote Sensing image is huge, the storage capacity and the internet flow increase accordingly. Discovering how to decrease effectively, the size taken by these data remains a major interest. Certainly, in the past few years the compression plays a vital role in significant areas of image processing.

The storing of huge volume of data can be solved by applying compression techniques, [1] which can reduce the size of the image without degrading the image quality to an acceptable level by removing the redundant pixels in the image. It also resolves the data transmission problem by reducing the transmission time [2].

Compression can be classified into two, lossy and lossless. In lossy compression method the close estimate of the original data can be attained. But in lossless scheme exact original data can be recovered while decompression [3-6].

1.1. Interpreting Optical Remote Sensing Images

The four-main information contained in optical images are.

- Radiometric information (brightness, intensity, tone) [7]
- Spectral information (Color, hue) [8]
- Textural Information [9]
- Geometric and Contextual Information [10]

* *Corresponding author.*
E-mail address: sanjithss@gmail.com
Peer review under responsibility of University of Echahid Hamma Lakhdar.

http://dx.doi.org/10.5281/zenodo.4589482

1.2. Panchromatic Image

It has only one band and usually displayed as a grayscale image [11].

1.3. Multispectral Image

Consists of several bands of data while displaying each bands of the image may be displayed one and at a time as a grayscale image, or in combination of the three bands as a color image [12].

1.4. Color composite image

These images are displayed by the three primary colors (Red, Green, Blue) when these three colors are combined in various proportions, they produce different colors in the visual spectrum [13, 14].

2. Color Component Based Lossless Compression (CCBLC)

Generally, remote sensing images will cover a wide range, the swath and the resolution of the image will be of kilometers, since the image covers large area similar color components will be available increasingly and it can be effectively traced in the images. Visually 70% to 80% of the blocks looks similar.

2.1. Process of CCBLC

1. Get the input image.
2. Divide the image into small blocks.
3. For each block calculate the histogram values for RGB colors separately.
4. Remove the high order color components.
5. Store the removed values in the frequency table.
6. The process will be repeated for all blocks.
7. Remaining block values will be combined to form compressed image (Figure 3.).
8. Decompression is reverse process of compression.
9. Interpret all the block values from frequency table.
10. Decompressed image (Figure 4.).

In this color component-based compression method the image will be splitted into small blocks (4x4, 8x8, 16x16) depending the resolution of the image. Each block will be analyzed for different colors ie. RGB and for each color a histogram will be calculated. The high valued histogram blocks will be deleted and the values are stored in a frequency table, which holds the information how frequent the color is occurred in the block and the depth of the color.

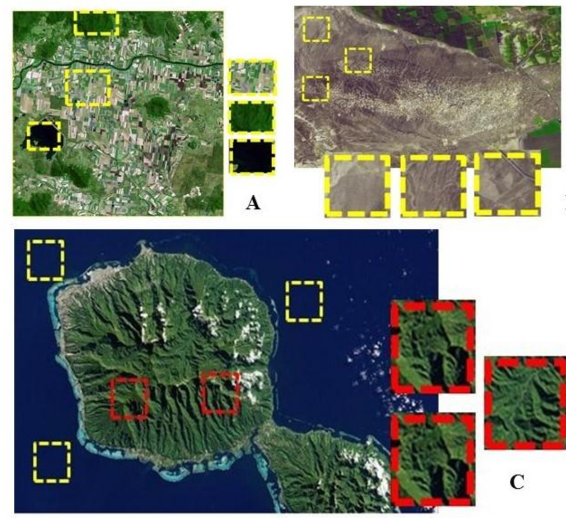


Figure 1. Sample Satellite Images

Figure 1. shows the similar blocks by color the highlighted areas are the major color values available in the image. Figure 1. (A, B and C) depicts the same.

Figure 2. represents the graphical representation of the algorithm which explains the overall process of the algorithm.

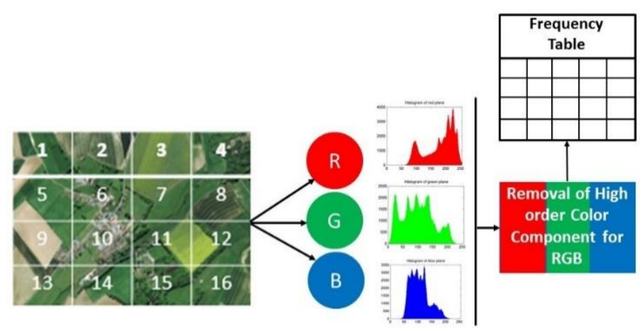


Figure 2. Graphical Representation of the Algorithm

The given image has been divided into 16 small blocks, each block is analyzed and histogram calculation is done for each block, the blocks with higher color value will be removed and the value of the same will be stored in the frequency table for decompression purpose.

