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# Contrast Improvement of Blurred Multispectral Remote Sensing Satellite Images using SVD-DCT and Contrast Limited AHE

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**Abstract:** In this paper we proposed a methodology for satellite images. The proposed calculation has the limit enhance contrast also it has the limit keep up mean brightness of given data image. In the proposed method information image is rotted into two repeat sub-gatherings using Discrete Cosine Transform (DCT) and after that it uses the Singular Value Decomposition. We examine that the states of workmanship calculations have the ability to redesign contrast of given satellite image however these methods are not prepared to ensure the mean wonder in the readied image. The test outcomes show that the proposed calculation has the limit redesign many-sided quality of given satellite image without much impacting its mean wonder image.

**Keywords:** Sub-gatherings using Discrete Cosine Transform (DCT), Contrast Limited AHE

## I. INTRODUCTION

In digital image processing, complexity upgrade of shading images is considered as most difficult assignment. The term contrast is characterized as the distinction in luminance reflected from two contiguous surfaces. The image improvement methods are utilized for upgrading the representation highlights [1]. By and large the shading satellite images contain moderately limited scope of brightness values, this thin scope of brilliance lead to deficient difference in these sort of images. For improvement of contrast in these images the standard difference upgrade methods are utilized [2]. A standout amongst the most well-known issue happen in satellite images amid their arrangement procedure is that these have been taken in exceptionally dull or a splendid circumstance, the data may be lost in the ranges which are unnecessarily and consistently dim or brilliant [2]-[3]. Presently the principle testing undertaking is to enhance complexity of these sort of images. A few methods have been proposed for upgrade of complexity of all kind of shading images. The issue is the way the contrast of a image can be enhanced from the data satellite image which has complete data yet is not unmistakable. Histogram balance HE is a generally utilized technique for difference improvement of all sort of shading images. There have been a few HE based method reported in writing for the contrast Enhancement [4]-[14]. These methods can be algorithmically examined in [15]. The HE method is broadly utilized as a part of different image contrast upgrade strategies. In these methods then HE method is either used to enhance their execution or it is utilized as a pre-preparing. One such technique is produced by A.K. Bhandari et al in [16].

Here authors have utilized the idea of discrete cosine change and particular quality deterioration. This method is primarily created for complexity upgrade of obscured satisfy satellite images. The detailed description of this technique can be found in [16]. We watch that the technique for [16] has the capacity to enhance contrast of given obscured satellite shading image however it is not able to save the mean brightness in the processed image.

One such explanation for this is, the method [16] utilizes HE procedure as a part of its handling and the HE technique experiences the 'mean-shift' issue [7]. In this work we are going to give an expansion of the technique for [16]. The proposed method has the capacity improve contrast of given obscured satellite image without much influencing its mean brightness. The remaining part of the chapter is described as follows. After provided a brief introduction in section 1, in section 2 we provide a detailed description of proposed method. Section 3 contains the experimental results to show the effectiveness of the proposed method. At last section 4 concludes the entire work.

## II. THE PROPOSED METHOD

As said before that the method [16] is using HE in it not ready to keep up the brightness in the prepared image. Commonly for protection of shine in the handled images the CLAHE [6] technique is utilized. This method produces image without much influencing their mean brightness. We break down that we can substitute the HE method from CLAHE in [16] and the new augmentation

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will deliver images without much influencing their brightness. In the Fig. 1 we are showing the flowchart of method of [16].