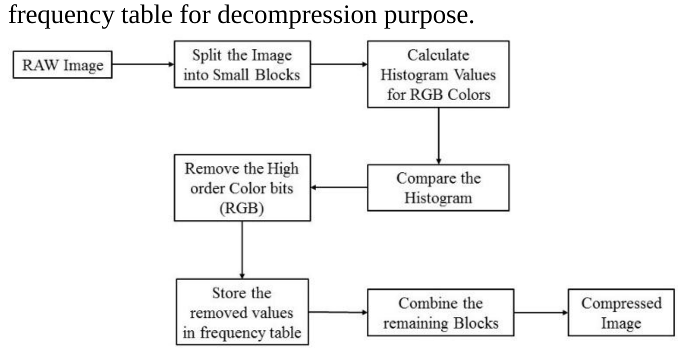


Figure 3. Block Diagram of Compression Process

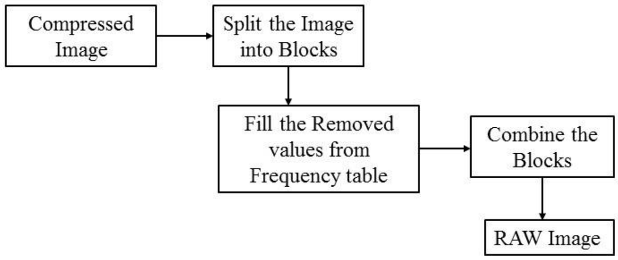


Figure 4. Block Diagram of Decompression Process

3. Results and Discussion

In order to provide experimental results six different satellite images with different colors are provided as input and the result obtained are revealed in Table 1. The algorithm will measure the height and width of the image and the total color components in the image then the compression process starts. Figure 5 (A) is the input image and Figure 5. (B) exposes the result of it. The compression result is calculated by subtracting the total color component and the final compressed image component. In Figure 5. A. the total color value compression done is 17230. This compression values includes the RGB color values Separately.

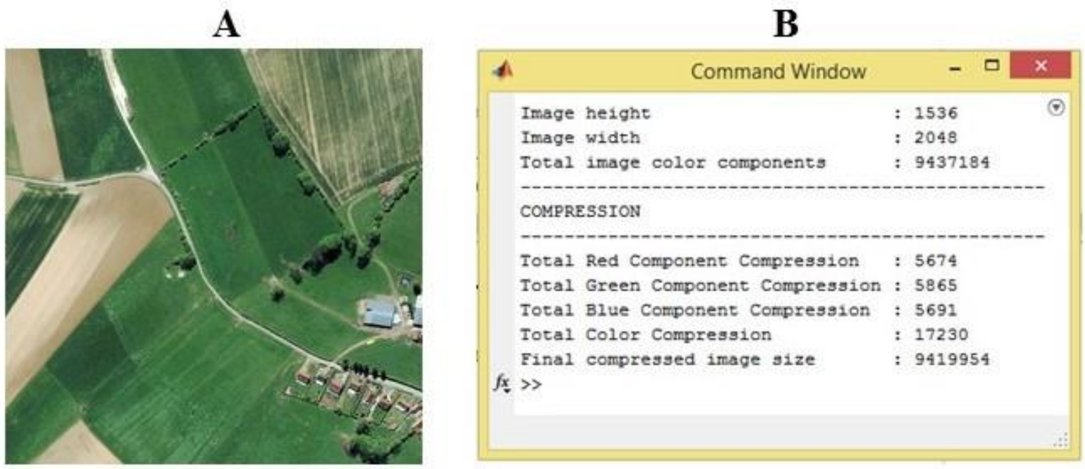


Figure 5. Compressed results (Fig 5. B) of the given image (Fig 5. A)

- Total Color Values Found = 9437184
- Total Red (R) Values Removed = 5674
- Total Green (G) Values Removed = 5691
- Total Blue (B) Values Removed = 5865
- Total color values compressed is calculated by adding the removed RGB valued i.e = 17230
- The compressed value of the image is. Total color value (9437184) – Removed color values (17230) = 9419954.

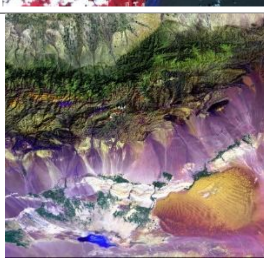
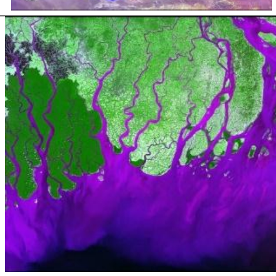
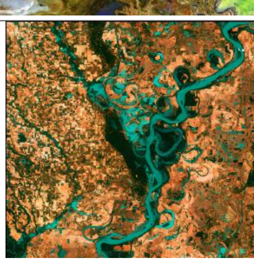
Table 1. displays the sample images used for compression using CCBLC and the compression ratio gained.
As of now this compression method works good in satellite image compression, but it need to be fine-tuned for better results. Few future works have been identified in order to make the method better in all aspects like, compression ratio, time complexity etc.