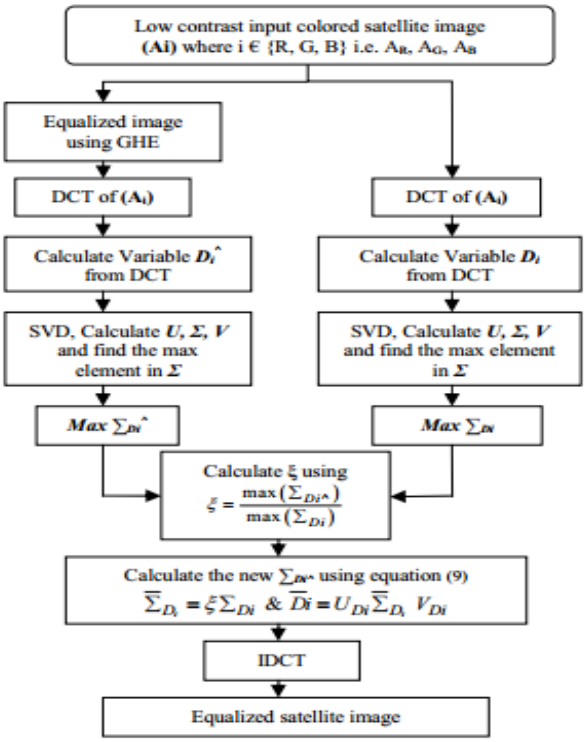



**Fig. 1** flow chart of method of [16], (source [16])

As we have already mentioned that the proposed method is an extension of method of [16], in the extended version we are just changing the HE method from CLAHE method. Now we are going to provide a brief description of the CLAHE method.

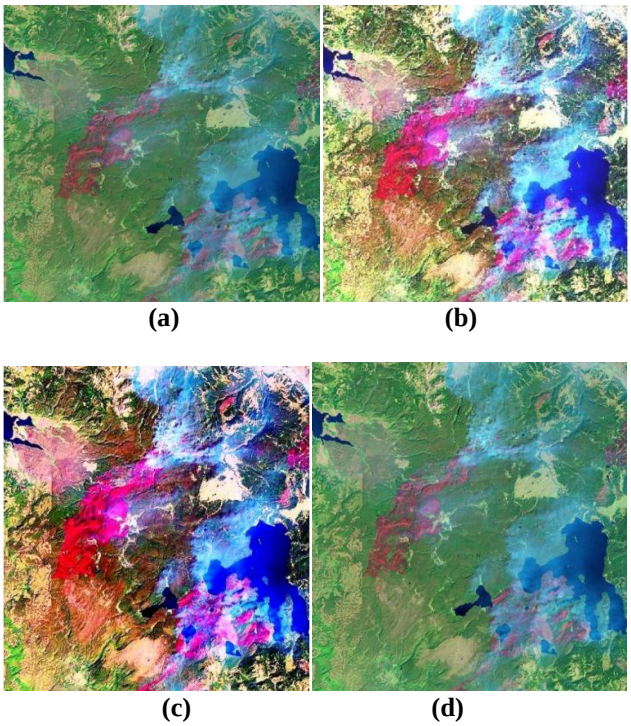
A generalization of Adaptive Histogram Equalization is CLAHE [6]. It has more flexibility in choosing local histogram mapping function. By selecting clipping level of the histogram undesired noise amplification can be reduced.

The CLAHE method applies histogram equalization to a contextual region. Each pixel of original image is in the center of the contextual region. The original histogram is clipped and the clipped pixels are redistributed to each gray level. The new histogram is different with ordinary histogram, because each pixel intensity is limited to a user-selectable maximum. So CLAHE can limit the noise enhancement.

The whole working of this proposed method is as follows.
1. Initially we take the input color image and then decompose it into three channels of the RGB color model.
2. In second step we make a copy of the R, G and B part of the image and then apply the CLAHE method in it.
3. In next step we apply DCT on the all (R, G and B) parts of the image and obtain its higher and lower frequency part. For the remaining processing we only use its lower frequency part.
4. Now we apply singular value decomposition on the image and obtain $\max(\sum D_i)$.
5. Now we apply the same steps on the output of step 2 and then obtain $\max(\sum \hat{D}_i)$.
6. Next we calculate parameter $\xi$ using the equation $\max(\sum \hat{D}_i) / \max(\sum D_i)$.
7. Now we obtain modified value of $\sum \overline{D}_i$ as $\sum D_i = \xi . \sum D_i$.
8. Now we form the modified singular valued decomposed matrix and then merge it with the remaining higher frequency component of the image.
9. At last we apply inverse DCT to form the processed image.

## III. EXPERIMENTAL RESULTS

For evaluation of performance of proposed method we are using same image set as [16]. In the following Fig. 2 we are comparing results of proposed method with HE, method of [16] and the proposed method.



**(a)** **(b)**

**(c)** **(d)**

**Fig 2 (a) input image, (b) results of HE method, (c) results of DCT-SVD based method, (d) results of the proposed method.**

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