4. Conclusion and Future work

Remotely sensed images are used in broad range of disciplines and the main challenge is its size. In order to overcome the problem, we have developed a new algorithm which works based on color components of the image, there is no standardized approach for this technique. This paper briefly introduces the color component based algorithm for satellite image compression and a good result has been produced. Table 1 depicts the outcome of few satellite images.
The proposed compression method considers the image color characteristics to reduce its size. Based on the known literature the proposed method is an innovative method for satellite image compression. MATLAB is used to simulate this algorithm. This method should be fine-tuned for comparative results.
The major problem we found while executing this algorithm is the computer consider only the perfect RGB values as Red, Green and Blue, i.e (255,0,0 as Red, 0,255,0 as Green and 0,0,255 as Blue) if the values are little bit increased are decreased it does not mean the values as Red, Green are Blue.
So, in order to overcome this, we have identified few techniques, they are.

- Using Neural Network are Fuzzy logic to train the algorithm about different RGB color values.
- Block similarity based compression can be done.

Table .1 Results obtained for different satellite images.

Image Used	Resolution	Image Format	Total RGB Color components	Compression by each Color Components	Compressed Size	Compression Ratio
	1024 x 1024	TIF	2474956	Red 1577 Blue 1375 Green 1413 *Total (RGB) 4365*	2470590	1.0017
	1024 x 1024	TIF	2478204	Red 2893 Blue 3119 Green 3115 *Total (RGB) 9127*	2469077	1.0036
	1024 x 1024	TIF	2484054	Red 1118 Blue 1013 Green 1268 *Total (RGB) 3399*	2480655	1.0013
	1024 x 1024	TIF	2490228	Red 2283 Blue 2829 Green 2076 *Total (RGB) 7188*	2483040	1.0028
	1024 x 1024	TIF	2467500	Red 1105 Blue 1133 Green 1124 *Total (RGB) 3362*	2464138	1.0013
	1024 x 1024	TIF	3145728	Red 3710 Blue 2316 Green 2490 *Total (RGB) 8516*	3137212	1.0027

References

1. Singh A, Gahlawat M. Image compression and its various techniques. *International Journal of Advanced Research in Computer Science and Software Engineering*. 2013;3(6):650-654.
2. Nivedita SJ. Performance analysis of SVD and SPIHT algorithm for image compression application. *International Journal of Advanced Research in Computer Science and Software Engineering*. 2012;2(2).
3. Sanjith S, Ganesan R. A review on hyperspectral image compression. *In2014 International Conference on Control, Instrumentation, Communication and Computational Technologies* (ICCICCT) 2014 Jul 10 (pp. 1159-1163). IEEE.
4. Sanjith S, Ganesan R, Isaac RS. Experimental analysis of compacted satellite image quality using different compression methods. *Advanced Science, Engineering and Medicine*. 2015;7(3):227-233.
5. Sanjith S, Ganesan R. Overview of Image Quality Metrics with Perspective to Satellite Image Compression. *InInternational Journal of Engineering Research in Africa* 2016 (Vol. 24, pp. 112-123). Trans Tech Publications Ltd.
6. Sanjith S, Ganeshan R. Evaluating the Quality of Compression in Very High Resolution Satellite Images Using Different Compression Methods. *InInternational Journal of Engineering Research in Africa* 2016 (Vol. 19, pp. 91-102). Trans Tech Publications Ltd.
7. Anuradha D, Bhuvaneswari S. A detailed review on the prominent compression methods used for reducing the data volume of big data. *Annals of Data Science*. 2016;3(1):47-62.
8. Miranda FP, MacDonald JA, Carr JR. Application of the semivariogram textural classifier (STC) for vegetation discrimination using SIR-B data of Borneo. *International Journal of Remote Sensing*. 1992;13(12):2349-2354.
9. Zhang L, Huang X, Huang B, Li P. A pixel shape index coupled with spectral information for classification of high spatial resolution remotely sensed imagery. *IEEE Transactions on Geoscience and Remote Sensing*. 2006;44(10):2950-2961.
10. Ryherd S, Woodcock C. Combining spectral and texture data in the segmentation of remotely sensed images. *Photogrammetric engineering and remote sensing.* 1996;62(2):181-194.

Recommended Citation

Sanjith S. Color component based lossless compression method for satellite Images (CCBLC). *Alg. J. Eng. Tech. 2021*, 4:54-58.
http://dx.doi.org/10.5281/zenodo.4589482